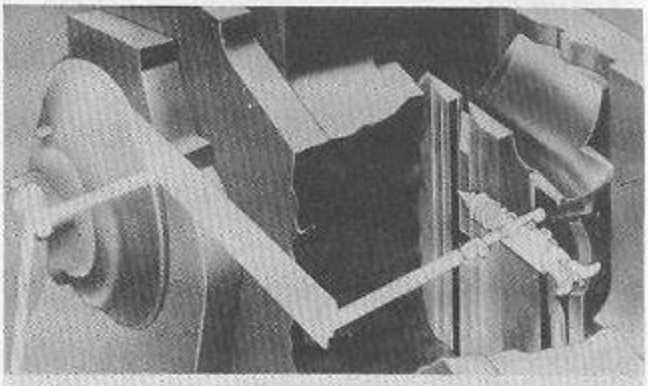
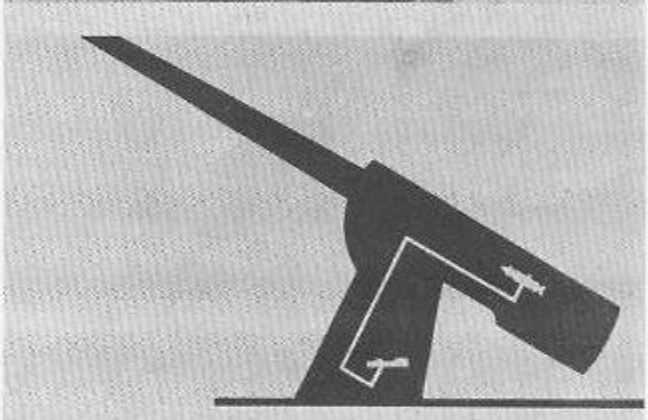
CHAPTER 16—DISASSEMBLY AND ASSEMBLY OF THE FOOT FIRING AND FIRING STOP MECHANISMS

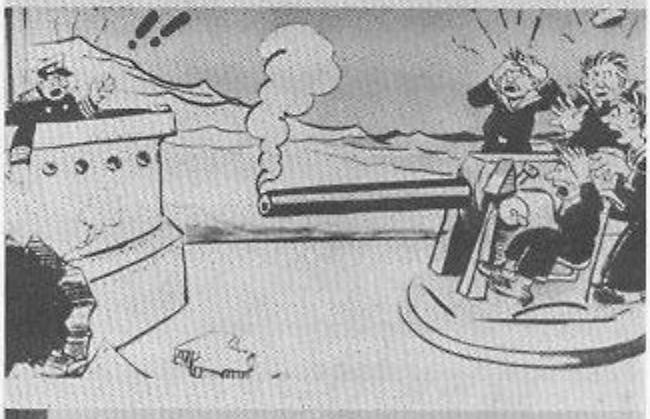
We know that the high rate of fire of the 5"/38 can be maintained with safety because of the design of its efficient firing mechanism.



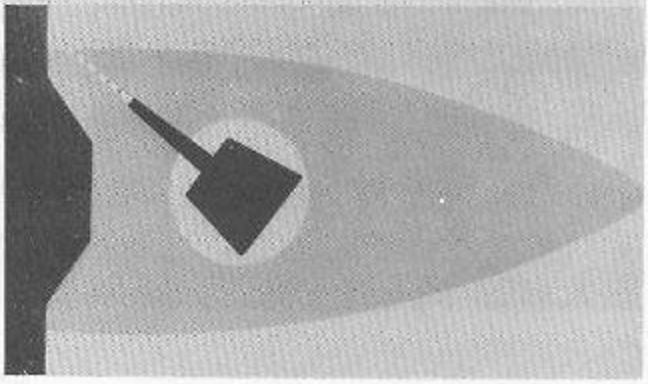
To provide an unfailing standby means of firing in the event of electrical failure, the foot firing mechanism must be maintained in perfect working order.

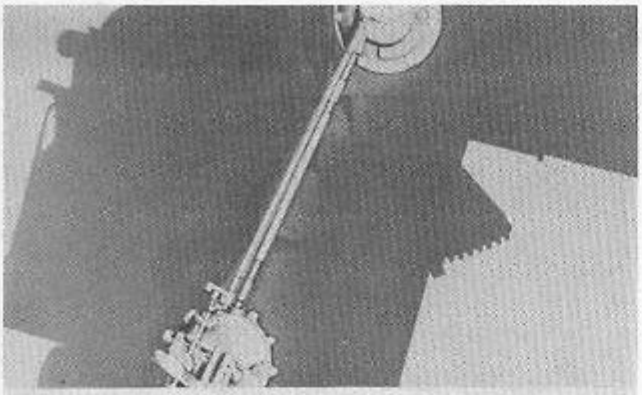


Firing into the ship's structure is extremely unhealthy for all concerned.



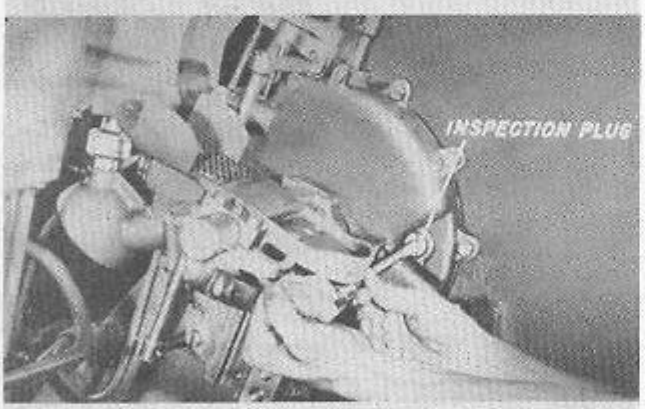
To prevent electrical or percussion firing whenever the gun is pointed at any part of the ship's structure, . . .



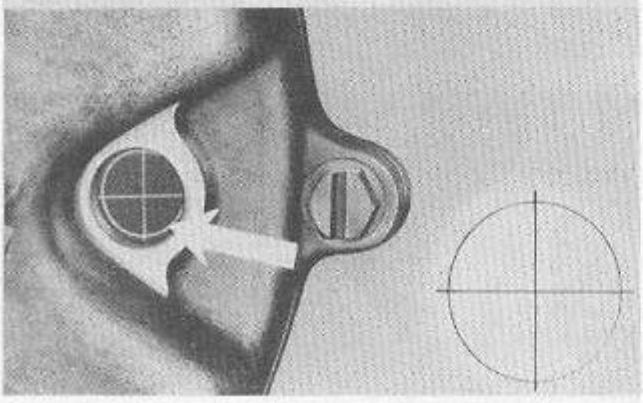


. . .the firing stop mechanism must also be maintained in efficient operating order. The foot firing mechanism and the firing stop mechanism are both located in the two housings on the pointer's side of the mount. One housing is located over the left trunnion and the other just below the pointer's handwheel. If their parts stick or do not function, or if the ship's structure is altered and a new cam plate must be installed, these systems must be taken apart for overhauling.

These mechanisms are simple enough to rip down, but intelligent preparation is required to put them back together so that they will work properly.

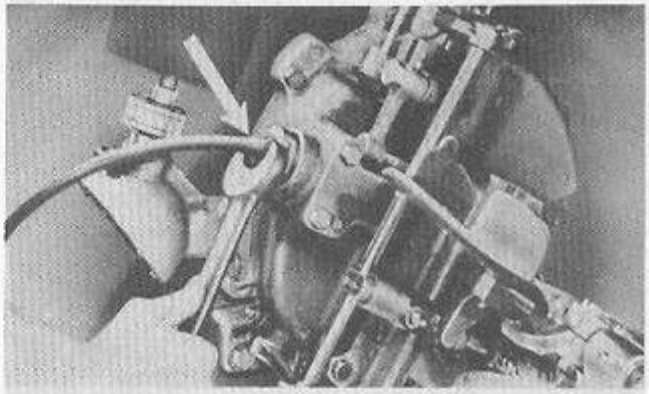


Before you take these precision mechanisms apart, see that they are set so that you can put them back together again in correct alignment. Train the mount to the secured position. An inspection plug is provided in the lower housing to check the position of an indicating scribe mark on the firing stop cam plate.

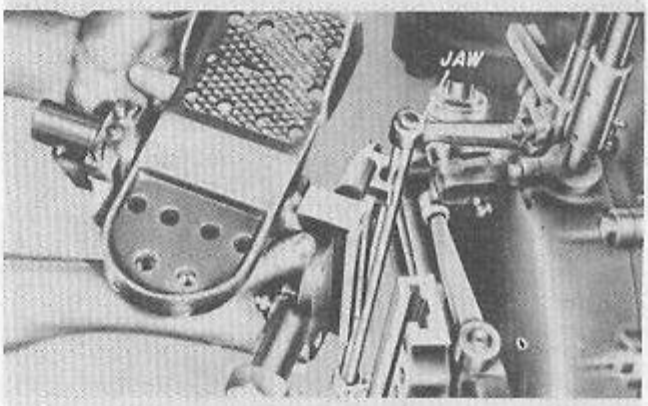


After the inspection plug is removed, the permanent scribe mark (the cross within a circle) may be seen through the inspection hole. When the gun is trained to the secured position, this scribe mark should be centered in the inspection hole if the cam plate is correctly installed with respect to the train of the mount. With the mount trained to the secured position. . .

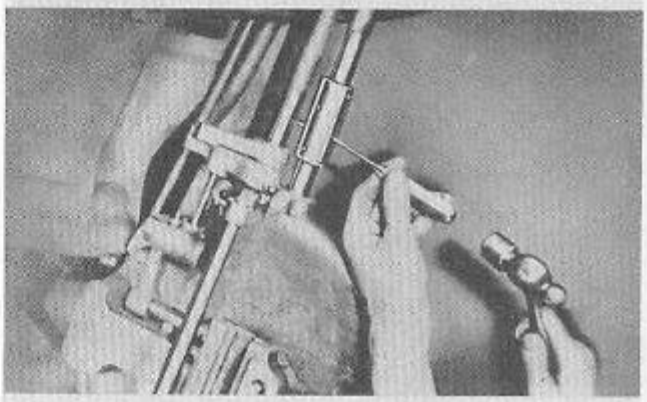
. . .remove the electrical firing lead connection.



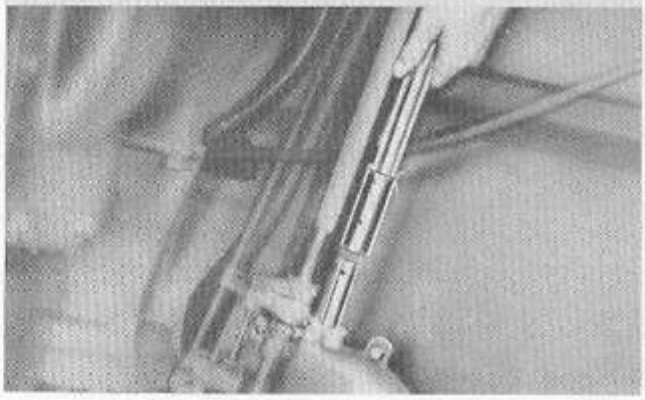
Remove the foot-firing treadle bracket from the housing and slide it up out of its guides. Disengage the jaw of the connection rod from the outboard rod of the connection lever.



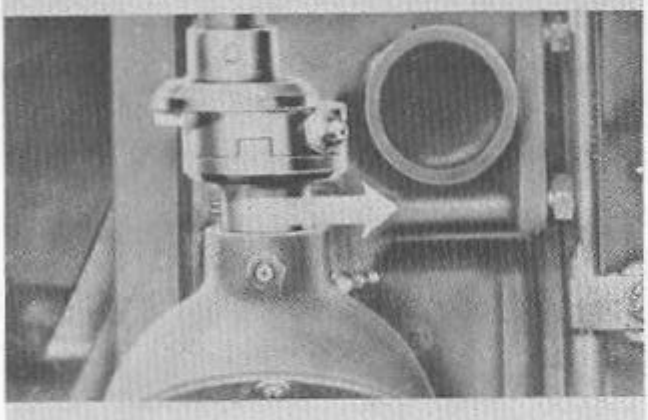
Drift out the taper pins in the sleeves of the elevation input and firing rods.



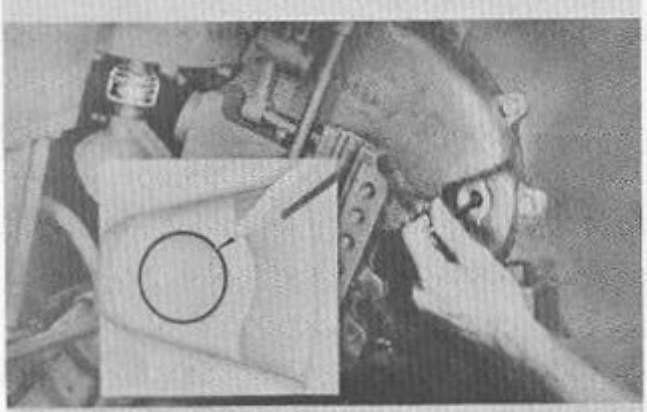
The elevation input rod is then removed, . . .



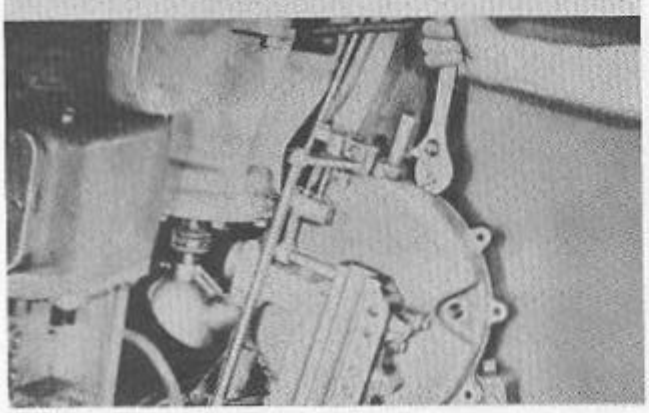
. . .and the firing rod is lifted out of the sleeves on the connection lever rod.



Before we can remove the lower housing cover, one set of grooves and an Oldham coupling must be lined up so that the part of the coupling connected to the cover can be slid outboard when the cover bolts are removed.

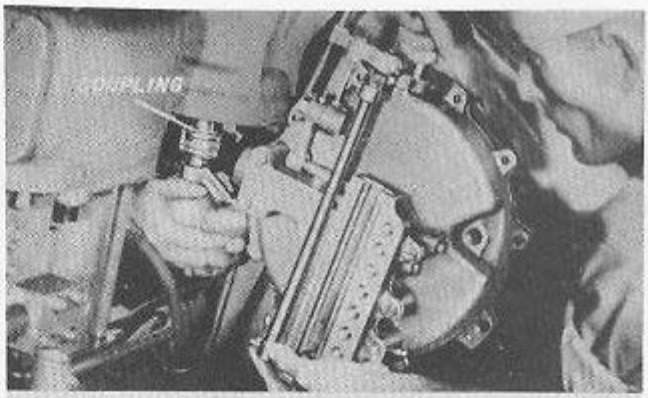


After the set of grooves in the coupling have been lined up, the exact angle of train should be read from the train indicator and recorded so that it can be referred to in reassembling the parts. Then make a pencil mark on the cam plate through the inspection hole. The pencil mark will be used in reassembling the cam plate.

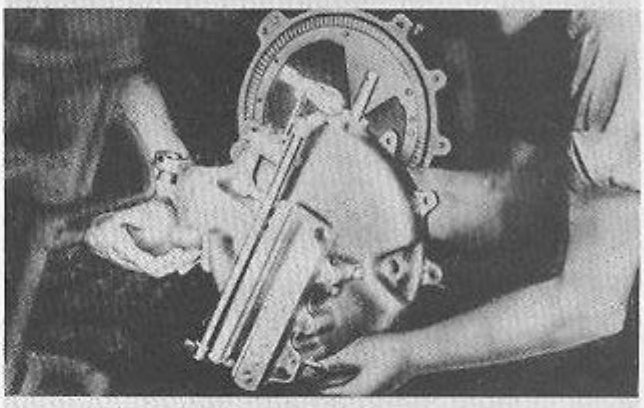


Now unscrew the bolts around the edge of the housing cover, . . .

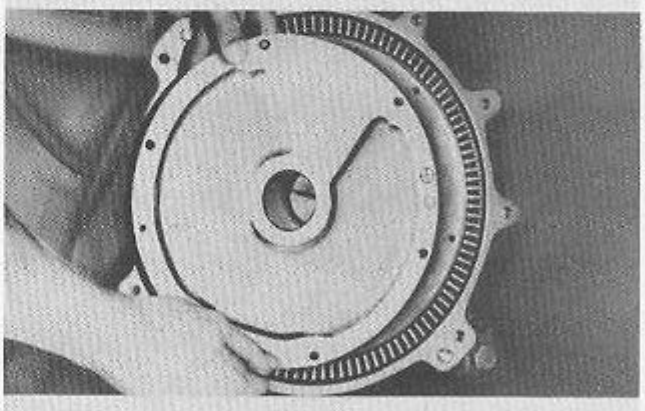
. . .and slide the housing cover outboard. As the cover comes out, it will carry the lower part of the coupling with it.



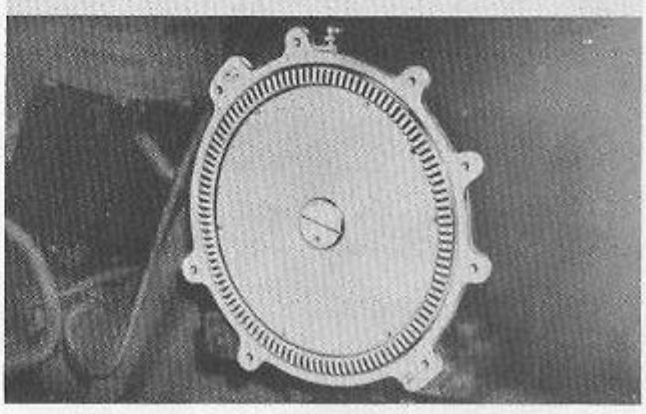
Then, after the coupling has been disengaged, the housing cover is pulled out to the rear and set aside for later inspection and adjustment of its parts. The cam plate is now exposed in the housing. . .



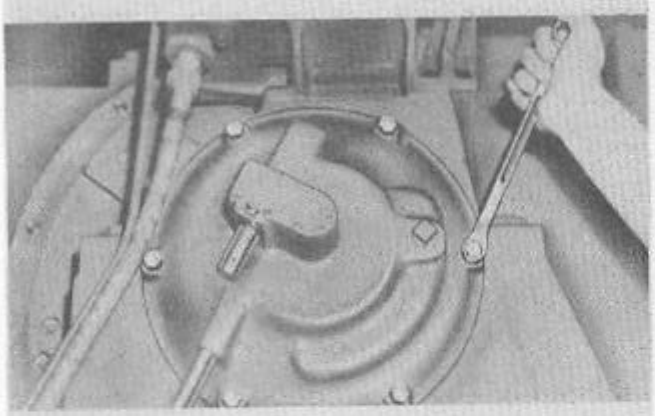
. . .and the screws that secure it to the cam gear are removed so that the cam plate can be lifted away from the cam gear.



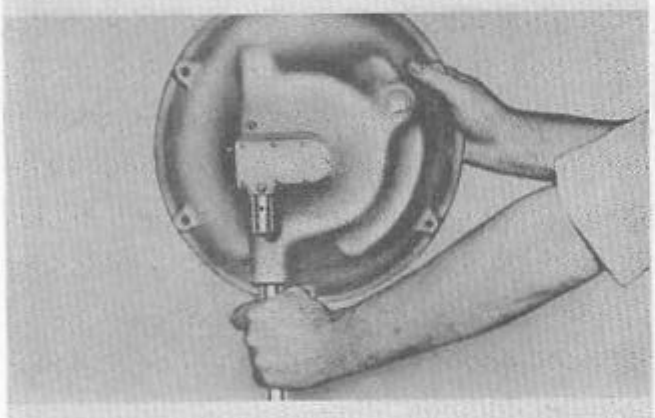
Inspect the cam carefully for burrs on its teeth or for signs of corrosion. Clean it and stone down any burrs which are found.



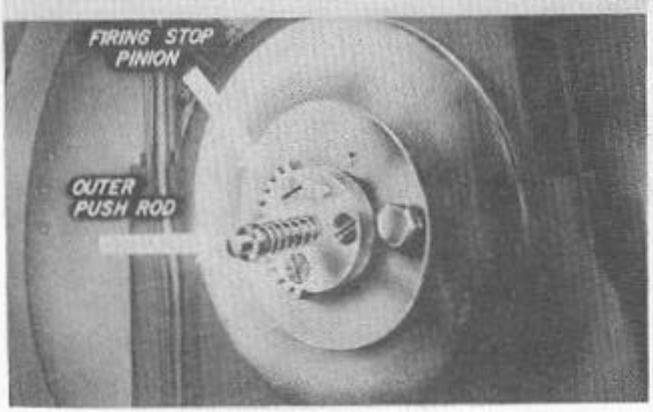
If the ship's structure has been altered and a new cam plate must be installed, the pencil mark on the old cam plate, which has been removed, should be carefully transferred to the new one by measuring the distance of the pencil mark from the scribe mark on the old cam plate with a pair of dividers and laying out this distance on the new cam plate.



To remove the upper housing of the foot firing and firing stop mechanisms, we unscrew the bolts that secure the housing to the cheek.

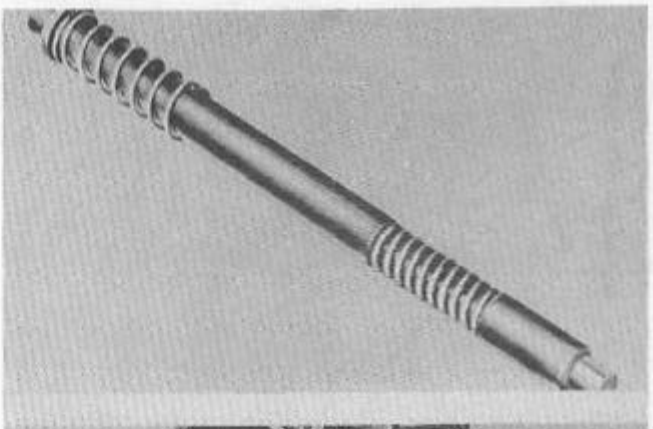


As the housing is being lifted away, a firm hold should be kept on the elevation input shaft to prevent its rack from falling out and being damaged. The rack section is then slipped out of the housing.

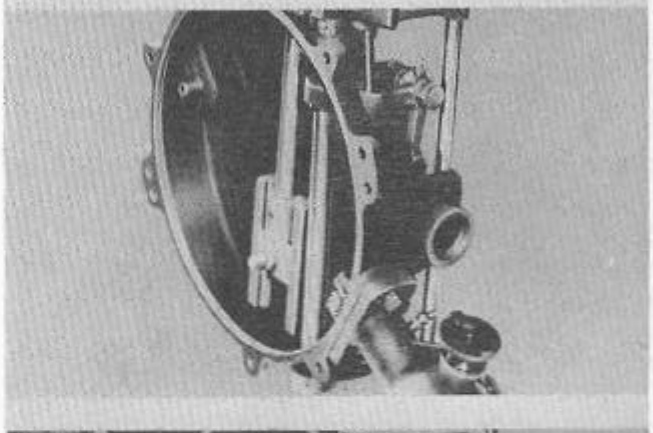


When the upper housing is removed, the firing stop pinion should be cleaned and its teeth carefully checked. See that the screws holding the pinion on the trunnion clip are tight. The outer push rod can be pulled out of its seat in the trunnion for inspection.

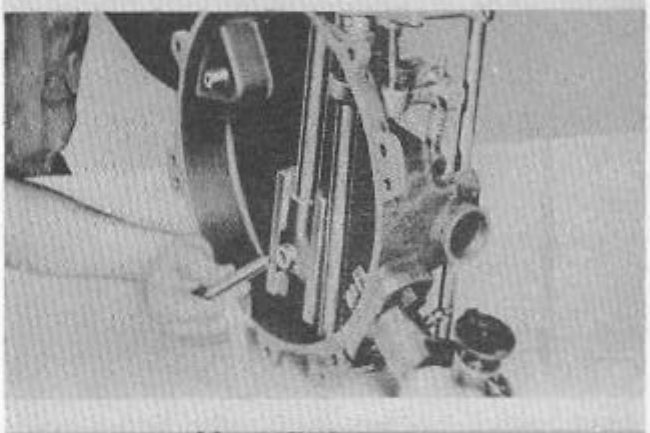
The outer push rod is not disassembled. Clean and lubricate it and see that the two springs are not weak or broken. If the rod is defective in any way, replace it with a new assembly.



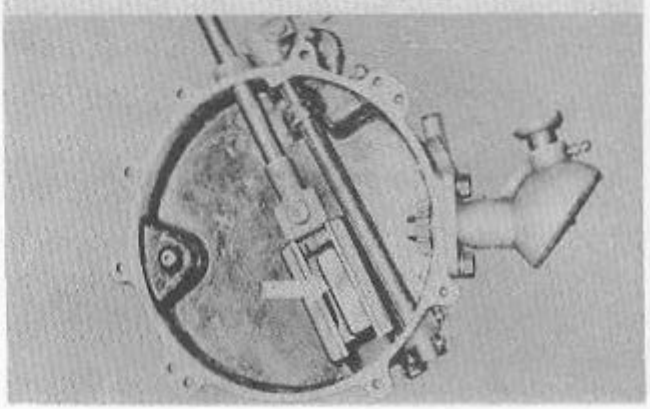
Now let's look at the lower housing cover which we set aside earlier. This cover should be thoroughly cleaned with diesel oil and compressed air. And a detailed inspection should be made of each part mounted on the cover beginning with those on the inside.

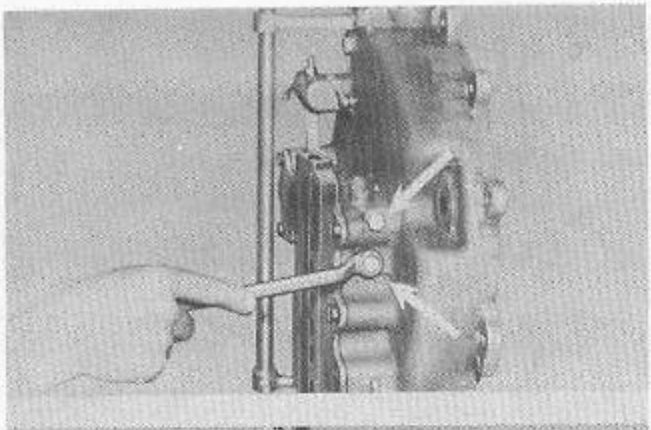


Pull out the plunger. Stone off all corrosion and see that the ball at each end rolls freely in its seat. Lubricate the plunger and replace it in the elevation input rod.

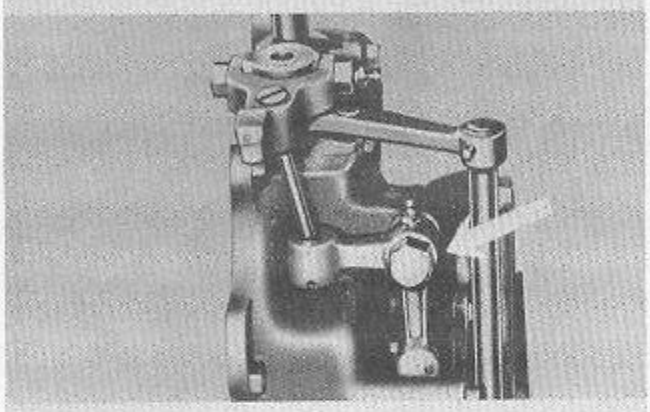


Inspect the inner face of the plunger lever carefully. If corrosion or pitting is found, a new plunger lever must be installed.

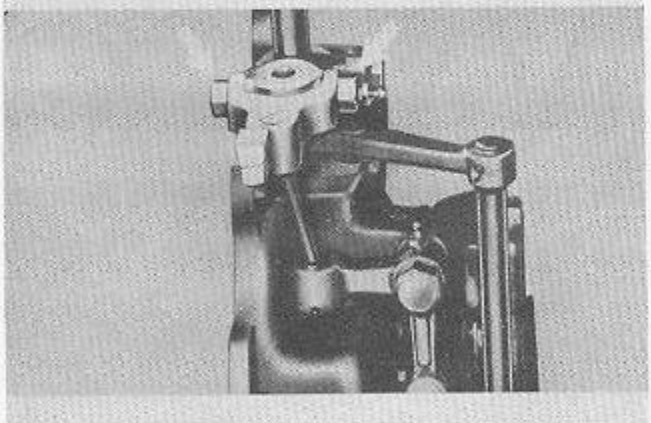




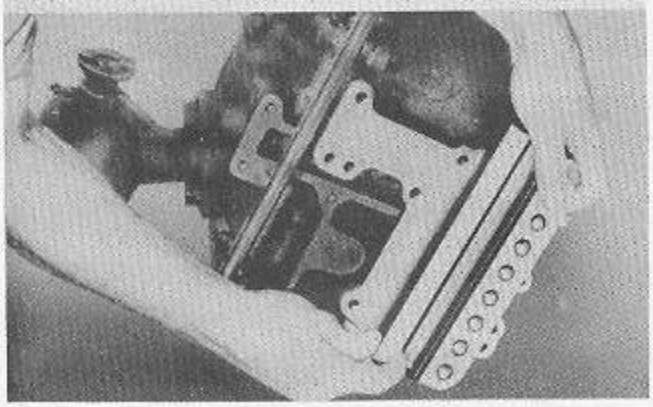
Then turn the cover over and inspect the parts on its outer side. First, test the tightness of the metalic packing around the plunger lever shaft by taking up these two plugs in the housing. Excessive tightening should be avoided, in order to allow proper operation of the plunger lever shaft.



The bellcrank, and the bolt about which it pivots, are examined next. The bolt is removed for cleaning and lubricating and then put back. Don't make the bolt too tight or the bellcrank will bind.

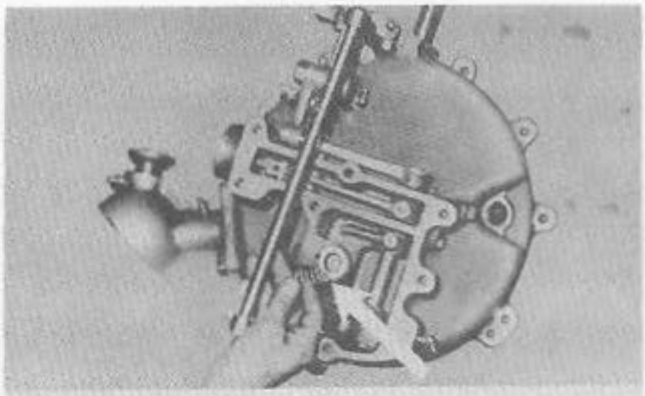


The bearing bolts on the clutch throwout lever should be carefully checked. If corrosion or dirt prevents free operation of the lever, unscrew the bearing bolts and thoroughly clean all the parts. When the bearing bolts are put back they must not be screwed in so tightly as to prevent free operation of the clutch throwout lever.

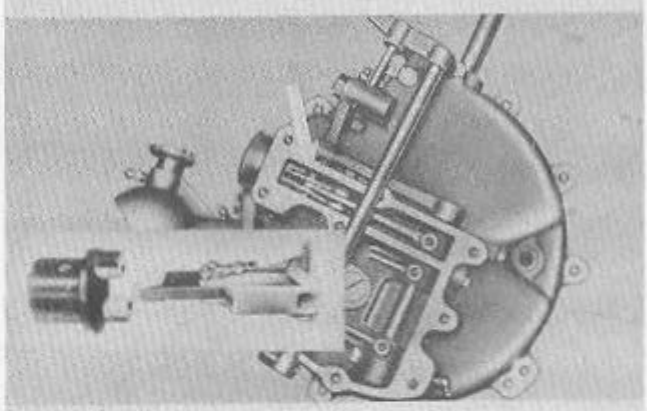


To get at the remaining parts in the cover assembly that may need attention, remove the foot-treadle guide bracket. This guide bracket is taken off after removing its mounting bolts and screws.

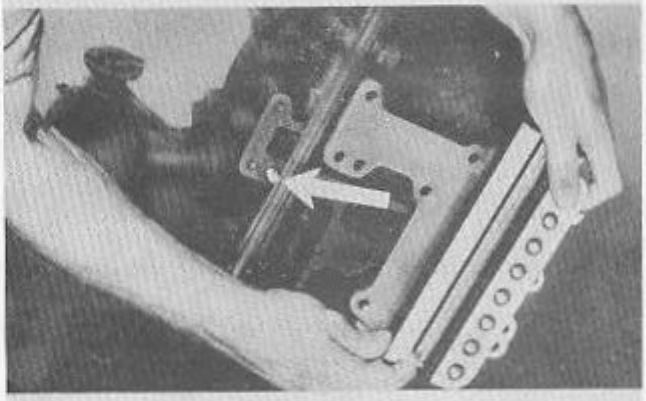
To take out the plunger lever spring, remove its keeper screw and plug. If the spring is weak, it must be replaced by a new one.



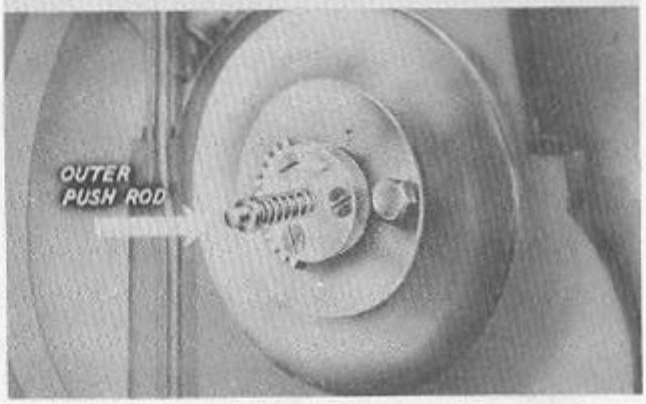
Then clean the bridge contacts on the electrical stop switch with alcohol and with alcohol only. No abrasives are to be used.

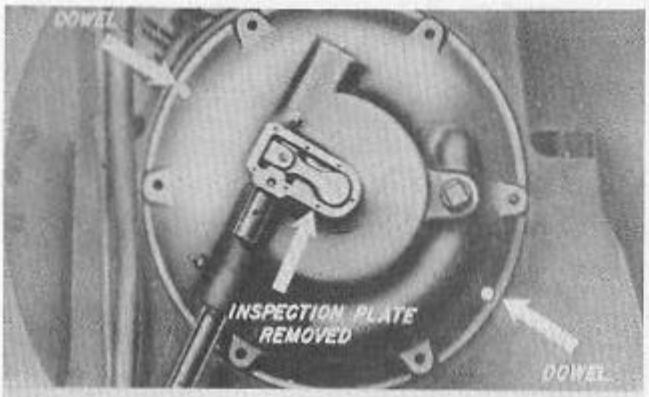


The foot-treadle guide bracket is then replaced in the housing cover by matching up the dowels. The bracket is only temporarily secured by screwing in two mounting bolts, since it will be removed later to check the setting of the elevation input rod after assembly. When all parts of the foot firing and firing stop mechanisms have been carefully cleaned and lubricated, they must be placed back in the housing in proper alignment.

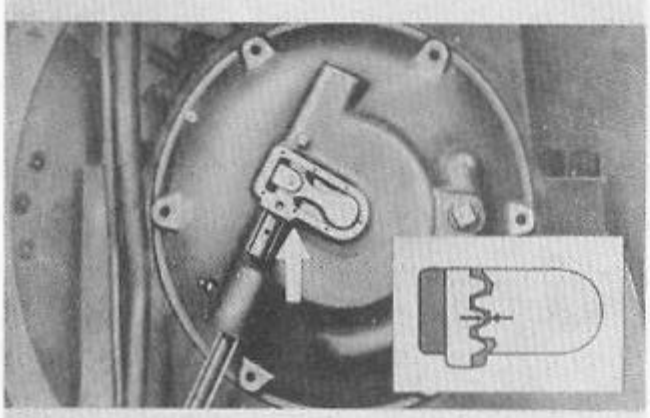


To assure proper alignment of the parts in reassembly, the gun must be set at zero elevation. The outer push rod is then replaced in its hole in the left trunnion clip.

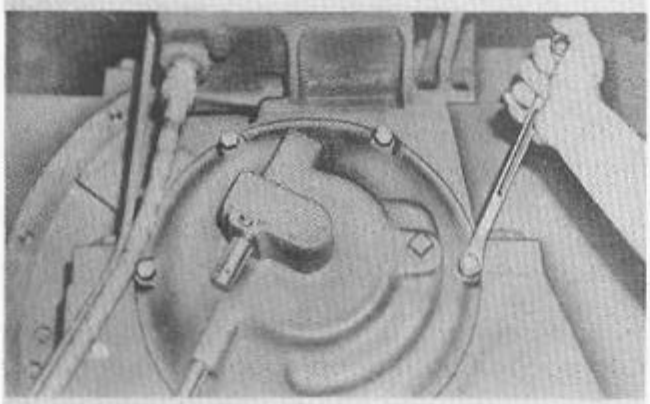




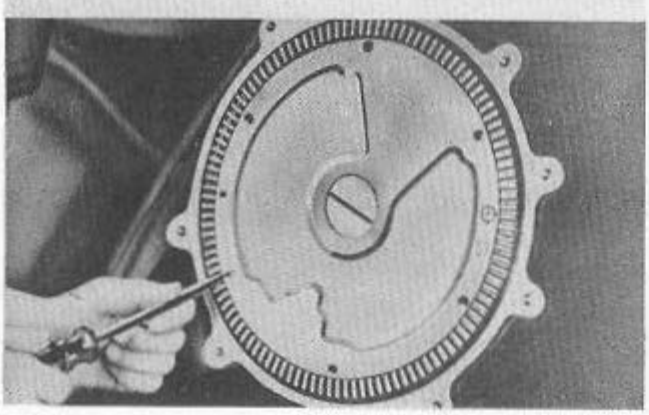
To line up the firing rod rack with the firing stop pinion, the inspection plate over the firing rod lever is removed from the upper housing. Then the housing, with rack in place, is set on the trunnion and guided into position by the dowels.



Using a flashlight, look under the firing lever to make sure that the arrow on the fourth tooth of the rack meshes with the pinion tooth also marked by an arrow. In the insert, with the firing lever removed, we see the gears properly aligned. This alignment will assure that the rod will not be bent and that the plunger will always be properly positioned on the firing cutout cam plate.

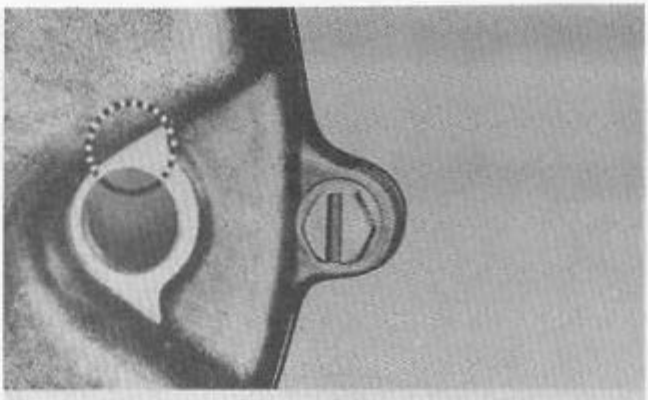


The upper housing is then secured on the trunnion clip with its mounting bolts, and the inspection plate is replaced. This completes the assembly and adjustment of the upper housing.

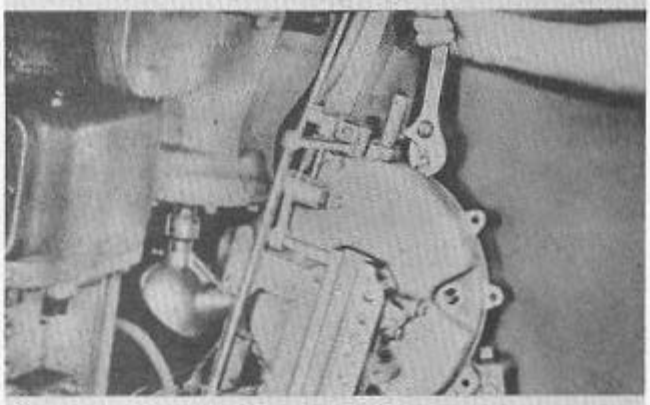


To assemble the parts of the lower housing, we set the cam plate on the cam gear, match up a dowel pin on the cam gear with a hole in the cam plate, and secure the plate to the gear. In order to line up the position of the cam plate, see that the gun is trained to the angle recorded when the cam plate was removed.

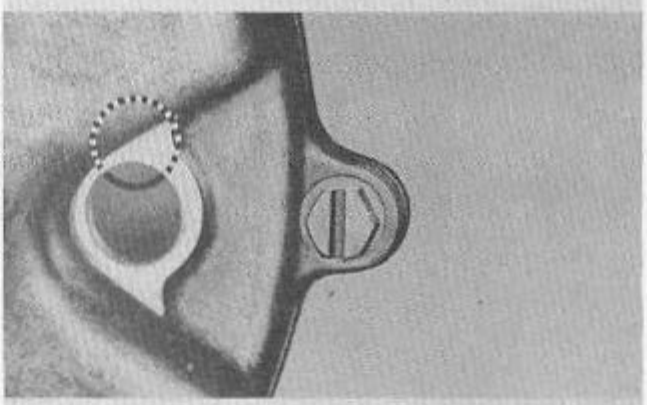
Then, position the lower housing cover over the cam gear housing and rotate the cam gear to bring the penciled mark on the cam plate in line with the inspection hole in the cover to ensure that the cam plate is in the correct position. With the cam plate lined up. . .



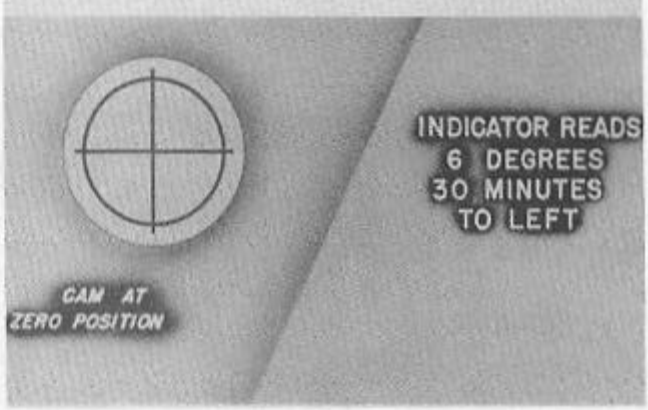
. . .and with the jaws of the Oldham coupling engaged and the cover lined up over two dowel pins, seat the cover and attach it temporarily by screwing in two of its mounting bolts.

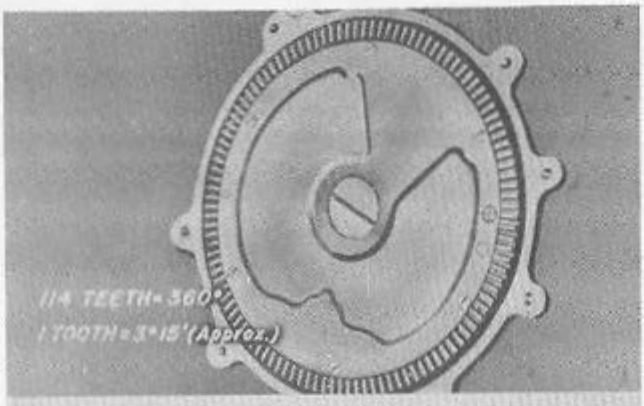


Once again, check the position of the pencil mark through the inspection hole. If this pencil mark is centered in the inspection hole, the cover is then secured by screwing in the remaining mounting bolts. If the pencil mark is <u>not</u> centered, the cam plate must be repositioned properly. To do this, . . .

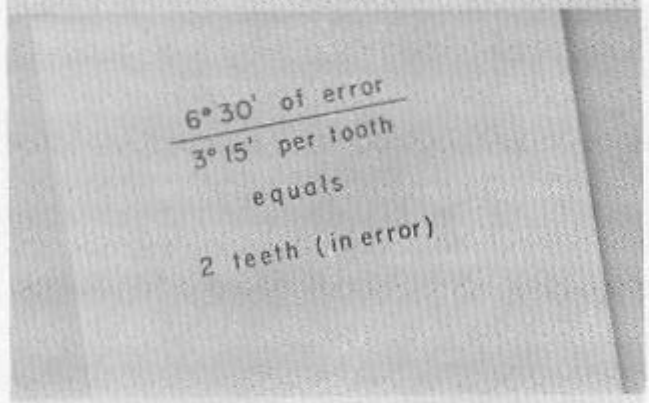


. . .train the gun to center the prominent scribe mark in the observation hole. The train indicator is then checked to determine how much the gun is trained off its secured position. Let us assume that in this case the indicator reads six degrees and thirty minutes to left of zero. This means we must reset the cam plate six degrees and thirty minutes in a clockwise direction.

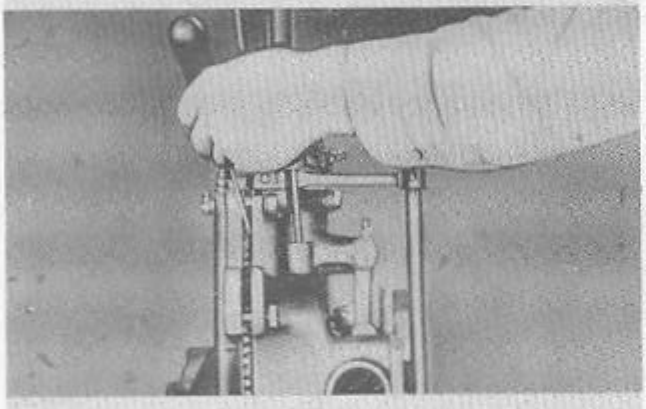




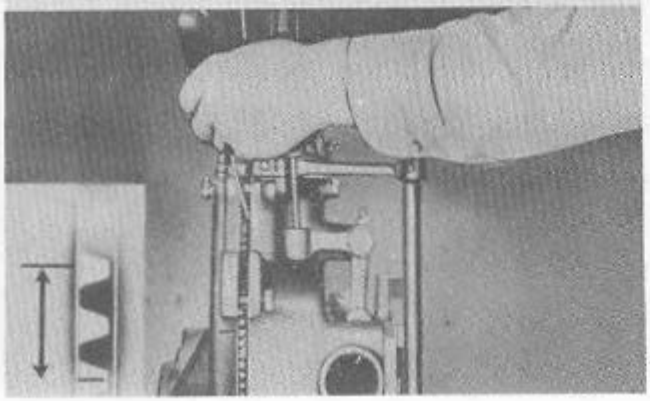
There are 114 teeth around the circumference of the cam gear. Since there are 360 degrees around the circumference of a circle, each of the 114 teeth represents slightly over three degrees and fifteen minutes.



Since each tooth represents about three degrees and fifteen minutes, two teeth will represent six degrees and thirty minutes, which is the amount we must reset the cam plate. So, the cam gear must be moved the distance of two teeth in a clockwise direction.

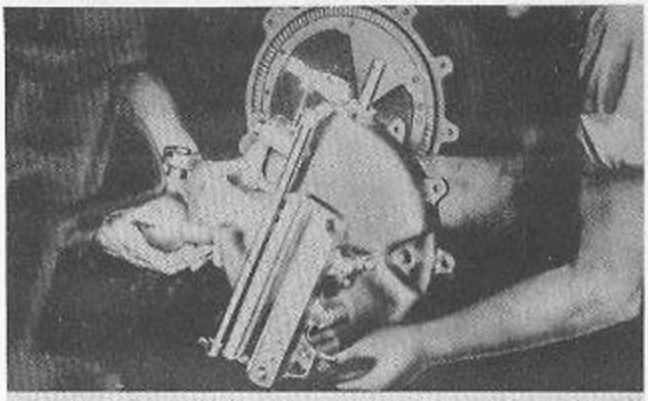


To move the cam gear a distance of two teeth, we first loosen the two mounting bolts that temporarily secure the lower housing cover and slip the cover away from the cam gear far enough to disengage the train input pinion from the cam gear. We assume that the person doing this is standing on the forward side of this assembly.

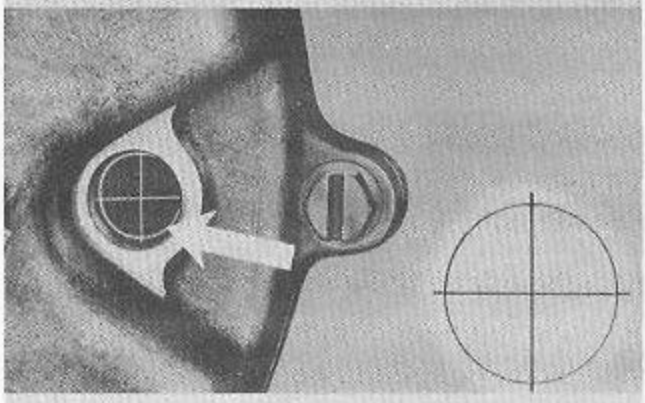


A pencil mark is made on the edge of one of the cam gear teeth and a corresponding mark is made on the edge of the cam gear housing a distance of two teeth clockwise from the mark on the gear. The cam gear is then rotated clockwise until the marks match up, changing the setting of the cam plate a distance of two teeth or six degrees and thirty minutes, the amount of error shown by the train indicator.

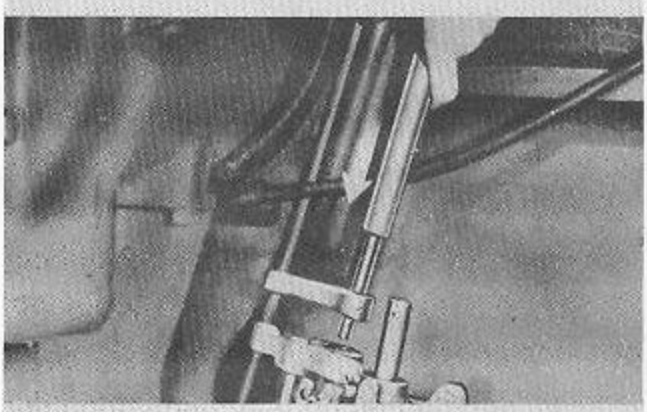
The housing cover is then slipped back into position taking care to mesh the train input pinion and the cam gear properly. The mount is then trained to the secured position to make sure. . .



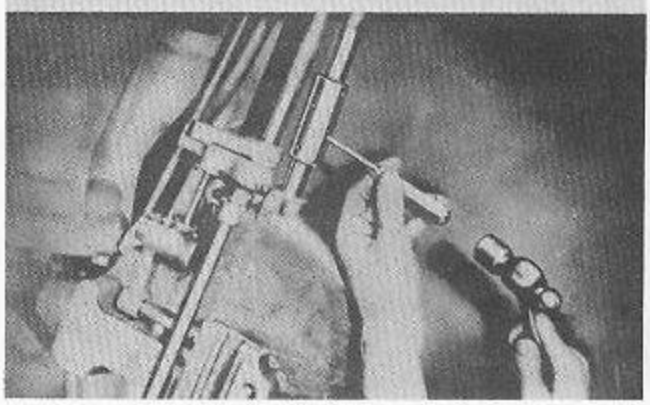
. . .that the permanent scribe mark is centered in the inspection hole. The housing cover is then secured by tightening the eight mounting bolts. With both housings in place, . . .

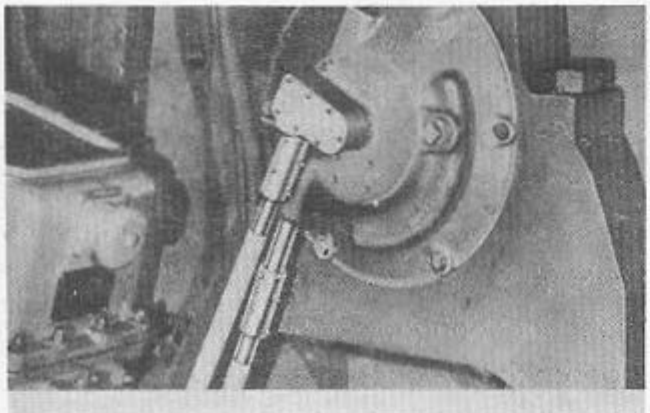


. . .the firing rod is now set in place over the lower housing. . .

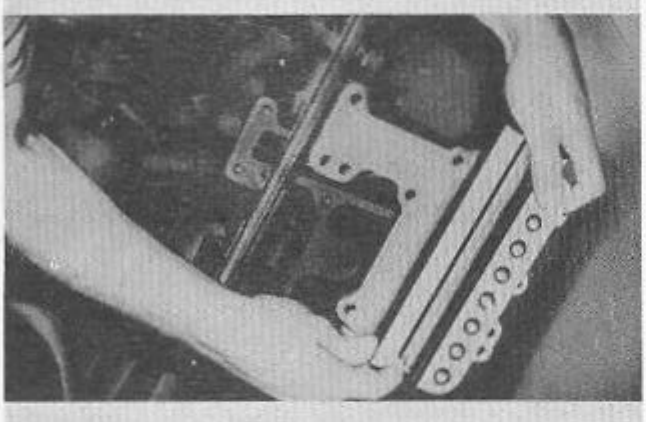


. . .and the elevation input rod is also set in place over the lower housing and secured with the two taper pins in the coupling sleeve.

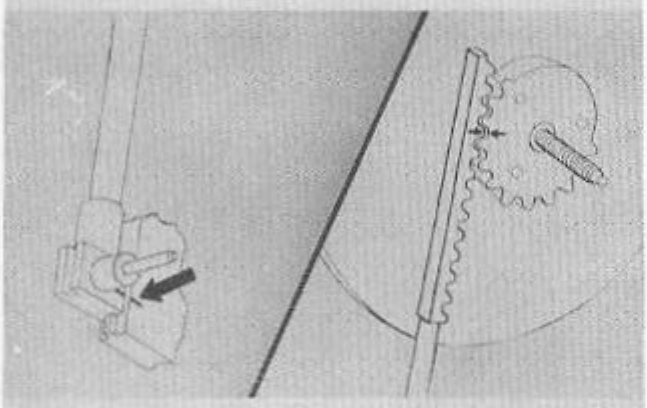




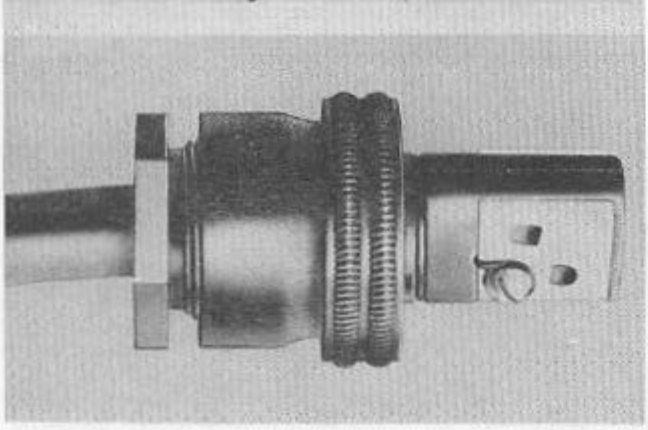
The upper sleeves on the firing rod a elevation input rod are then slipped in pla and secured by their taper pins. The firi rod and elevation input rod now link the t housings. With the elevation rod in place, . .



. . .the setting of the elevation input rod mus be checked to assure that the plunger wil follow the gun correctly in elevation. Th first step in this operation is to remove th foot-treadle guide bracket which was tem- porarily secured to the housing cover b two bolts. With the bracket off, . . .

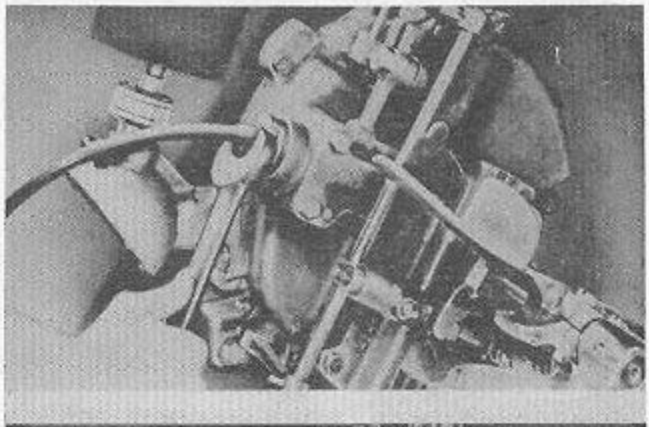


. . .a scribe mark on the plunger housing and another mark on the plunger housing guide can be matched up by setting the gun t zero elevation. If the arrows on the firing stop pinion and the rack at the trunnion cli were properly set, these scribe marks should also match. If the scribe marks and arrows do not match up when the gun is at zero elevation, the elevation input rod has been incorrectly installed. When the plunger has been checked against elevation of the gun and cam plate against train, . . .

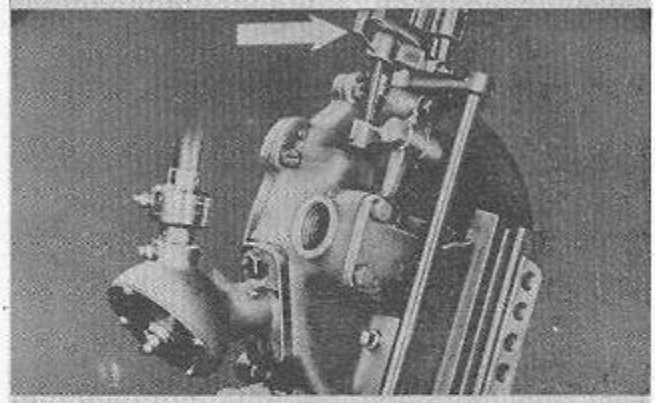


. . .the next step is to replace the electrical firing lead connection. Before doing so, clean its two contacts thoroughly with alcohol. This will make certain a secure connection between these contacts and the firing stop switch.

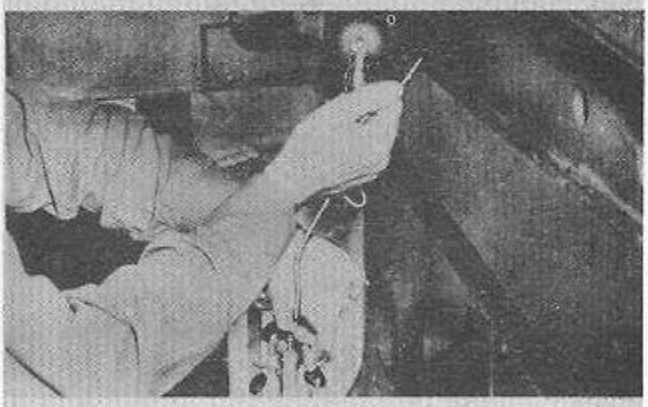
When the electrical firing lead is reconnected, . . .



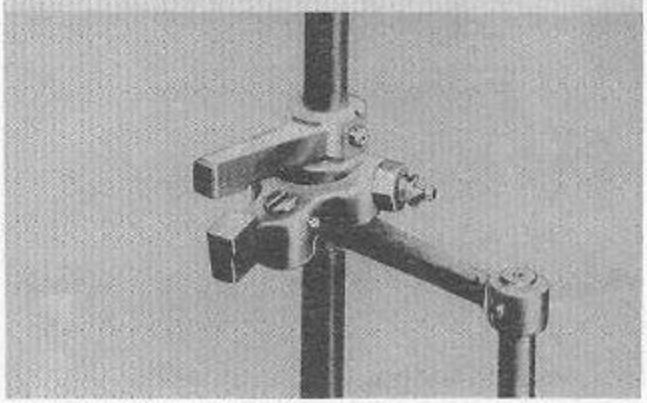
. . .the adjustment of the clutch throwout lever should be checked to ensure that it engages the upper clutch lever properly and that it operates in step with the firing stop switch. To do this, . . .

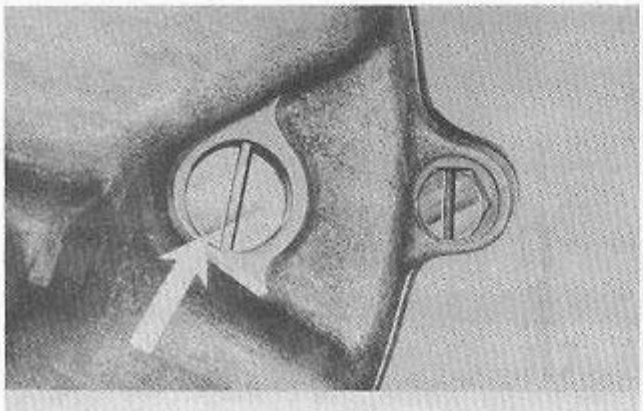


. . .first, insert a test bulb in the firing circuit terminal as shown here. With the firing key closed, this light will go out at the exact instant the firing stop switch is opened. With the firing key closed the gun is trained and elevated very slowly until the firing stop switch opens and the light goes out. Care must be taken to stop train and elevation at the exact instant the light goes out indicating that the firing stop switch has just been opened. To prevent percussion firing, . . .

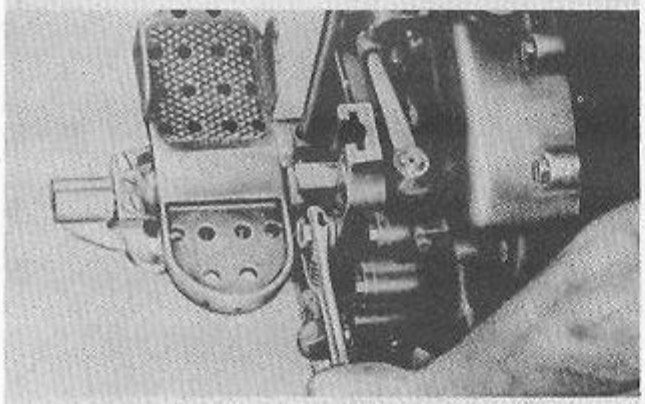


. . .examine the clutch throwout lever to see that its toe is clear of the upper clutch lever when the foot firing treadle is depressed. If the toe of the clutch throwout lever does not clear, it must be filed down until it will just slide past the upper lever. If it is found that there is too much clearance between the clutch lever toes at the time the electrical firing stop switch opens, a new clutch throwout lever must be installed. The new clutch must be tested, and excess material on its toe filed down in the same manner. When these tests have been completed, . . .

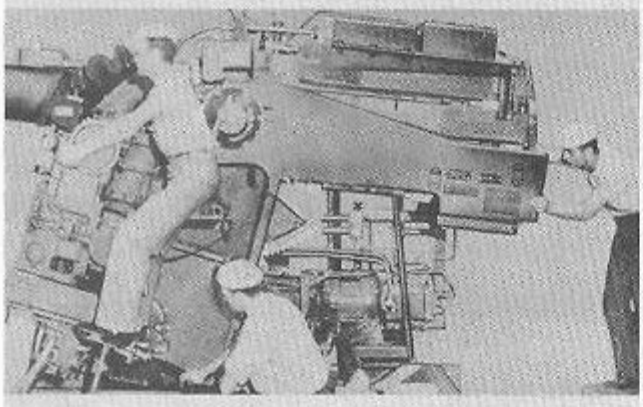




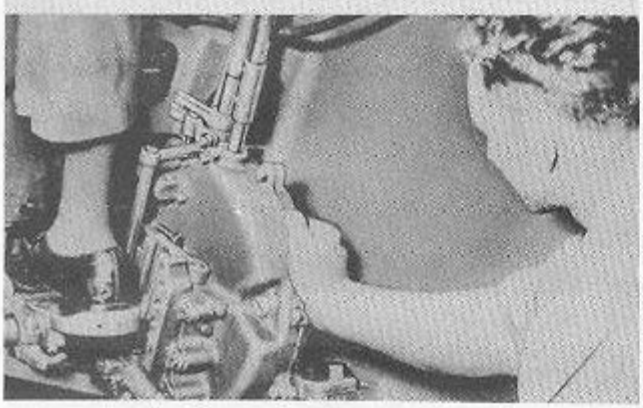
. . .we can complete the reassembly of the lower housing. The inspection plug is replaced.



The foot-firing treadle bracket is secured to the lower housing by the mounting bolts. The foot firing and firing stop mechanisms are now completely reassembled. We have made certain that the mechanisms will function smoothly, and are in alignment with each other.

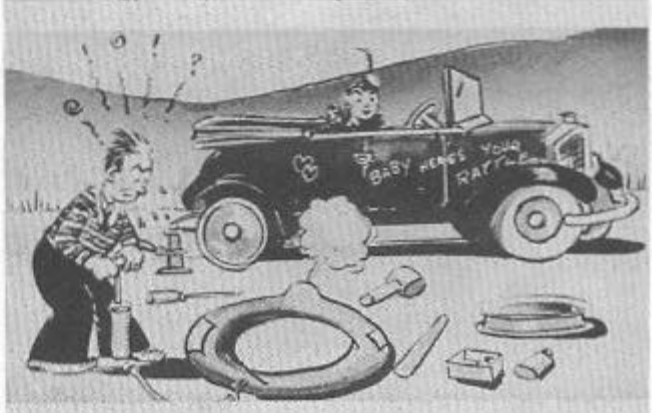


In addition, one final positive check of the firing stop mechanism is made by sighting through the bore of the gun to see that firing is cut out whenever the gun bears on any part of the ship's structure, and that firing is not interrupted when the gun is clear. With the observer sighting through the bore, the gun is trained and elevated very slowly into all parts of the ship's structure. Whenever he sees a part of the ship's structure beginning to cut across the muzzle of the gun, the observer marks. . .

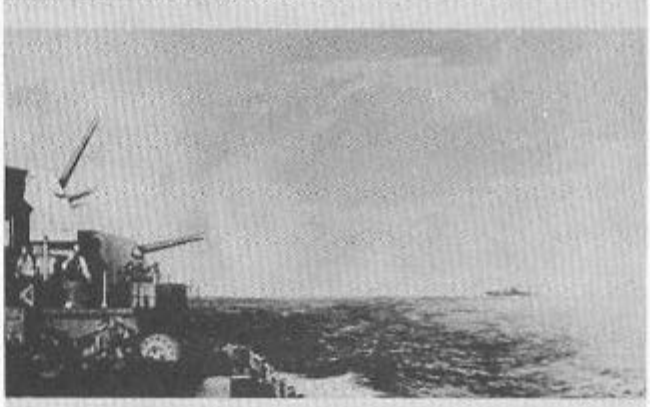


. . .and a second observer, who is watching the clutch throwout lever closely, notes whether the lever was disengaged just before the bore observer marked. The throwout lever should remain engaged whenever the gun is clear and should be disengaged just before the gun bears on any part of the ship's structure. Overhauling and checking the foot firing and firing stop mechanisms in this way will ensure that the gun will fire rapidly and accurately when required, and that it will be prevented from firing when firing might endanger our own ship and her crew.

Any mechanical device that is to be kept running properly must be given more or less regular care. Even an old die-hard jalopy needs an occasional oil change, tire check, brake adjustment, and grease job if it is to be kept running without casualty.

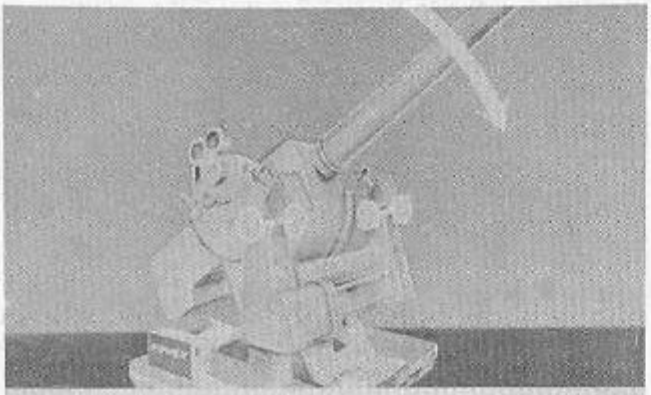


The amount and kind of care given to a mechanical device depends upon the use to which it is put. An automobile, for example, will usually run with a patched-tire or a leaky valve or two. If something goes wrong, you can generally patch it up sufficiently to get by for a while.

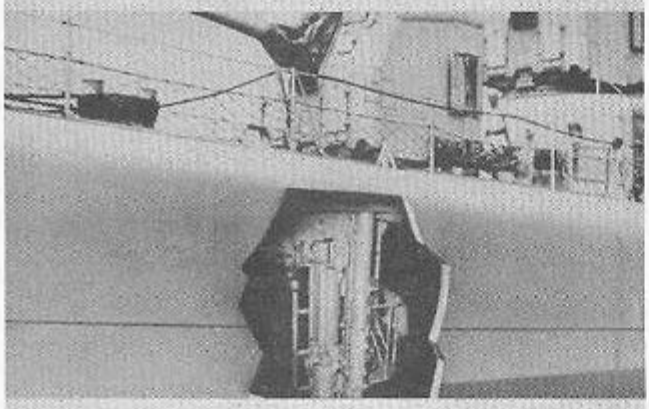


For the 5''/38 gun, however, getting by is not enough. Human life and the safe transport of vital war materials and supplies depend upon the precision and accuracy of this mechanism. A makeshift or slipshod maintenance treatment will not suffice.

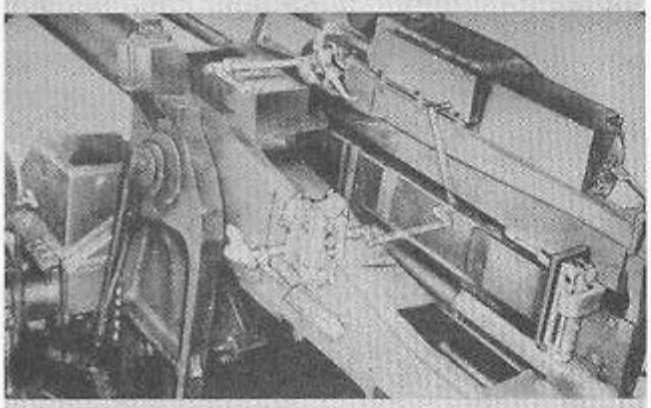
For this reason, all possible failures of this gun must be anticipated. To keep the gun firing they must be prevented by careful and painstaking maintenance. We've seen that this gun is a dual purpose weapon that must function against aircraft as well as surface ships. To hit fast moving air targets it must fire rapidly as well as accurately. This high rate of accurate fire can be made possible only by the smooth and unfailing functioning of all its mechanisms and parts.



The mount is designed to provide for eas train and elevation of the gun, and is equippe with a power drive to provide for fast an accurate control of these movements. Thi power drive and the train and elevation gear ing must be kept in perfect working order i the gun is to track its high speed aeria targets.



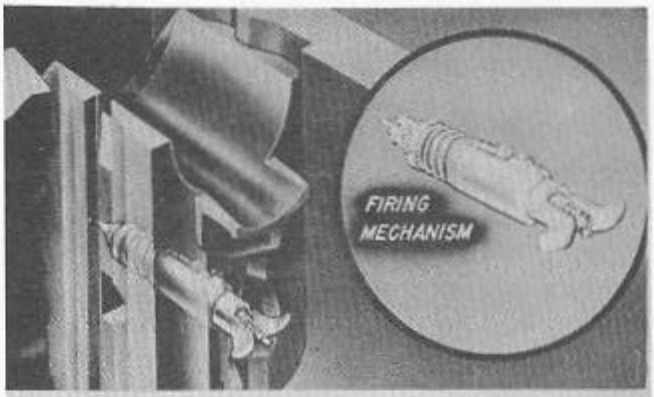
A high rate of fire demands that projectiles must be supplied rapidly to the gun. For this reason, the power driven projectile hoist must be kept running smoothly.



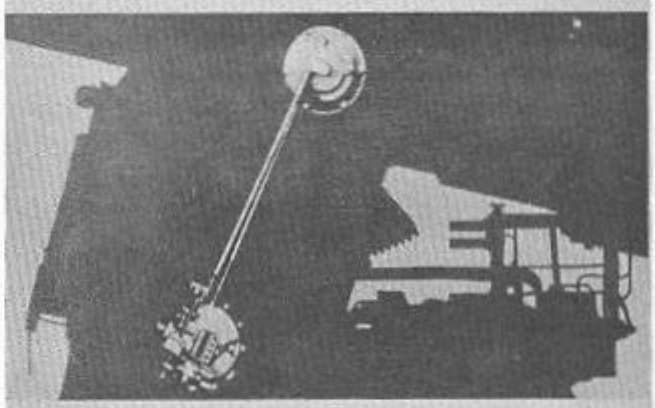
Largely responsible for the gun's ability to fire rapidly is the automatic operation of its breech mechanism, which must be maintained so that it will operate unfailing and without casualty.

Working in conjunction with the breech mechanism is the power driven rammer, which rams the rounds into the chamber. Maintenance of this mechanism will guarantee operation, without failure, in both ramming and retracting, and so enable the gun to fire rapidly.

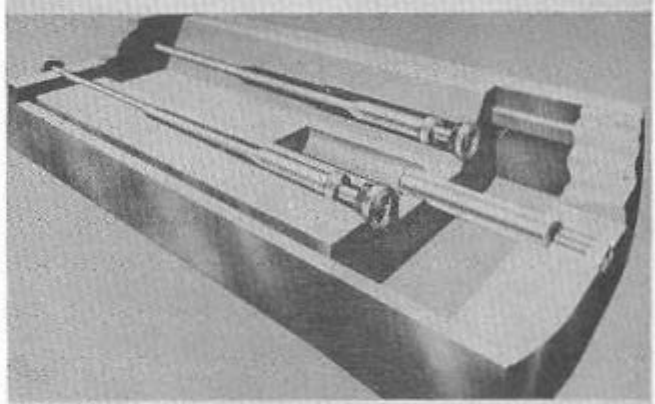
Careful maintenance of the firing mechanism is necessary so that the gun can be fired quickly by either firing method as soon as the breech is closed.



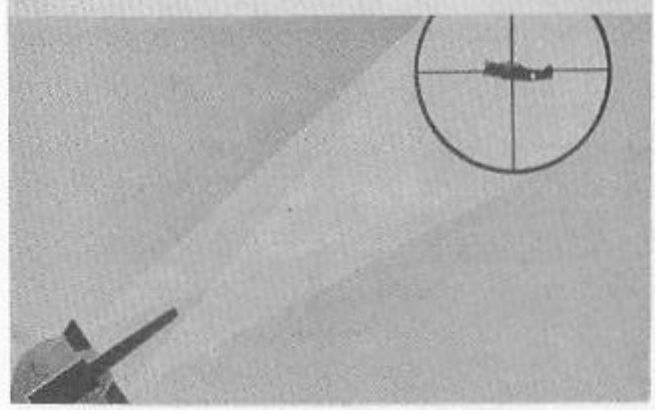
To assure that the standby method of percussion firing will always be available when needed, the foot-firing linkages must be kept in smooth working order. To prevent firing when the gun bears on the ship's structure, the firing stop mechanism must be checked and tested.

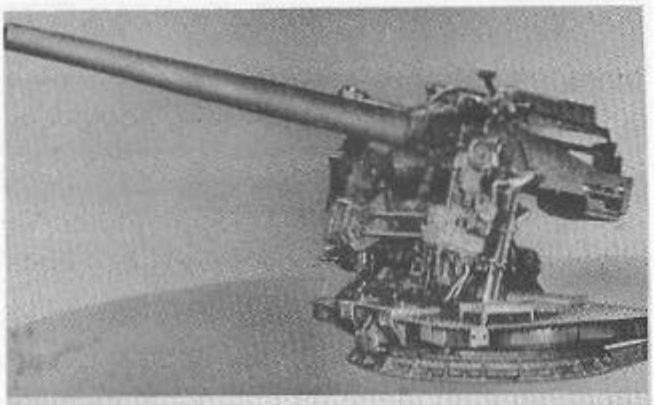


To absorb the shock of recoil quickly and smoothly, and to return the gun to battery, the recoil and counterrecoil systems must be kept in perfect working order. Rapid firing demands speedy recoil and counterrecoil.

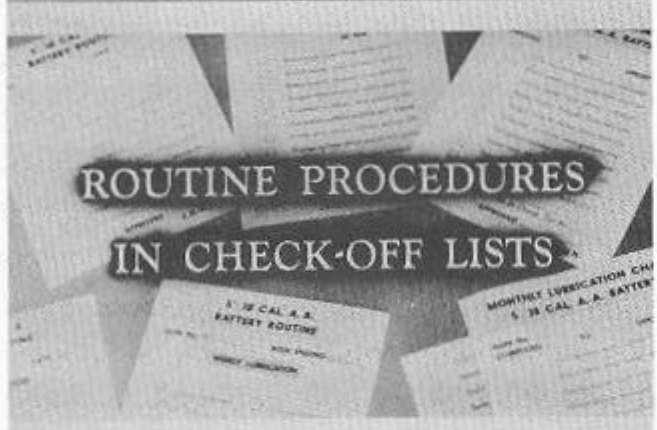


If the projectile is to hit the target, the sights must be frequently checked and adjusted.



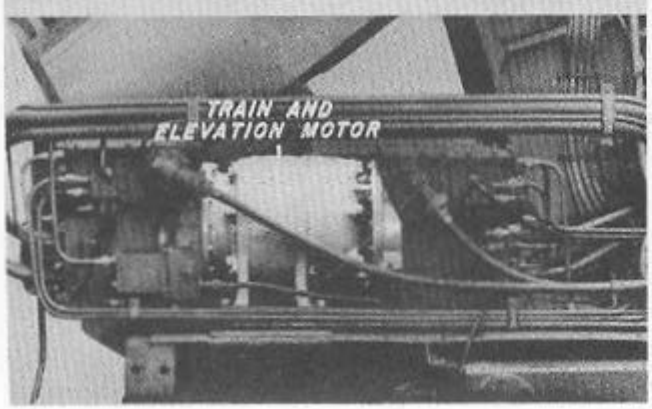


This gun will function without failure onl if all of these parts are correctly maintained Periodic maintenance involves systemati checking and testing of the operation each of these mechanisms, periodic overha to clean and inspect their parts, and th correction of any malfunctioning and mal adjustment that may be discovered.



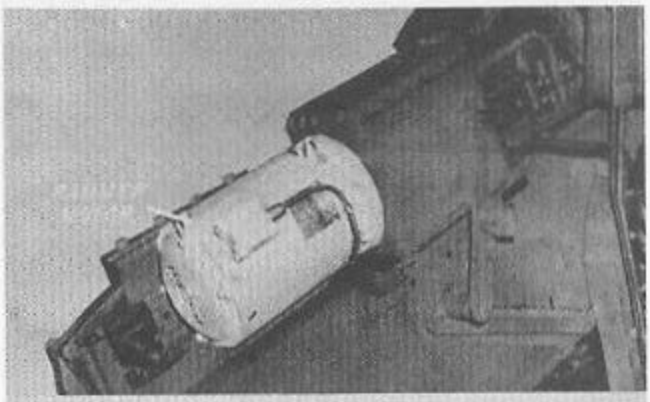
To assure thorough coverage of each mechan- ism, maintenance has been reduced to simpl routine procedures. On each ship these pro- cedures are indicated and thoroughly covere by checkoff lists. If these checkoff lists are used properly, which means taking u each step listed, in order, doing it carefully, and checking it off on the list as completed every mechanism will be maintained in good working order and the gun will function properly.

Let's study, first, the tests and procedures that are covered by the daily checkoff list and must be carried out every day to exercise the gun and to make certain that it is ready for combat.

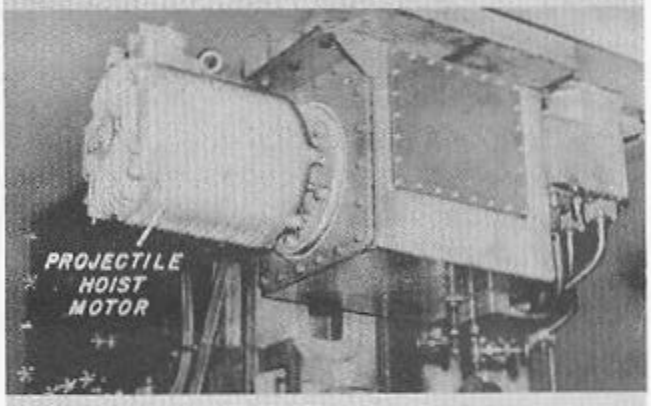


All the gun's electric motors must be checked daily to see that they run smoothly and quietly. Turn them on one at a time. In- clude the train and elevation power drive motor, . . .

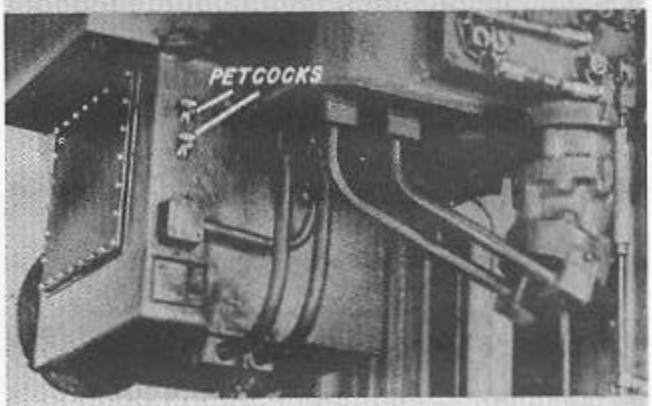
. . .the rammer motor, . . .



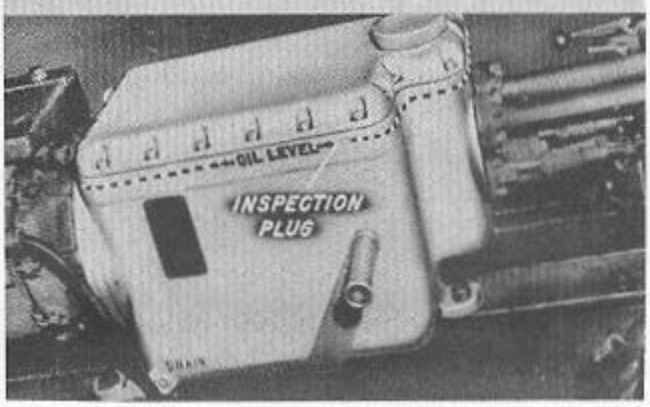
. . .and the projectile hoist motor. Investigate any excess vibration, scraping, clattering, and grinding. These mean trouble. Each of these motors drives its respective mechanism through a hydraulic system. Obviously their force cannot be transmitted hydraulically if there is insufficient oil in the systems. To see that there is enough oil, . . .

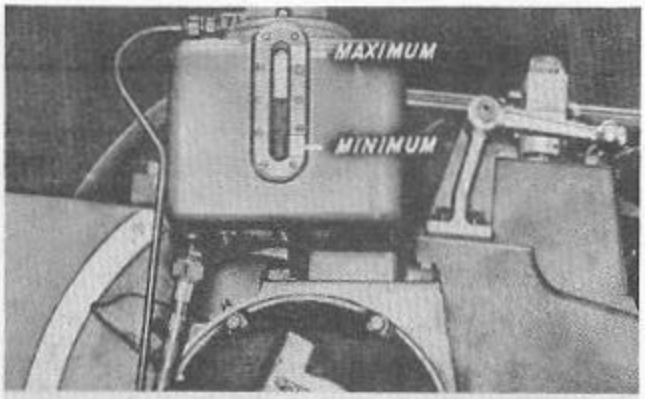


. . .check the oil level in the reservoirs in each of the three hydraulic systems. The oil level in the projectile hoist tank should be maintained between the two petcocks located on the tank.

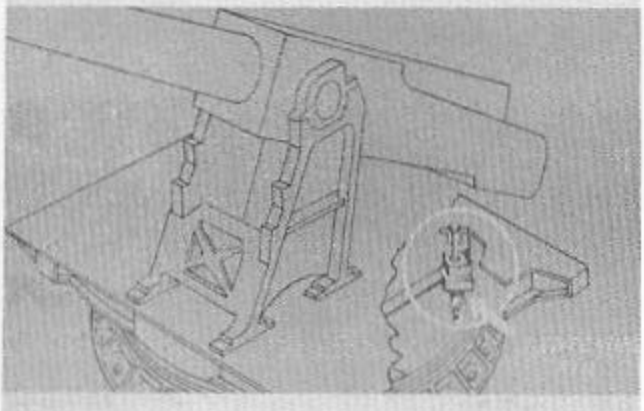


There is sufficient oil in the rammer reservoir if it leaks out when the inspection plug is loosened.

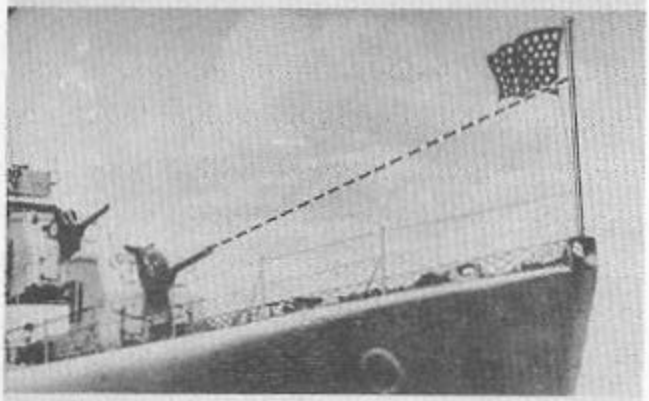




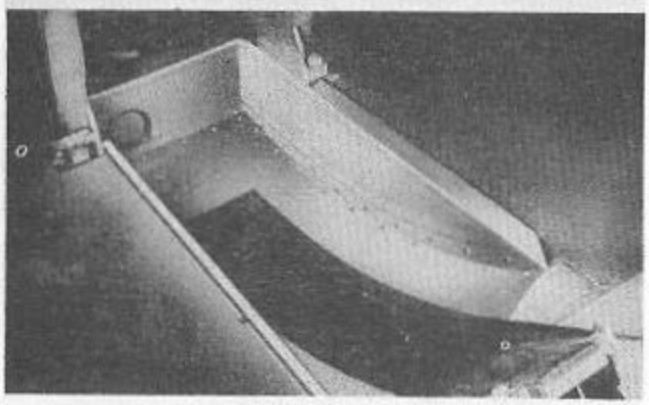
The oil level in the power drive expansio tank should be about half way between th minimum and maximum limits indicated o the gage glass after the motor has bee running for a few minutes. With all th motors warmed up and running smoothly and with oil in all the hydraulic systems the next step is an operational test of these drives and the mechanisms which they operate. Before testing the operation of th train and elevation power drives, . . .



. . .make sure that the centering pin is out so that the gun can be trained.

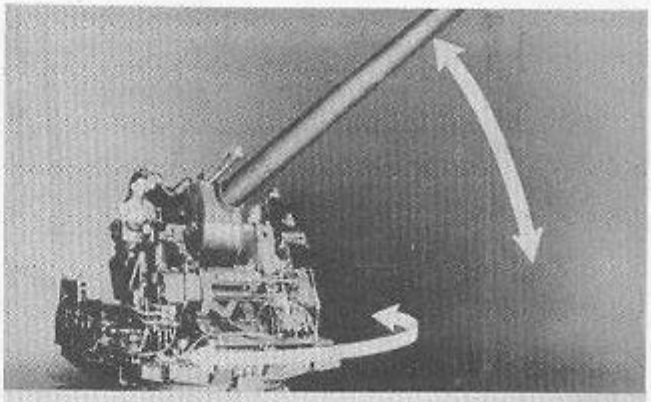


See that there is no obstruction in the line of fire or any in the path of the gun itself that will prevent free train and elevation.

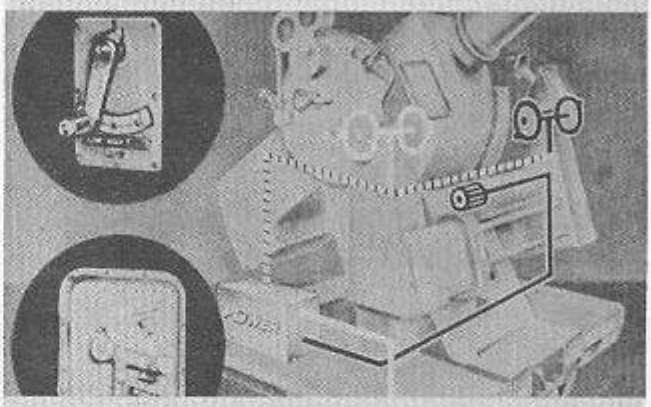


See, further, that the gun pit is clear of obstructions so that the after end of the gun will not be jammed in elevation.

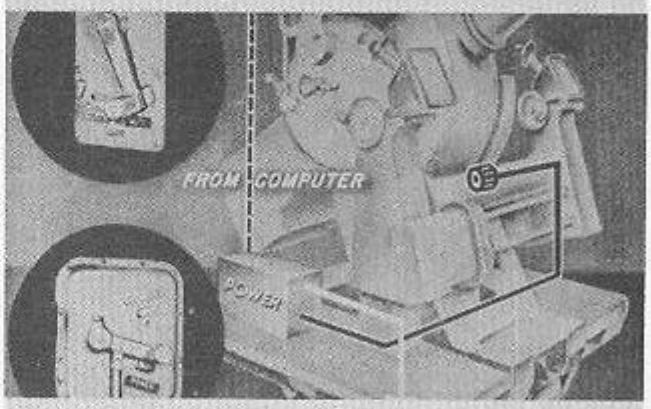
Then, to make sure that the drive is not injured by frozen gearing, set the train and elevation selector levers to manual and exercise the gun through a limited arc by manual control. If the gun moves freely, . . .



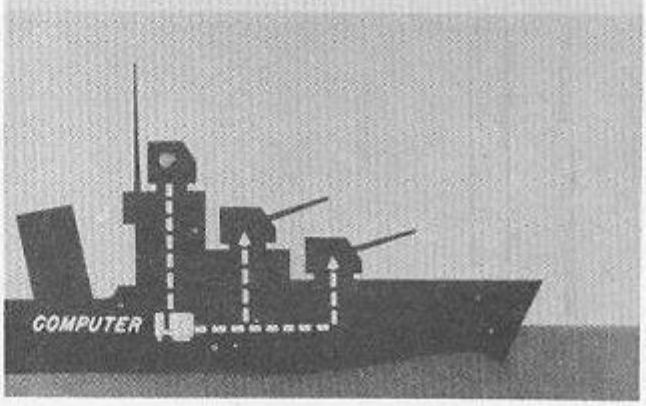
. . .test elevation and train in both low and high speed local power control. While doing this, drive the gun through full arcs of train and elevation to test the automatic limit stops. Be sure that this power operation is smooth and uninterrupted.

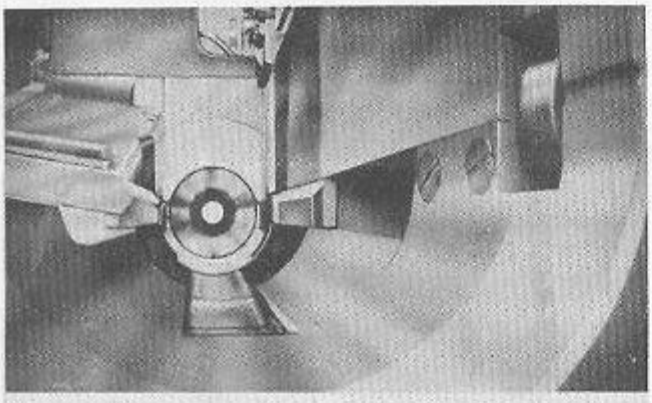


Finally, test elevation and train under automatic control to check signal transmission from the computer to the gun.

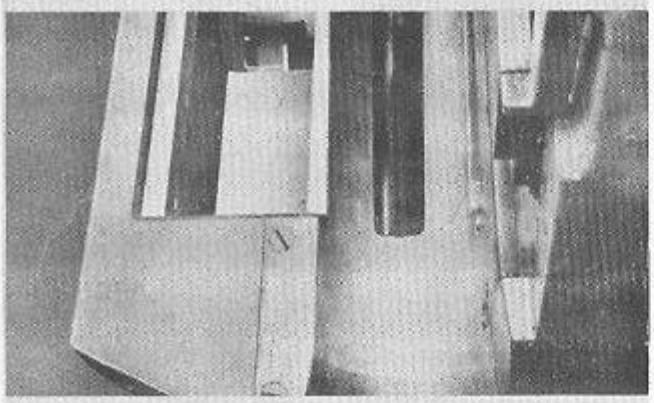


If the 5"/38 were merely a saluting gun, all we would have to do is maintain it well enough so that it would make lots of noise when it was fired. But since this gun must fire its projectile so as to hit and bring down the enemy, we must make certain that it obeys, accurately, all the signals transmitted to it from the computer. The computer is part of the fire control system and makes all the fine calculations that are involved in aiming the projectile accurately, and translates the results of these calculations into train and elevation of the gun, elevation and deflection of the line of sight, and correct fuze setting for the projectile. To assure accurate fire, . . .





. . .a daily transmission check must be m to see that the gun receives the compu signals in train, elevation, sight angle, flection angle and fuze-setting. With mount operating smoothly, the next step to check the operation of the mechanism the gun itself. Before doing this, see t the bore is clear.

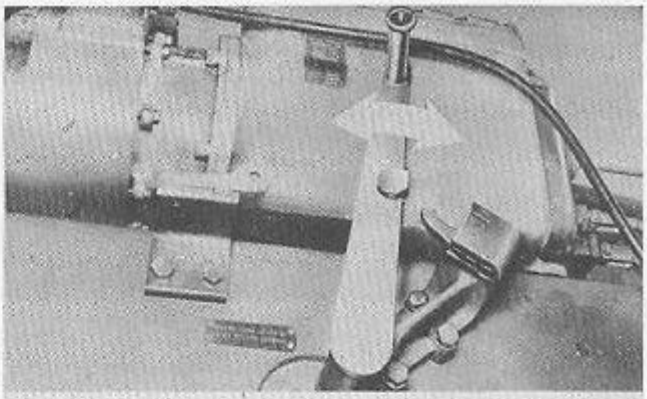


Also, see that the space between the sli rear plate and the breech housing clear, . . .

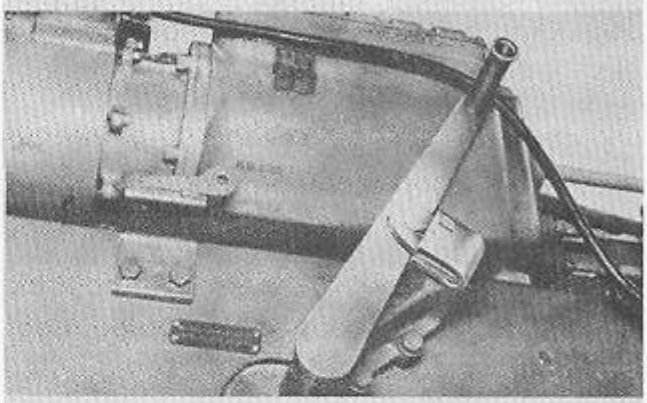
. . .and that the safety link is disconnect and secured in its unlocked position so th the gun can recoil freely when it is fire When these precautions have been take the operation of the breech mechanism a the rammer should be tested.

The operating spring chain connectors shou be inspected frequently. Vibration tends t loosen its securing screw, and if the scre comes out the spring will be disconnecte and will result in failure to close the breech

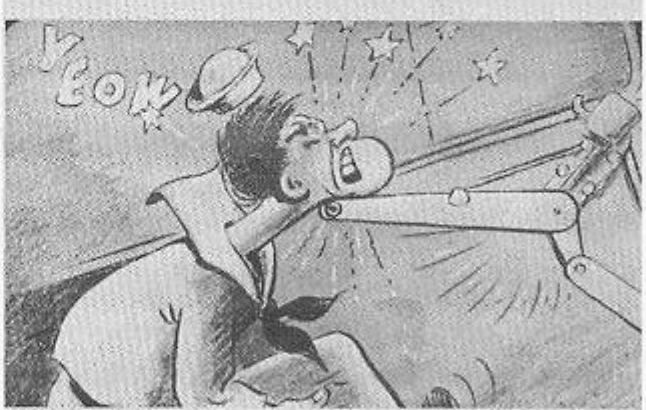
Exercise and check the action of the breech-plug. Lower it part way with the hand-operating lever. Lowering it all the way would cause it to latch. Ease the plug up with the lever to see that it works freely. Then raise and lower the plug in this manner, several times to exercise it and make sure that it does not stick. Then, to test operation of the rammer, lower the plug all the way until it is latched by the extractors.



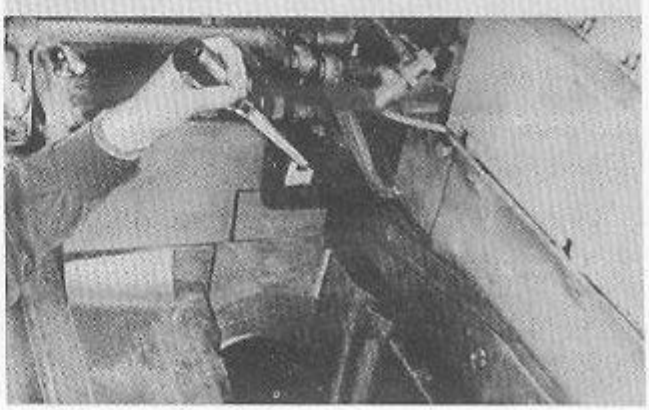
Be sure to latch the hand-operating lever in its secured position after lowering the plug. . .

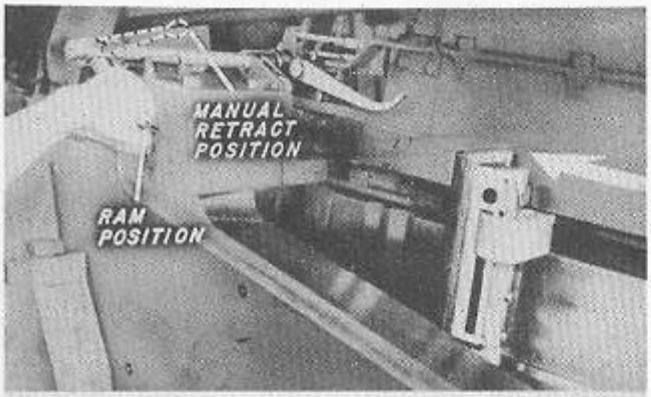


. . .or it may do <u>this</u>!

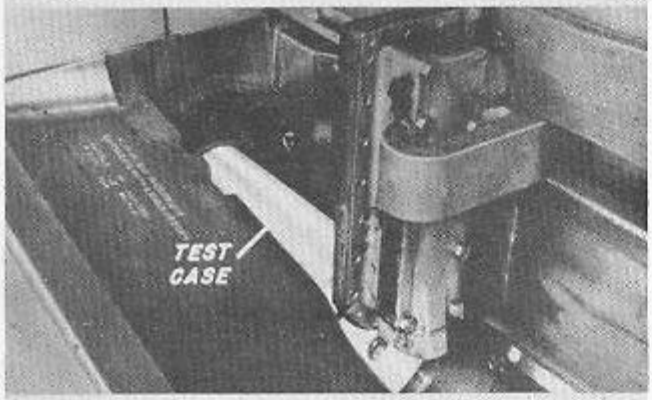


To exercise the rammer, hold the interlock latch retracted with a screwdriver or other tool, and with the rammer motor running, . . .

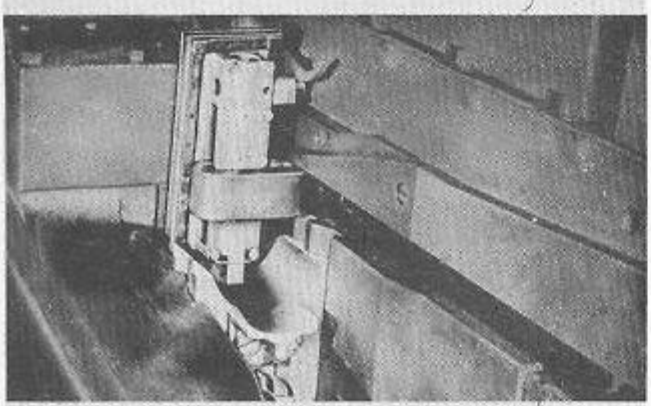




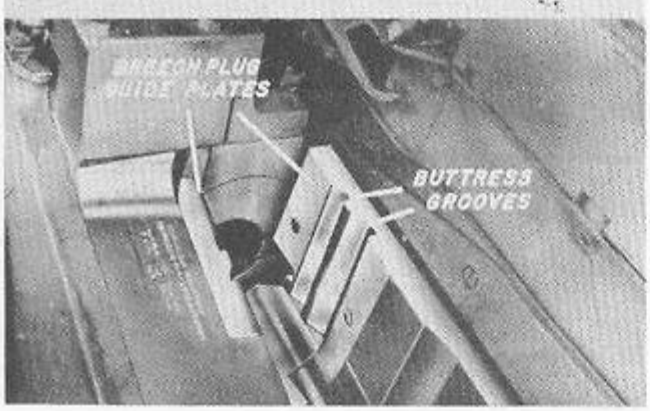
. . .run the spade back and forth abo fifteen times by pushing the rammer opera ing lever down to the ram position and th raising it all the way up to the manual re tract position. This will warm up the hy draulic fluid.



To test the working of the rammer an the breech mechanism in relation to eac other, seat a test case part way into th chamber over the lowered breechplug an with the interlock latch freed, . . .

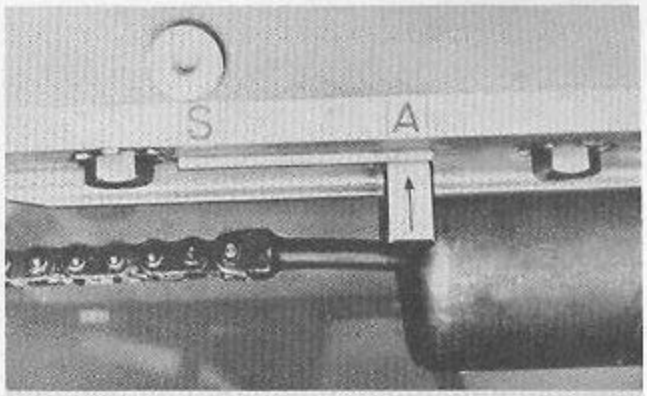


. . .ram the test case. The breechplu should rise smartly to its closed position Observe the movement of the rammer spad to be sure that it rides up freely as th breechplug comes up. If the breechplug doe not operate properly, the operating sprin requires immediate adjustment by a metho we shall discuss later.

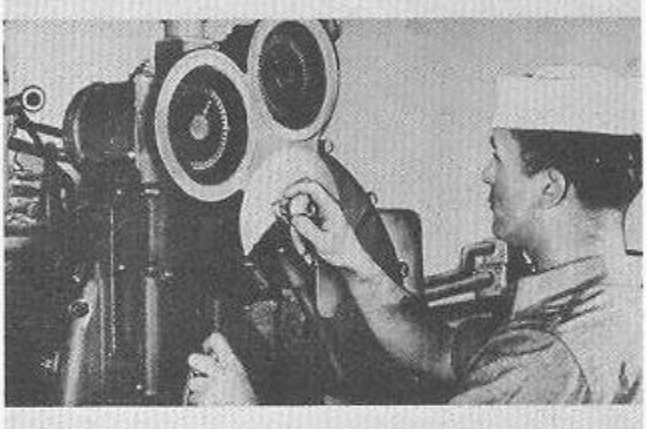


Inspect the breechplug guide plates an buttress grooves carefully. They must be kept clean and well lubricated. In lubricatin the plug, be careful to keep grease off the firing mechanism.

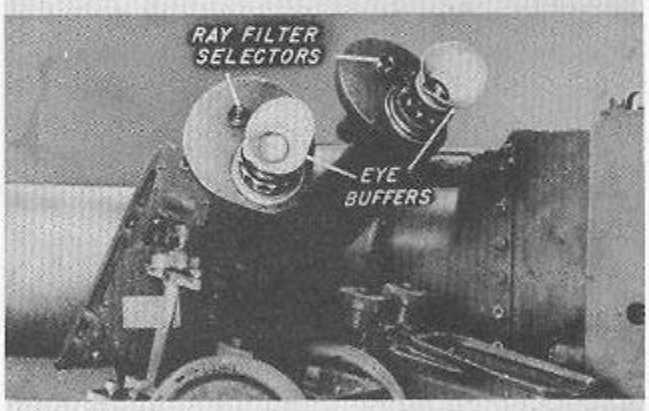
Before leaving the breech mechanism, check the position of the cam plate retractor. It should always be left on the "A" setting so that the breech mechanism will be operated automatically to ensure the highest rate of fire when the gun goes into action. When the loading mechanisms have been checked, . . .



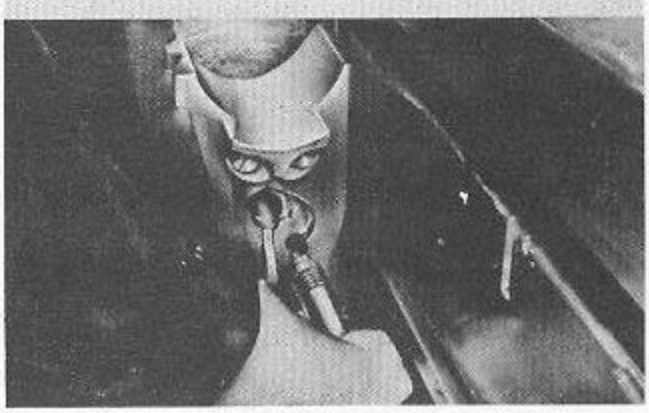
. . .the sights must be exercised and checked to ensure accurate aiming of the gun. Operate the sight-setting mechanism through its full arcs of elevation and deflection to ensure that lubricant will be carried uniformly over all the gearing.



Inspect the telescopes. Clean their lenses with lens paper. Inspect the ray filter selectors and eye buffers. Having made sure that the gun can be loaded and aimed, . . .

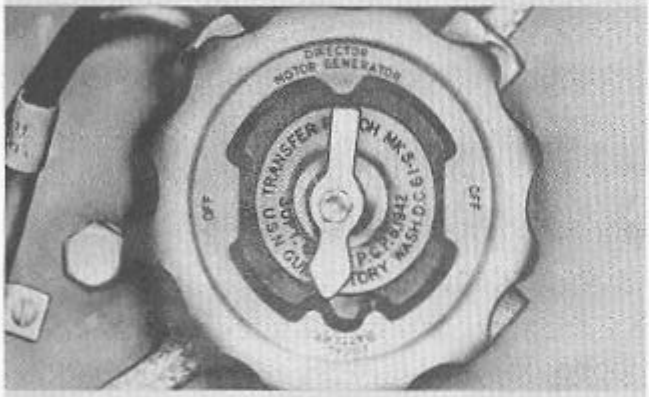


. . .our next daily check is to see that it can be fired. We start with the firing mechanism. Each day replace this mechanism with a cleaned and overhauled spare so that the one that has been in use can be cleaned and overhauled without putting the gun out of commission. With the spare installed, . . .

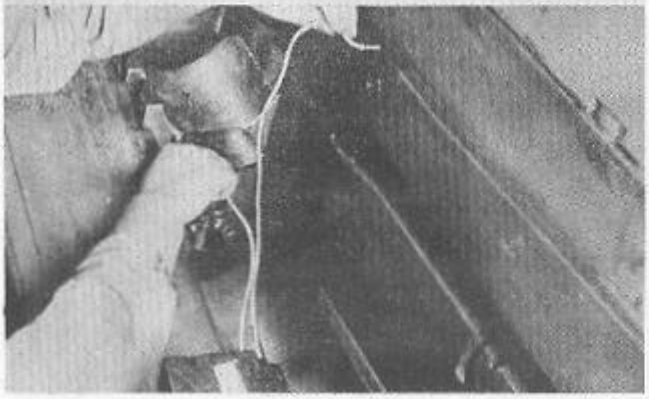


. . .check the electrical firing circuit wi . a test lamp to make sure that current c being delivered to the firing pin. With th ir firing key closed the lamp should light whe ti one lead is held against the firing termin r and the other grounded to the gun. Thi b test should be conducted. . . o f

. . .on motor-generator circuit. . .

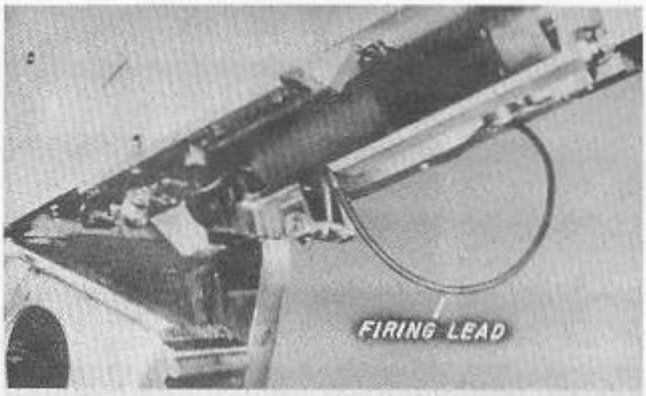


. . .and on local battery. With current being supplied by either circuit, the test lamp should glow brightly when on the motor-generator circuit and dimly on the local battery circuit. If it does not, trouble is indicated in the firing circuit.

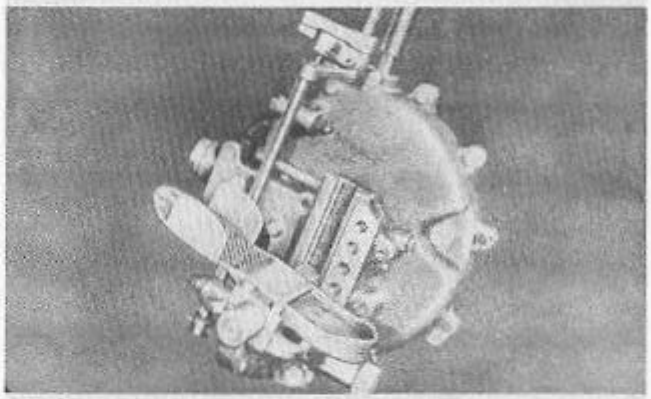


If a megger is available topside, test the insulation of the firing mechanism. Attach one lead of the megger to the firing terminal and ground the other lead to the gun. When the handcrank is turned the megger should read at least one megohm. If the reading is lower, the insulation should be checked carefully to locate the partial ground. The most common place for trouble to occur. . .

. . .is in the firing lead. Look this over carefully. To prevent deterioration of the insulation it should be kept clean, and particularly, no lubricant should be allowed to remain on it. If there are twists, kinks or breaks in the lead, replace it with a new one. Having made certain that the electrical firing circuit is in good condition, . . .

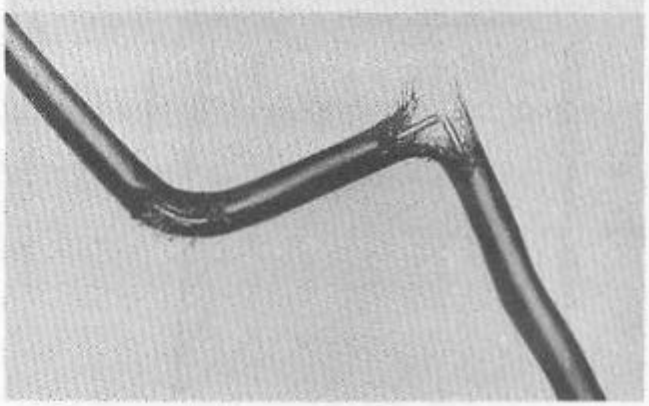


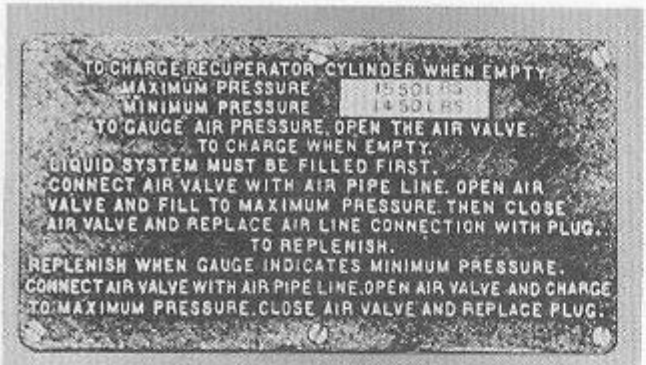
. . .make a quick check of the foot-firing mechanism. With the gun pointed in the clear, depress the foot-firing treadle. When you do so, the clutch throwout lever should engage the upper clutch lever to rotate the firing rod.



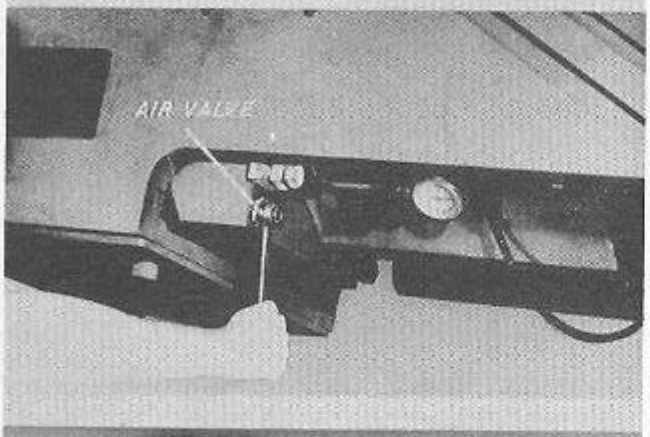
Next, test the firing stop mechanism by training the gun to a blind spot on the ship and depressing the foot treadle. If the clutch throwout lever is disengaged from the upper clutch lever when you do this, the cutout mechanism is functioning properly.

Now, take a look at the lighting circuit. Inspect the leads for cracks and worn spots in the insulation. Be sure that all lights function and that all the leads are secure.

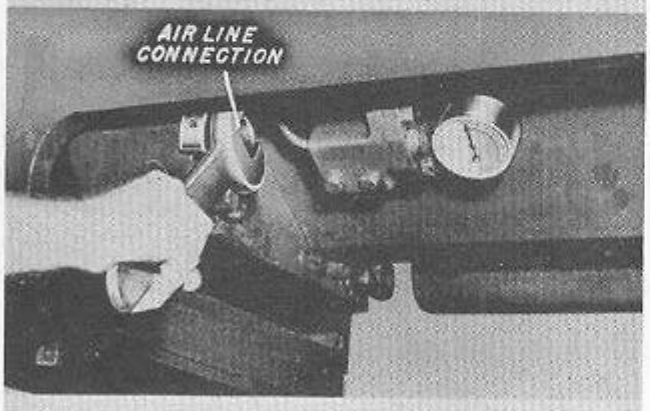




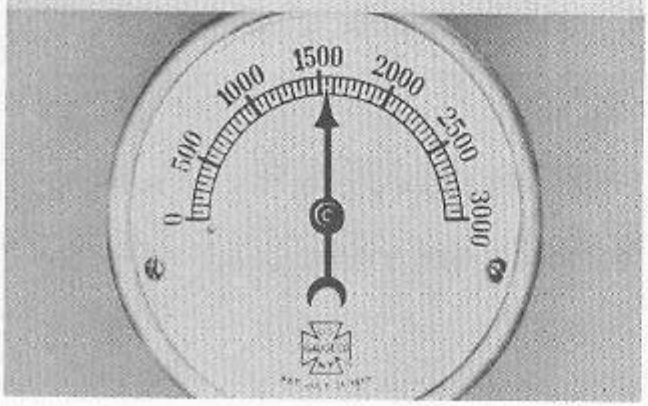
Our next daily check concerns the counte recoil system. As indicated on the instru tion plate, the pressure in the counterrec air chamber should not be allowed to dr below 1,450 pounds per square inch. If it less, the gun will not be returned to batte at the proper speed, and the rate of fire wi be slowed down.



The counterrecoil chamber air pressure i indicated by the gage. To check this pres sure, make certain first that the plug sealin the airline connection is tight, and then ope the air valve. After reading the pressure close the valve to prevent air from leakin out through the gage. Release the ai between the valve and the gage. . .

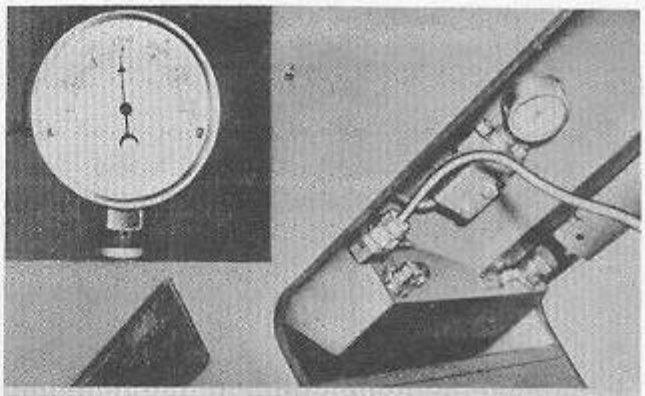


. . .by cracking the plug on the airline con nection. The plug is provided with a bleede hole for this purpose. Close it after releas ing the air pressure on the gage.



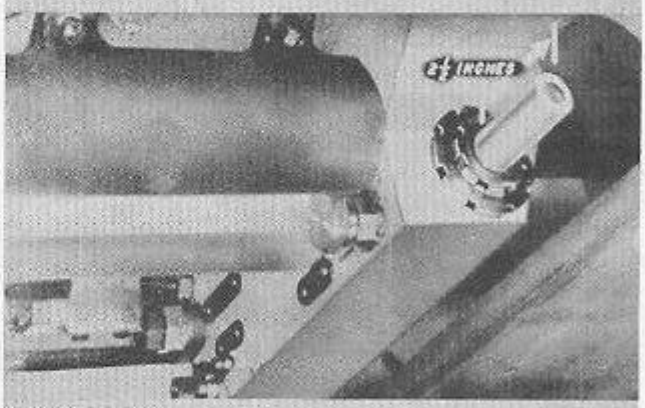
In checking the gage for air pressure in the counterrecoil chamber, compare the pres sure reading with that recorded on the previous day. Tap the gage gently to make sure it has not stuck. Temperature varia tions from day to day will cause slight changes in the gage pressure. But con sistant dropping in pressure indicates leakage and should be investigated.

If the air pressure is below 1,450 pounds per square inch, recharge the system to bring the air pressure up to 1,550 pounds per square inch in the manner described in our discussion on the Disassembly and Assembly of the Recoil and Counterrecoil Systems (chapters 13 & 14).

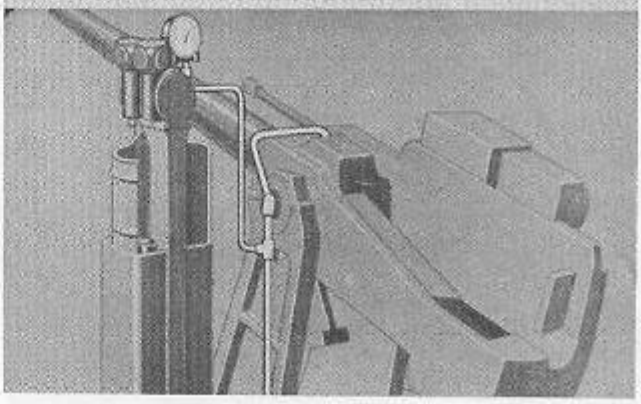


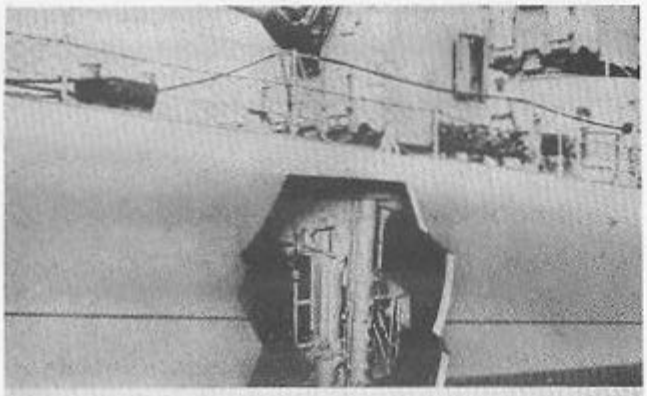
We've seen that oil leaks can occur in the differential system. The oil supply in the differential cylinder, therefore, should be checked daily by measuring the protrusion of the differential plunger. When the differential cylinder is full of oil, the end of the plunger is flush with the packing gland nut. As the oil supply diminishes, the plunger moves outboard beyond the packing gland.

Never allow the oil supply to become so low that the plunger projects more than about two and one-half inches beyond the gland nut. Compare the measured position of the differential plunger with that recorded on previous days. Should there be a noticeable difference from day to day, leakage of oil is indicated and should be investigated and corrected.



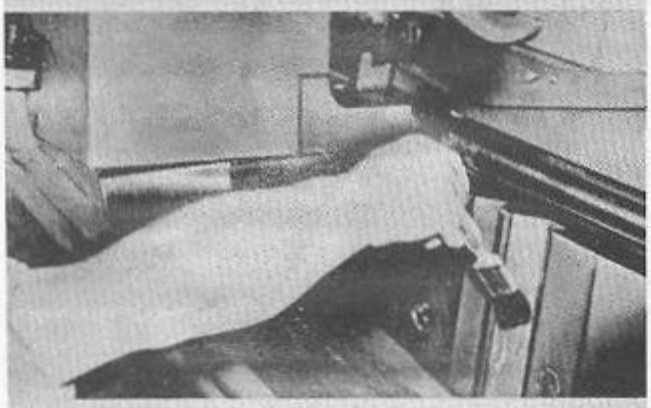
If the gun mount is fitted with a gas ejector, all water must be bled from the gas ejector air line system daily, and the air pressure checked by reading its gage. Pressure in this system should not be permitted to drop below 65 pounds per square inch.



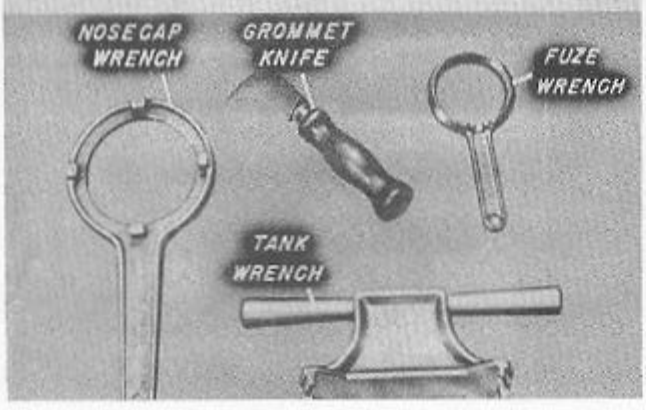


The final daily check is to test the operati of the projectile hoist, first manually, a then under power as outlined in your stu of the hoist mechanism. Run up two or thr rounds of drill ammunition. At least two these should have dummy fuzes for a fuz setting check.

Many parts of the gun and mount requir daily lubrication. To be sure that none these parts are missed, follow the dail lubrication chart carefully. Always us the lubricant specified in the chart.

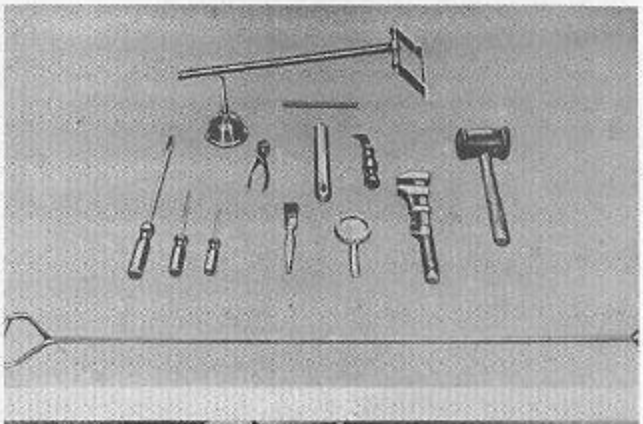


In spreading lubricant over large surfaces such as the breechplug guide plates, a brus or clean rag should be used. Cotton wast would leave lint to foul up these parts, an fingers would leave perspiration to corrod the highly polished metal surfaces.



When all the daily maintenance routines hav been completed, check to see that the nos cap wrench, grommet knife, fuze wrench and tank wrench are all on hand in their proper locations in the magazines, handlin room, and at the gun.

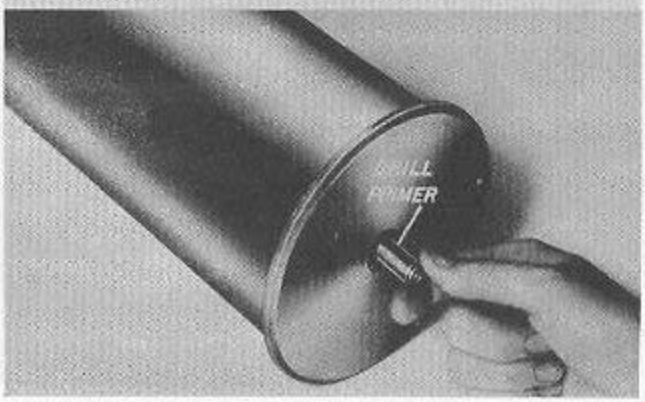
In combat, there isn't time to look for tools. Check the ready tools to be sure that they are all present. These should be kept together in a very convenient location.

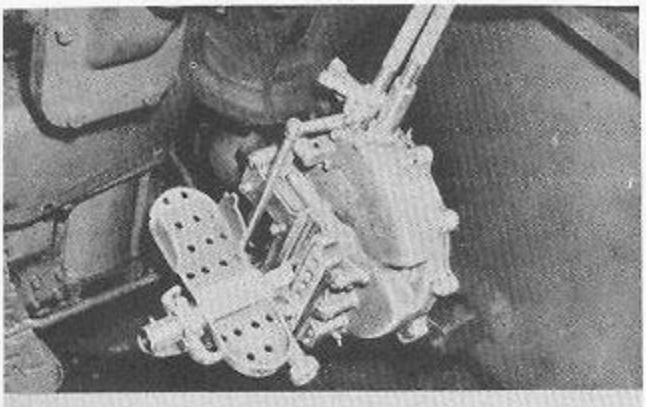


While the daily checks and tests cover all the operating mechanisms thoroughly, there are a few additional maintenance points included in special weekly checkoff lists.

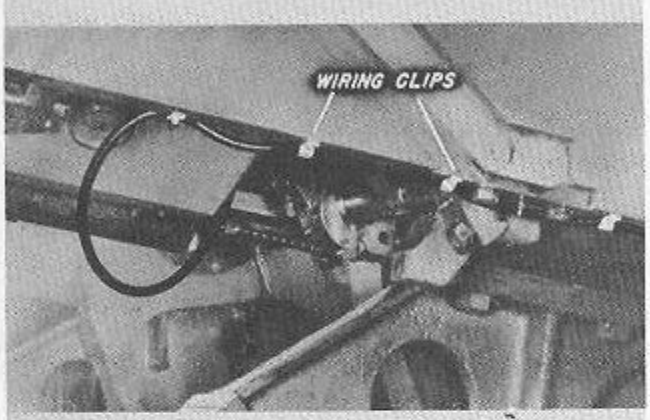
Once each week, in addition to the procedures of the daily checkoff list, the recoil cylinders must be filled or primed in the presence of the division officer. Follow the procedure of filling and venting given on the instruction plate secured to the slide.

If the gun has not been fired, a positive check of the firing mechanism should be made by firing drill primers. At least three drill primers should be fired to check percussion firing, local battery electrical firing, and motor-generator electrical firing. The primers are inserted in a test case which should be seated in the chamber and rammed manually to close the breech. If any of the primers fail to fire, a thorough check should be made of the firing system.

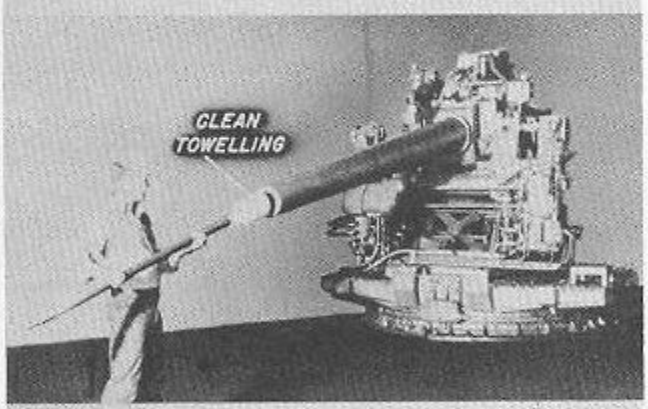




Test the action of the foot-firing mechanism. See that it works smoothly and is well lubricated. An excess of lubricant should be avoided in the lower housing because it may foul the contacts of the electric firing stop switch and interrupt electrical firing.



Make sure that all the wiring clips on the firing lead are tight, and check carefully to see that the lead is not broken and that its insulating covering is not damaged. When the tests of the electrical firing circuits have been completed, be sure to leave the firing circuit selector switch on motor generator.

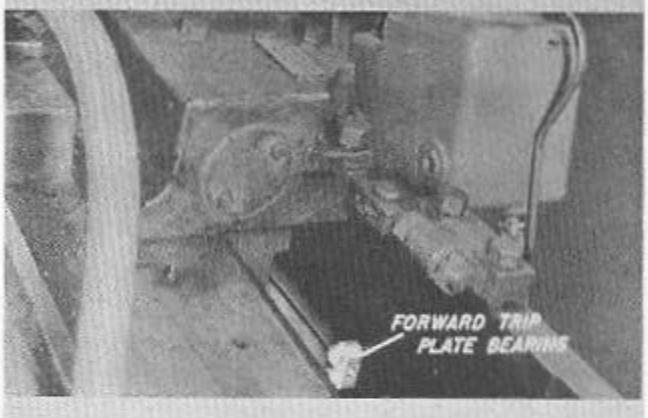


To protect the surface of the gun bore from pitting and corrosion, it should be sponged out weekly with clean towelling wrapped around the bristle bore sponge.

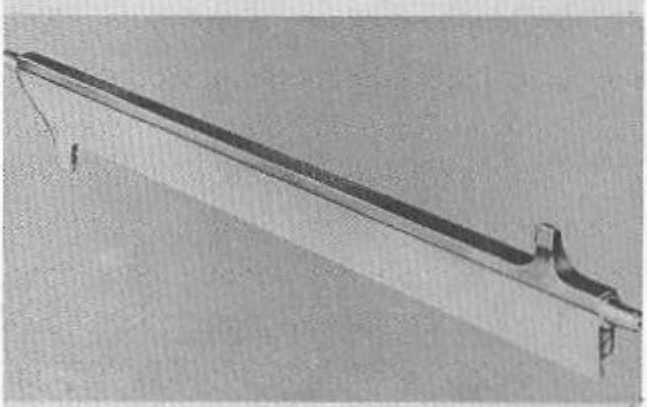
After cleaning, a film of protecting oil should be deposited on the bore by running an oil-soaked cloth through the bore with the bristle sponge.

In addition, after the gun has been in action, all combustion products must be cleaned out of the bore. Sponge out with hot soda solution. Wash the soda solution out with fresh water. Dry the bore thoroughly. Oil the bore to protect it from corrosion and finally, inspect the bore by passing a bore gauge. If the gauge will not pass, copper restriction should be removed with a wire brush. Be very careful to use the brush only in the vicinity of the copper deposits. Otherwise, you may scratch the very thin chromium plate of the bore. To be sure that all parts requiring weekly lubrication are attended to, follow the weekly lubrication chart step by step. One point on this chart, which is easy to overlook, . . .

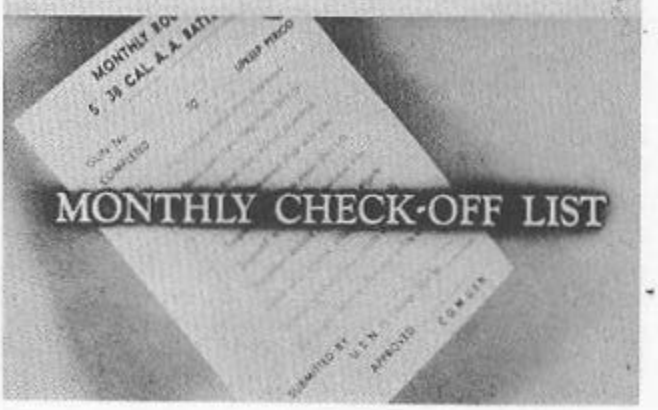
. . .is the forward trip plate bearing. It must be checked carefully for corrosion, particularly in open mounts where it is exposed to salt spray. If the trip plate shows any tendency to stick, remove and clean this bearing.

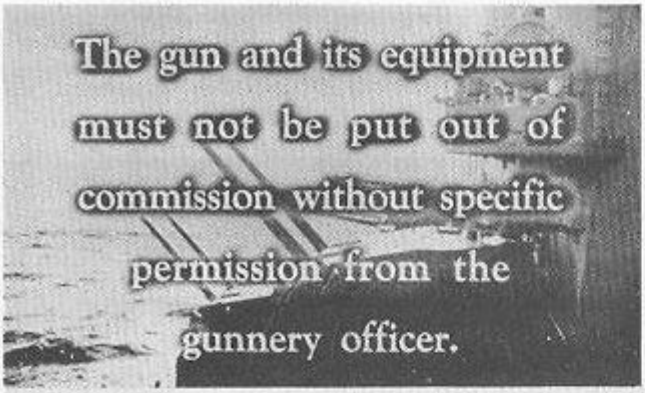


When the bearing has been removed the trip plate can be pulled out for cleaning and lubrication before reassembly in the slide.



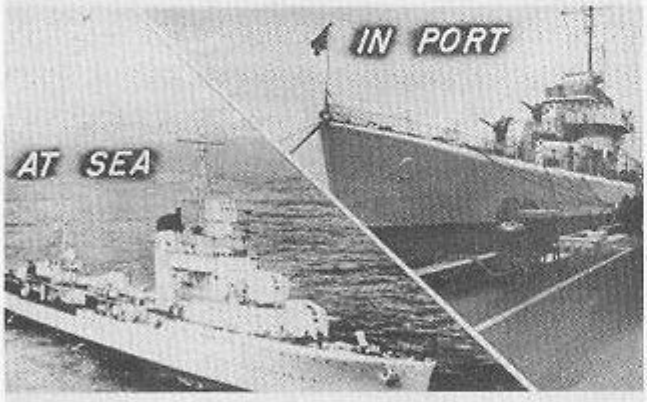
A monthly checkoff list includes a number of major maintenance operations which must be carried out to keep the gun operating smoothly. Some of these operations would involve disassembly of major units on the gun.



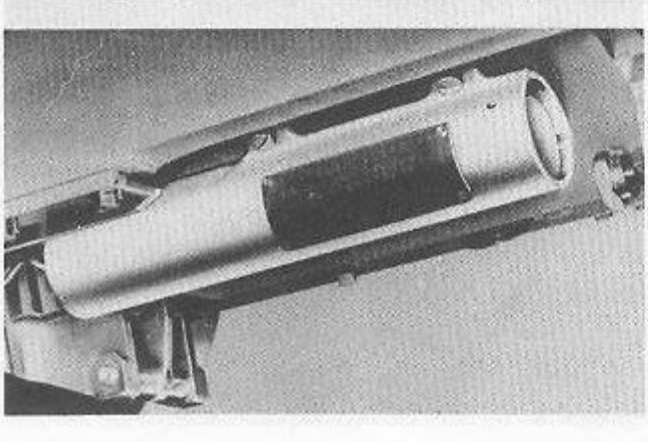


The gun and its equipment must not be pu out of commission without specific permis- sion from the gunnery (weapons) officer When this permission is granted and the gu is put out of commission in order to dis- assemble parts as required for monthl operations,. . .

. . .the disassembly must be carried out so as to decommission only one gun at a time. This will prevent the ship from being caught with- out defenses if a surprise raid occurs.

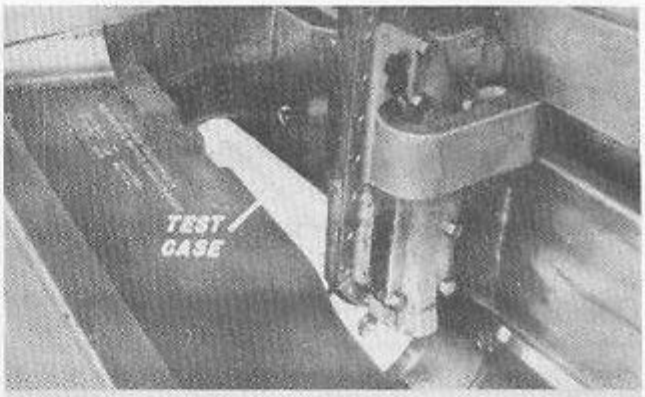


In order to conform with these requirements, the monthly checkoff list is divided into two parts. The first part concerns those opera- tions which can be carried out at sea. These are operations which require only minor disassembly and are of such a nature that the gun can still be fired on short notice. The second part of the monthly checkoff list deals with operations that can be carried on only when the ship is in port, because they involve major disassembly that prevents the gun from being used.

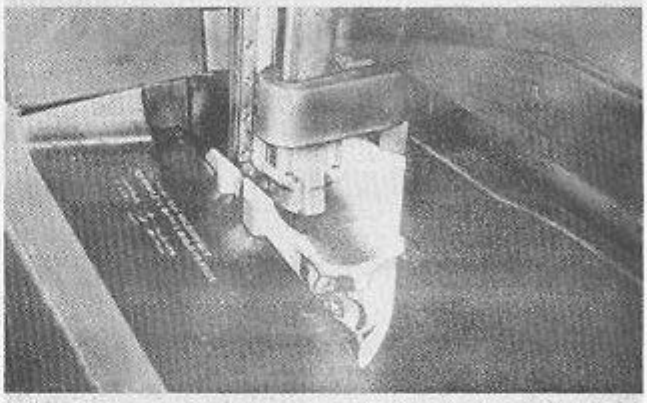


The first of the monthly procedures that can be carried out at sea is adjustment of the operating spring to ensure smart breechplug action. This should be done even if the ad- justment has been made as a result of a daily check and even if the breechplug is apparently functioning properly. Keeping the breechplug lowered, as is customary when the ship is in combat, and for this reason it should be ad- justed very carefully.

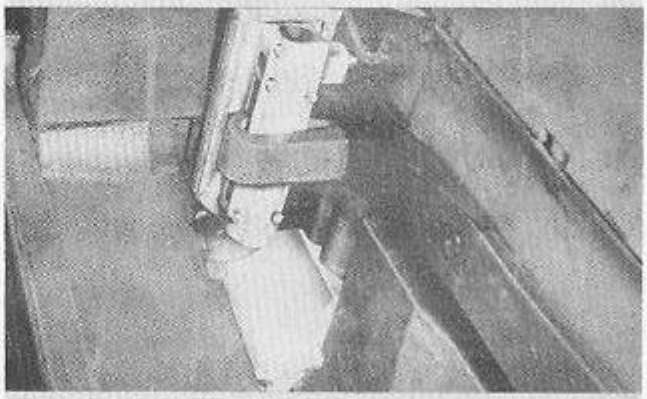
To begin this adjustment, place a test case in the chamber and ram it into the gun.



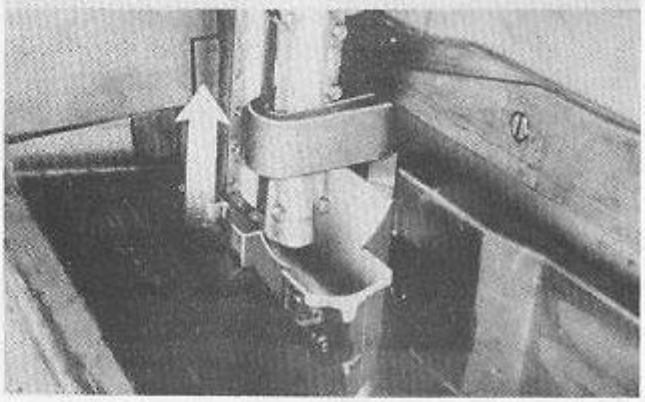
As the breechplug rises to wedge the case in the chamber, it will lift up the rammer spade.

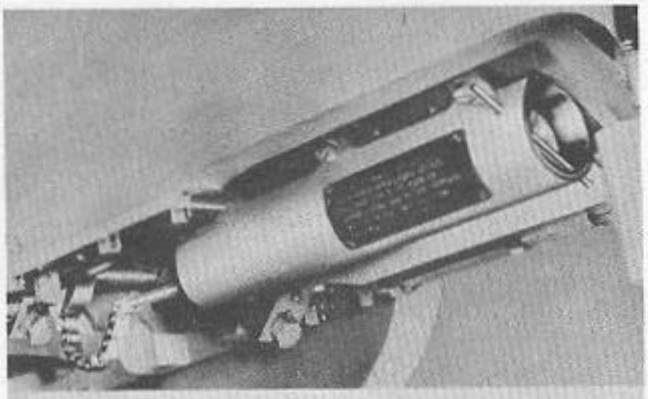


Lower the breechplug until there is a clear space between it and the bottom of the rammer spade.

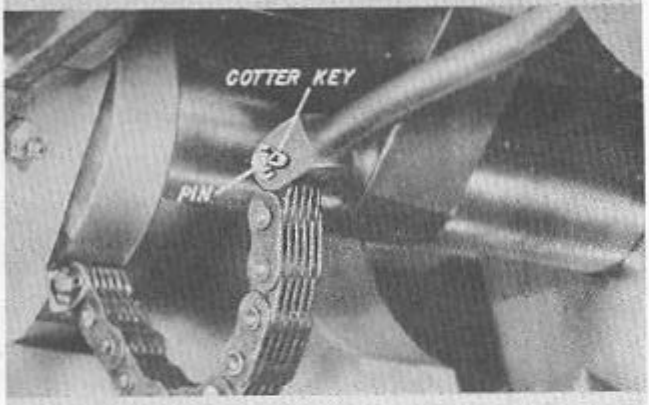


Then let go of the hand-operating lever. The breechplug should rise smartly pushing up the rammer spade. If the plug does not close, the operating spring must be taken up. To accomplish this,. . .

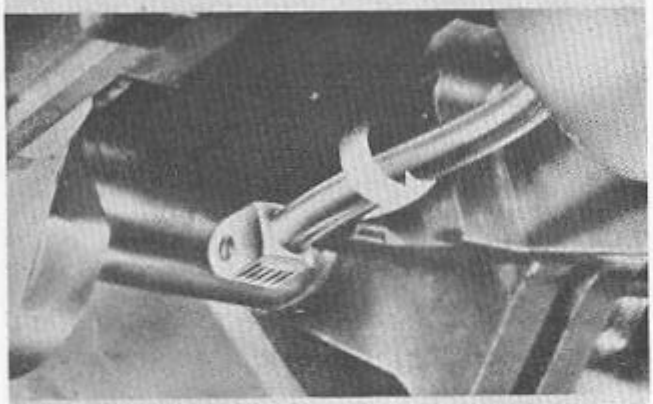




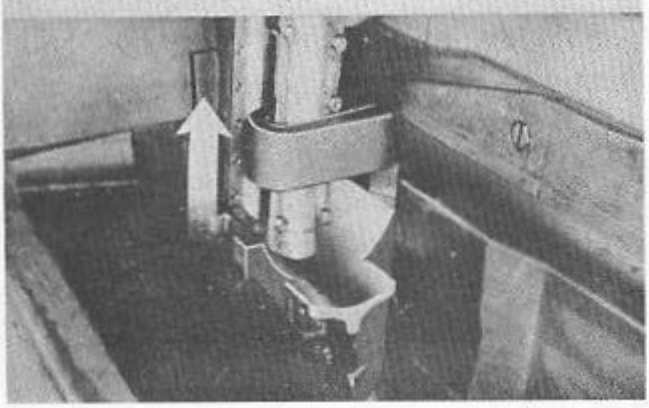
. . .compress the spring by lowering the breechplug part way with the hand-operating lever. Insert the block and rod in the after end of the spring housing to hold the spring compressed. Then trip the hand-closing latch key and raise the breechplug to slacken the operating spring chain.



Remove the cotter key and pull out the pin that connects the operating spring chain to the rod.

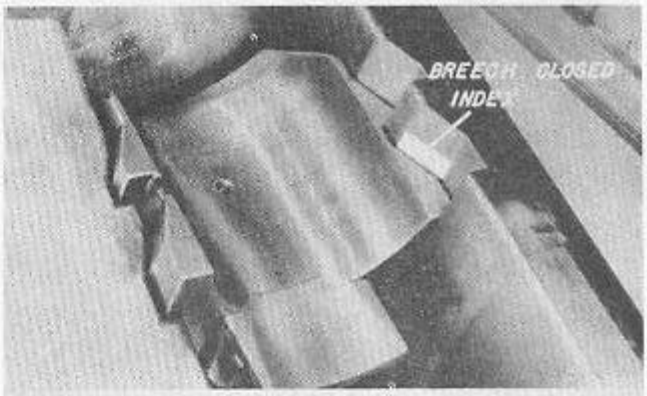


Take up the operating spring rod one half turn. Then reconnect the rod and chain so that the breechplug operation may be checked again.

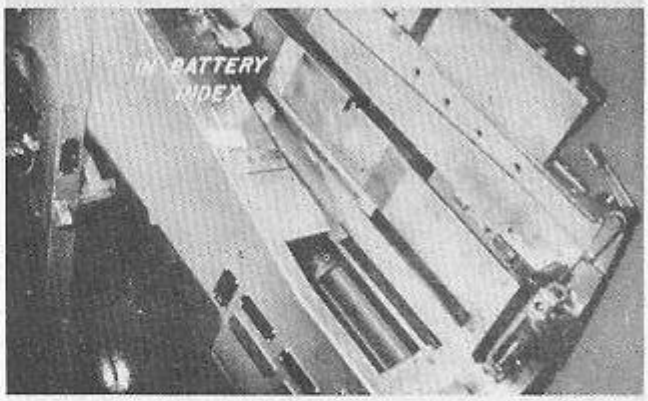


Once again, test the breechplug action. If the plug does not close completely and push the rammer spade all the way up, there is obviously not enough tension on the spring. Continue to take up on the rod one-half turn at a time until the breechplug closes properly.

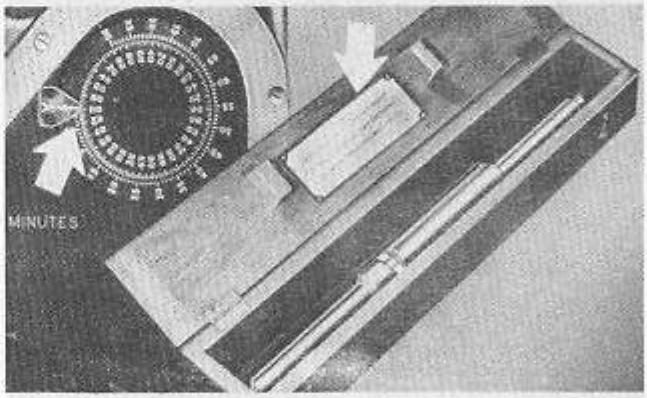
When the operating spring has been adjusted, freshen up the "breech closed" index mark. This is a red line painted on the right breech-plug guide plate to make for easy spotting of breech closing failure in the event of casualty.



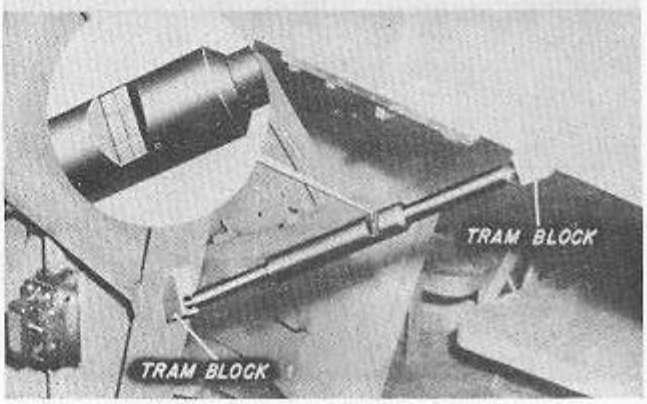
Freshen up also the "in battery" index mark that is painted across the housing and slide just forward of the projectile guide. This line facilitates easy spotting of failure of the gun to return to battery.

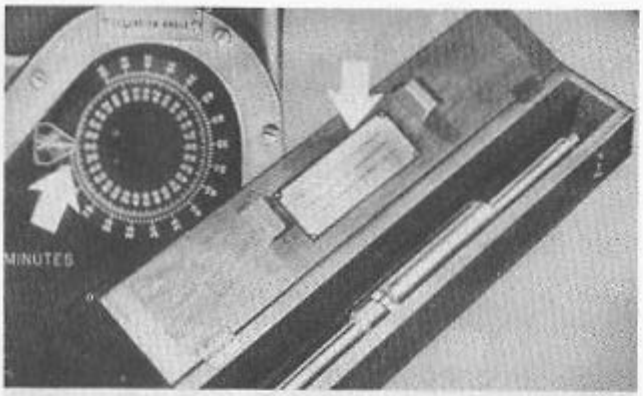


The train and elevation indicators must be checked for accuracy. To check the readings of these indicators against the train and elevation of the gun a measuring device called a tram bar is used. All of the five-inch guns on ships use the same tram bar for this check. Inside the cover of the tram bar box is listed the correct indicator readings for each of the guns. It may be that after the gun is fired the reading will have changed slightly and a later and more correct reading recorded in the battery log. To check these readings in elevation,. . .

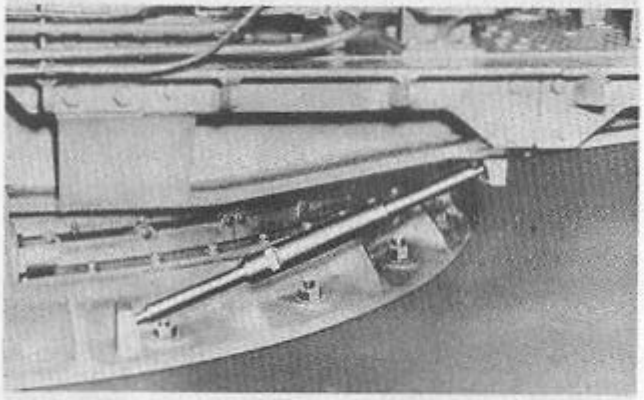


. . .the pin ends of the tram bar are inserted in two tram blocks, one on the left carriage cheek and the other underneath the slide. Elevate the gun until an index on the tram plunger matches an index on the tram barrel. At this point,. . .

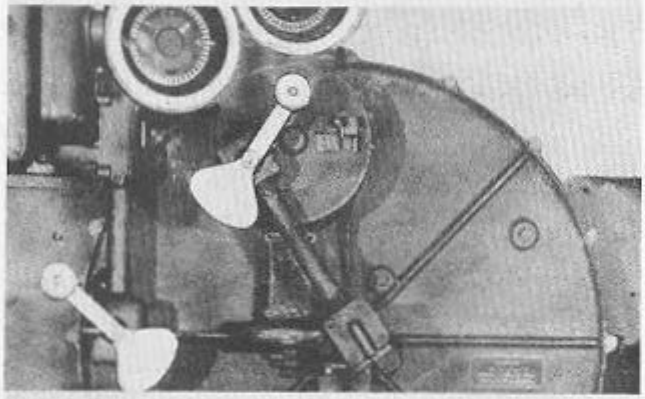




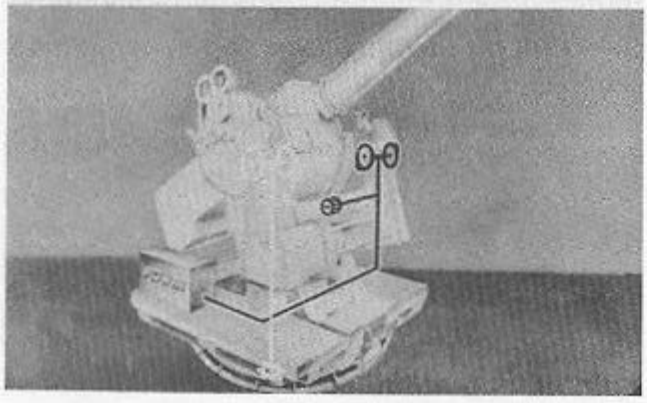
. . .the elevation indicator reading should correspond with the angle of elevation recorded for this gun on the box cover. If the readings do not agree, the elevation indicator dial should be reset to make them correspond.



The train indicator is checked in the same manner by inserting the pin ends of the train in the blocks on the base ring and stand. The mount is trained until the indexes on the train plunger and barrel are lined up, at which point the reading on the train indicator dial should correspond with that recorded for the gun on the box cover.

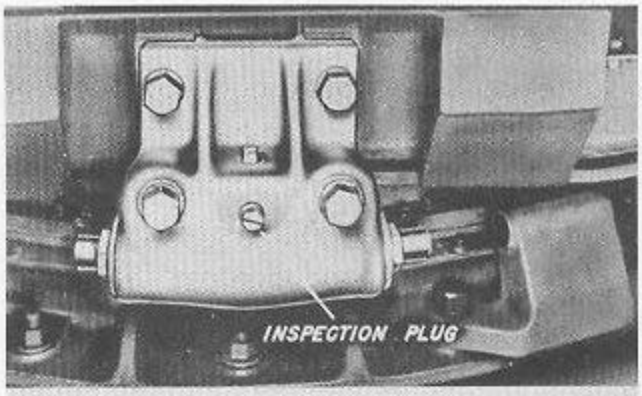


Check the sights for lost motion in the manner we have already described. The sight dials and telescope prisms should respond immediately to movement of the sight angle and deflection handwheels. Lost motion discovered here may, as we know, make necessary disassembly of the sight-setting mechanism. Do not attempt this without specific permission from the weapons officer.

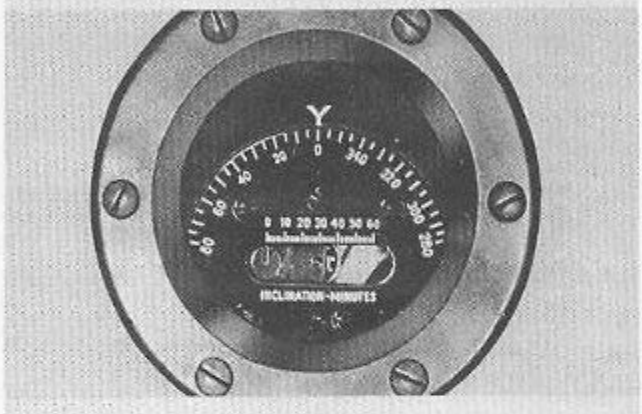


Also check for lost motion in the train and elevation gearing systems. If there is any lost motion in these systems check each gear train for back lash and correct any that is found.

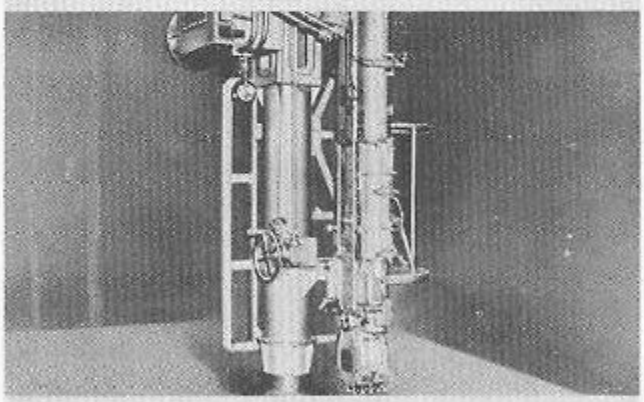
Check the training stop buffer. Be sure that the securing bolts are tight and inspect the plunger packings for leakage. The oil level in the buffer should be up to the inspection plug.



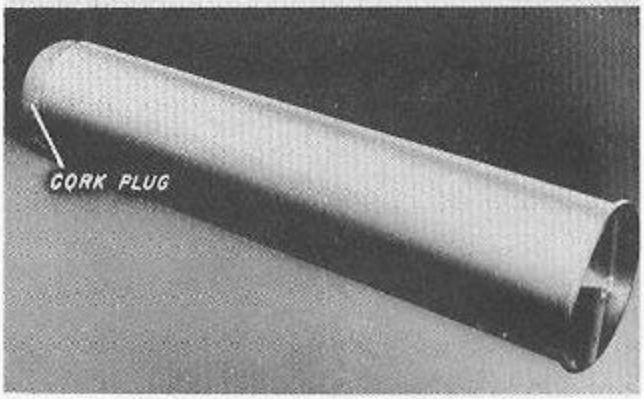
Check the train input to the roller path compensator by comparing its reading with the actual train of the gun.

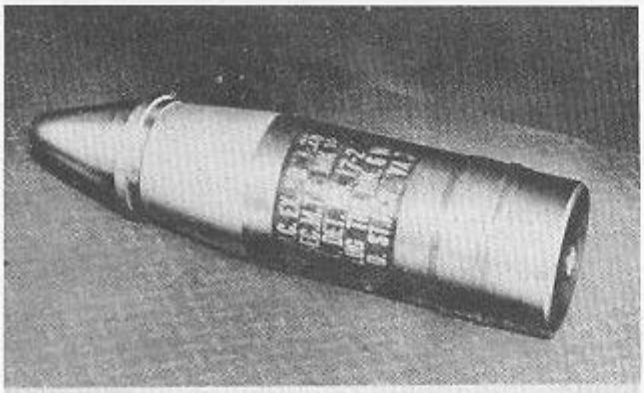


To test the fuze setter run several drill projectiles having dummy fuzes up through the projectile hoist. The test should be made over a full range of settings. Inspect the fuzes after the projectiles have come up to be sure that they correspond to the setting on the fuze setter.

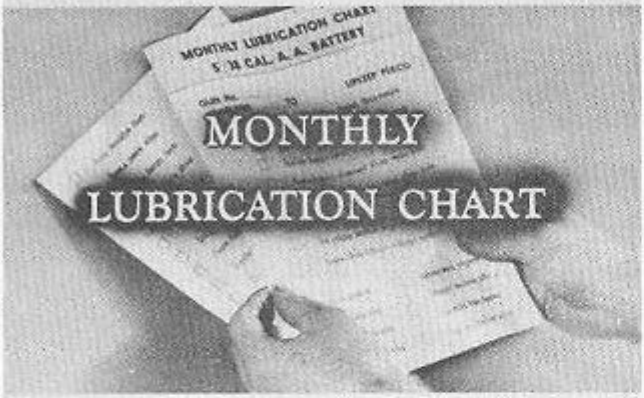


Also inspect the ready-service powder cases. The cork plug in the end of the powder case must not be jammed all the way into the case. Be sure that the cork is not broken and that it is of no greater diameter than the bore of the gun. Defective corks should be removed and replaced. See that the case is free from dents which might jam the gun in action.

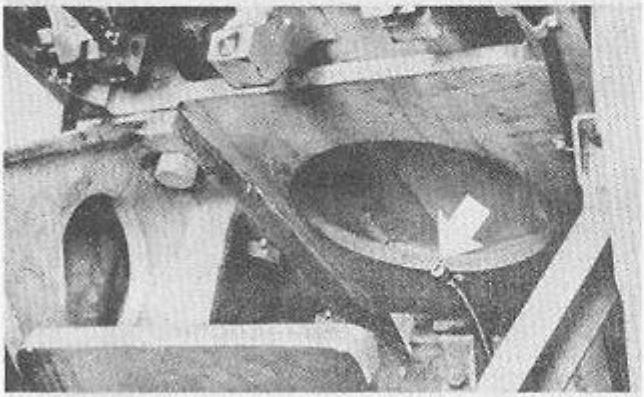




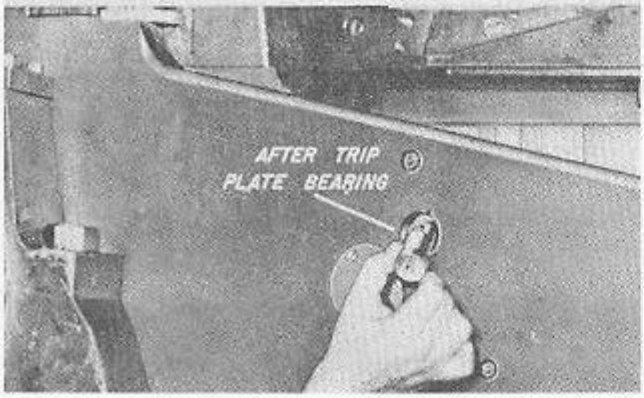
Inspect the ready-service projectile for sign of corrosion.



Follow your monthly lubrication chart carefully. The points requiring monthly lubrication are the heavy gears and bearings which take most of the weight and thrust of the gun. Their proper lubrication is most important. Don't overlook any of the points specified in the chart. One point that is sometimes easy to overlook. . .

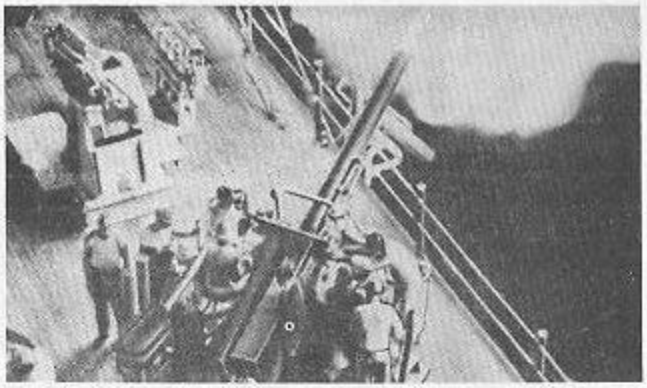


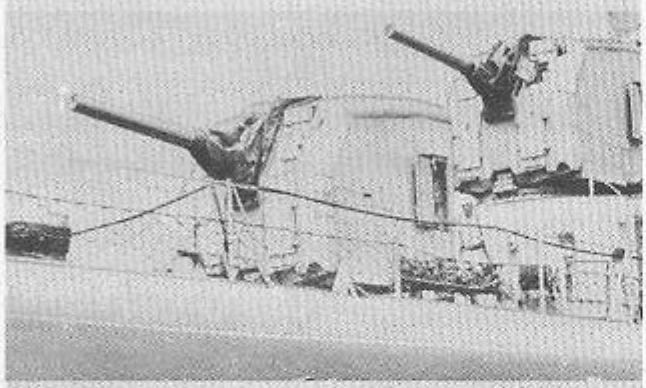
. . .is the grease fitting for the gun bearing. In enclosed mounts, this fitting is located at the end of a copper tube underneath the forward position of the housing.

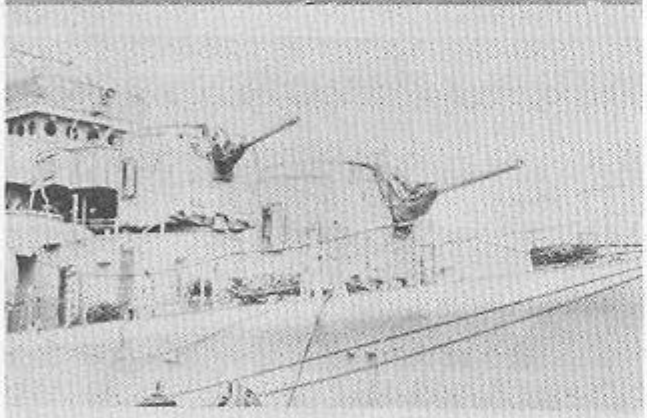


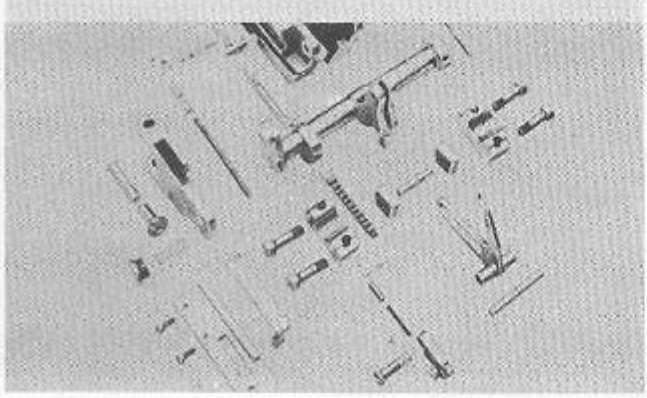
The after-trip plate bearing is another important point. Its lubrication will help to ensure proper functioning of the foot-firing linkage.

We have now completed the daily, weekly, and monthly maintenance procedures which can be carried out at sea. Follow these procedures carefully and you will be assured of a weapon that not only functions smoothly, but that is also ready when needed to strike against the enemy.









Having observed the seagoing maintenan procedures for the 5"/38 gun, you may getting the idea that we are dealing with delicate, temperamental weapon that wo work unless it is constantly coddled, adjuste tinkered with and cared for.

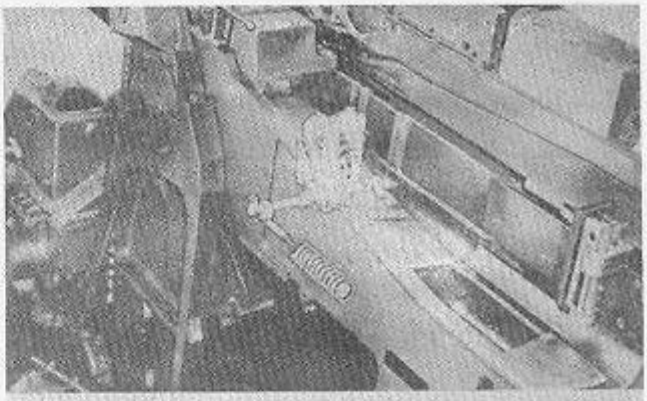
This is not true, of course. We have seen our study of this gun, so far, that it is bo rugged and precise. The purpose of mainte nance is to keep it that way. A weapon which so much depends can never be care for too carefully or too often.

For this reason, when the ship is in port fo an upkeep period, we take advantage of th fact by making further maintenance checks- operations that cannot be carried on at se because they require that the gun be put ou of commission for too long a time. There ar generally four of these routine procedures i port which are carried on in addition to th regular maintenance routine:

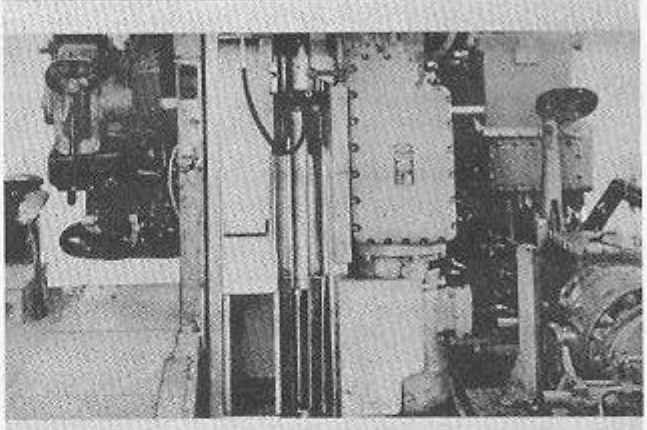
1. Overhaul and the breech mechanism
2. Run the gun in battery
3. Change the oil in the differential cylinder
4. Boresighting (not discussed in this book)

We know how the breech mechanism must b disassembled to clean and inspect its operating parts. (See chapter 10.)

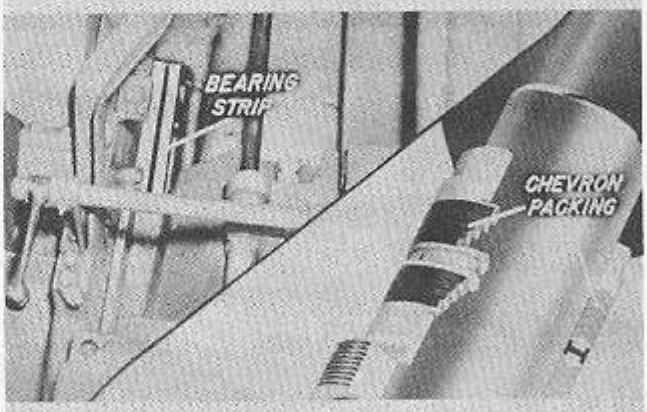
And we have studied the methods used to adjust the tension of the operating spring when the mechanism has been reassembled. (See chapter 17.)



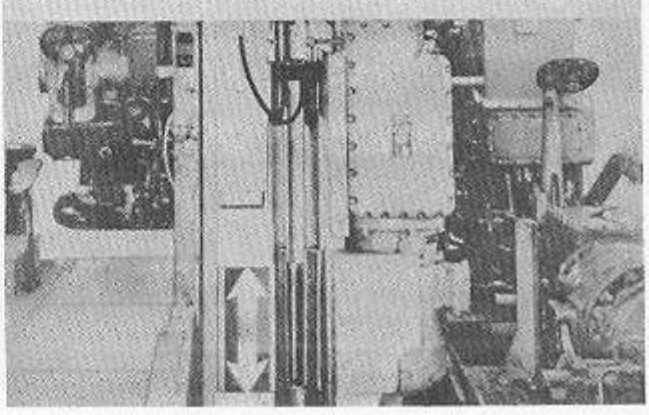
The second operation—running the gun in battery—is carried out by elevating the gun and permitting the barrel and breech housing to fall back within the slide by bleeding the compressed air from the counterrecoil air chamber.

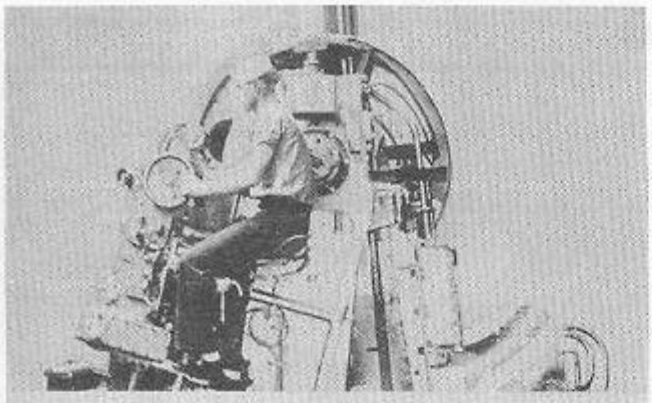


This action exposes the breech housing and bearing strips so that they can be cleaned and lubricated. It also tests the counterrecoil system and exercises its cheveron packings.

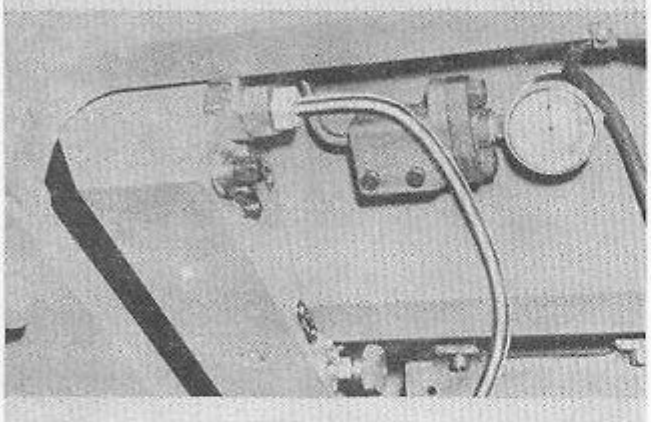


The gun should be run in battery several times by alternately forcing air into the chamber and bleeding it out. This works lubricant into the housing bearings and exercises the moving parts to free any that may have become frozen.

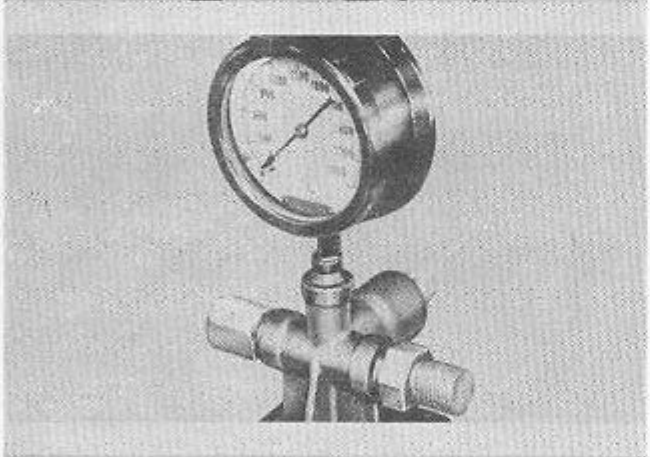




When the barrel and breech housing mo back the weight is shifted aft and the gun unbalanced. This shifting of weight might re sult in the gun elevating violently, and cou cause serious injury to personnel. For th reason the Bureau of Naval Weapons recom mends that the operation of running the gu in battery be carried out at the maximu elevation of 85 degrees. In this position th gun is against the elevation stops and ca elevate no further.



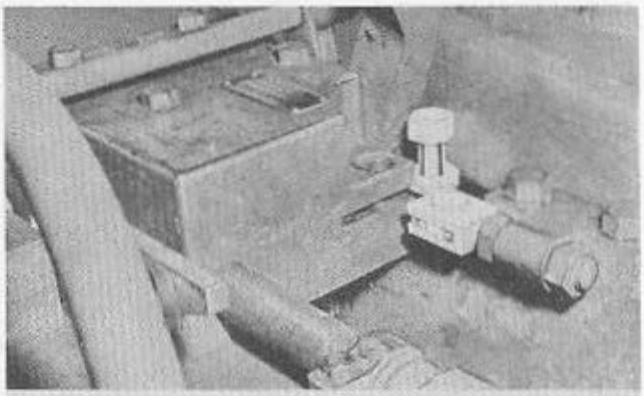
But running the gun in battery at 85 degree presents a few problems. For example, wit the gun in this position, it is impossible t read the air gauge located underneath th breech housing. Also, if a line were run to th counterrecoil air line connection, it would b sheared off when the gun was elevate



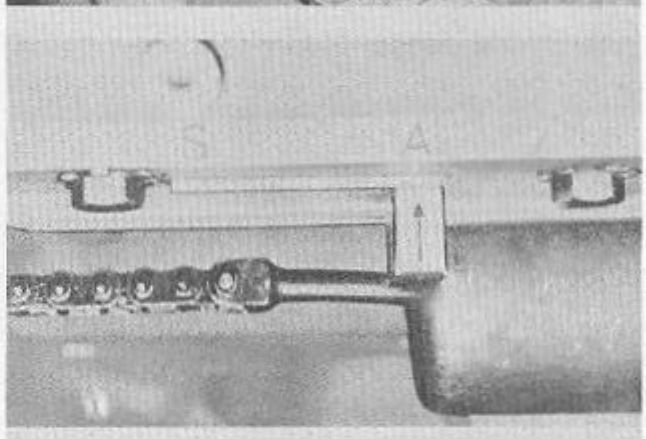
The Bureau of Naval Weapons solved thes problems by means of a special adapter whic can be mounted on the safety link bracke This adapter is fitted with an air pressur gauge and a valve for controlling the suppl of compressed air. It is also fitted with bleeder hole to permit bleeding the air fro the counterrecoil air chamber.

The compressed air for this operation is sup plied from a portable air bottle.

Before beginning this operation, be sure to check current type commander's instructions regarding pertinent safety procedures. Also, make sure that the safety link is disconnected so that the breech housing will be free to run aft in the slide. Then, check to see that all power controls on the gun are set to manual. It is also wise at this point to place a block of wood in the slide so that there will be no metal to metal contact if the gun should crash back against the slide.

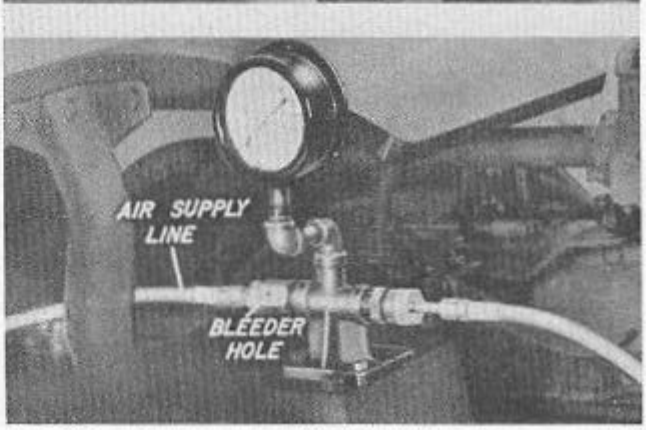


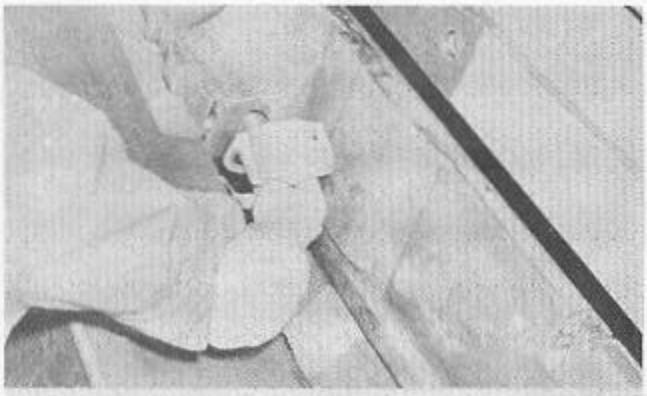
Set the cam plate retractor to AUTOMATIC so that the automatic operation of the breech-plug can be tested after the gun is returned to battery. During these operations watch carefully to see that the air line to the counterrecoil chamber does not become fouled.



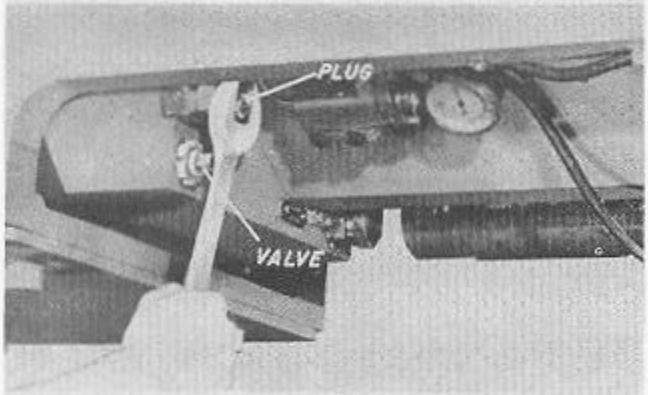
After this has been done, we install the adapter by bolting it to the safety link bracket which is aft of the rammer control shaft. Make certain that the counterrecoil air line connection is pointing aft in accordance with the instructions on the adapter.

Next, hook up the air supply line to the forward connector, and attach the short line for the counterrecoil connection to the after connector. Note that the forward connector is drilled with a bleeder hole. See that this hole is closed by screwing in the fitting all the way.

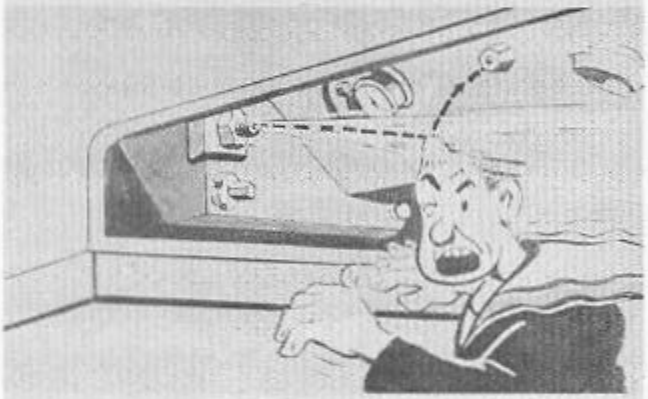




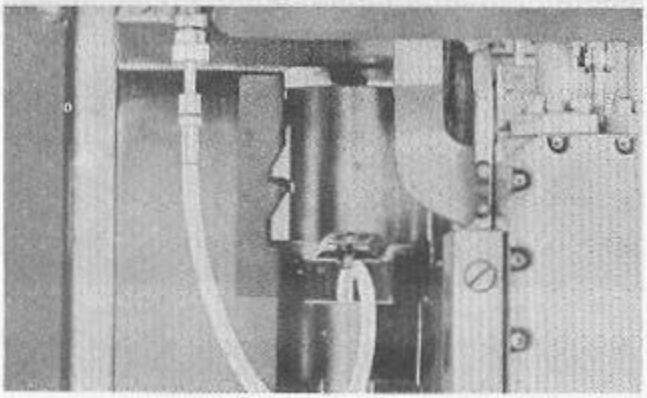
To provide passage for the line to the counter-recoil air line connection, first remove th firing mechanism from the breechplug. The remove the breechplug shelf extension b unscrewing its securing bolts.



We are ready now to attach the air supply lin from the adapter to the counterrecoil air lin connection. To do this, we must remove th plug from this connection. Before removing the plug, however, be very sure that the coun-terrecoil chamber air valve is closed.

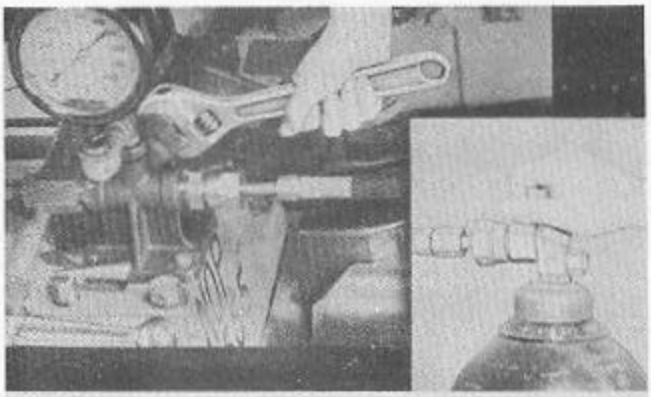


If the valve is <u>not</u> closed, the air pressur behind the plug might blow it out after yo start to remove it.

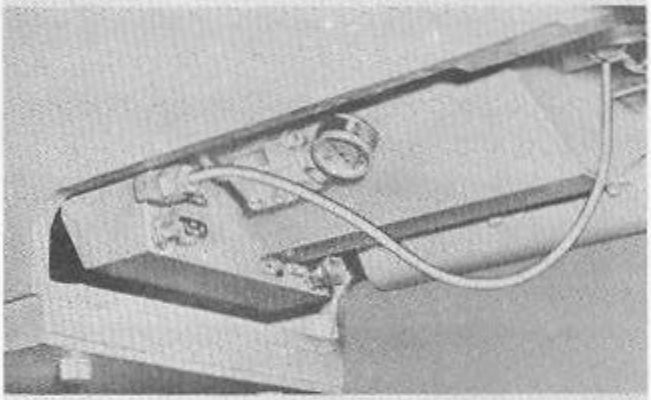


Returning now to the top side of the breec housing, pass the air supply line down aft o the breechplug. Before connecting this line, . . .

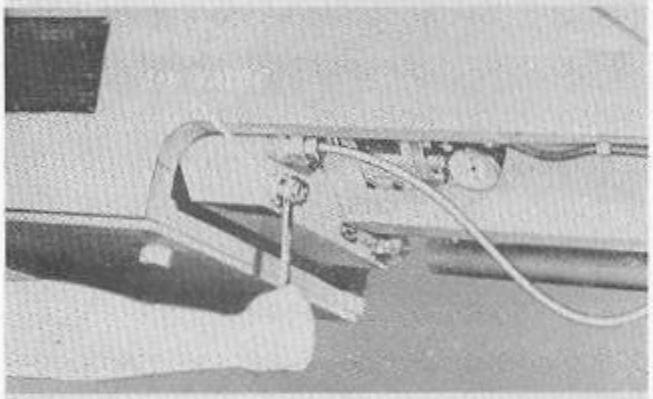
. . .the entire air supply line system must be blown out to prevent the introduction of dirt or moisture into the counterrecoil air chamber. The blowing is done by opening the air valve on the adapter and then, with the bleeder hole closed, opening the air supply valve to blow all dirt and moisture from the air lines. Having done this, shut off the air supply valve and the air valve on the adapter.



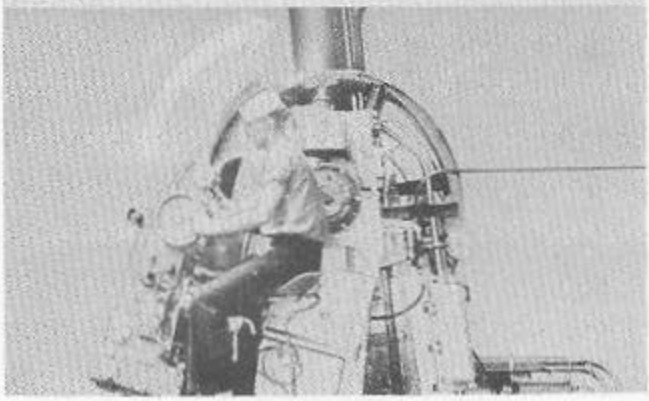
The line can now be hooked up to the counterrecoil air line connection.

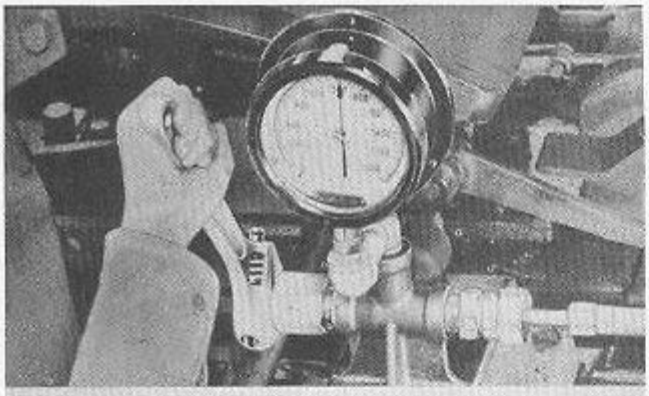


Open the counterrecoil chamber air valve while it is still accessible. Two or three turns are required to open the valve. It must be opened now because its location in the bottom of the breech housing prevents it from being reached after the gun is elevated. The air pressure in the counterrecoil chamber is held in only by the closed air valve on the adapter. Since we are able to control both the bleeding out and the charging of air from the adapter,. . .

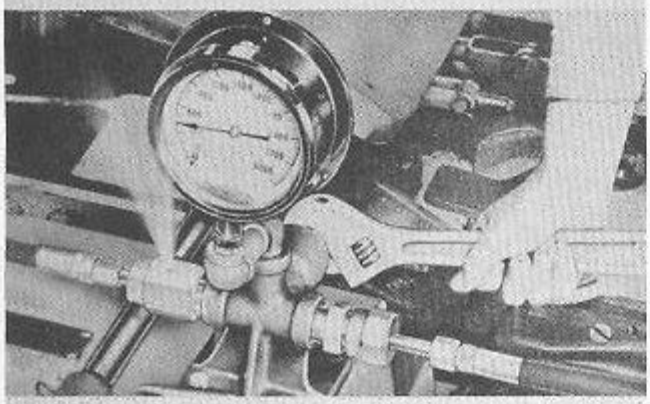


. . .we can elevate the gun to its maximum position of 85 degrees in order to run the gun in battery. As the gun is elevated, watch the air supply line to the adapter to make sure that it does not foul or become kinked. A break in the line is extremely dangerous. A break would cause the line to whip around violently and to injure anyone who got in the way.

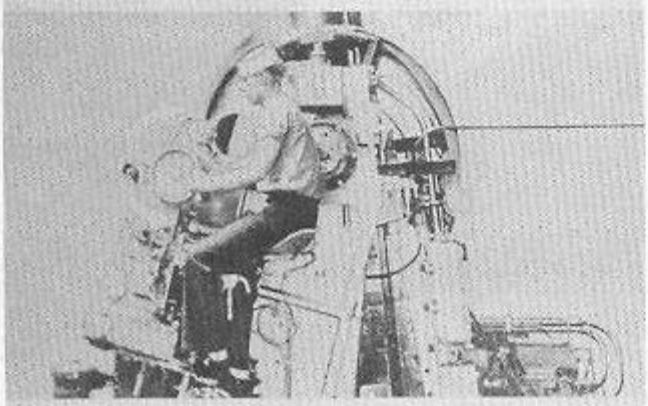




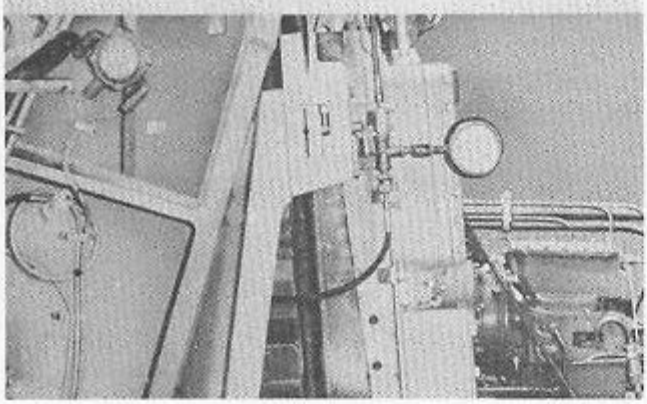
To run the gun out of battery, crack th bleeder hole on the adapter by backing out th air supply line fitting.



Bleed the air slowly by opening the air valv on the adapter watching the pressure dro on the gauge. If the gun has not run out o battery when the air is exhausted from th counterrecoil chamber, close both the ai valve and the bleeder hole.

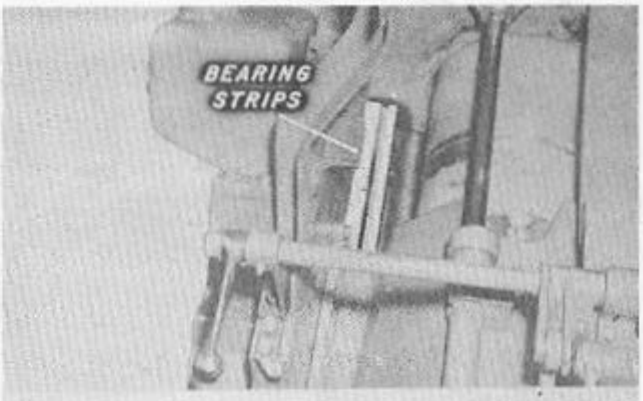


Then rock the pointer's handwheels to jar th gun loose. Stay clear of the breech housin while doing this. It may fall rapidly when th jam has been freed.

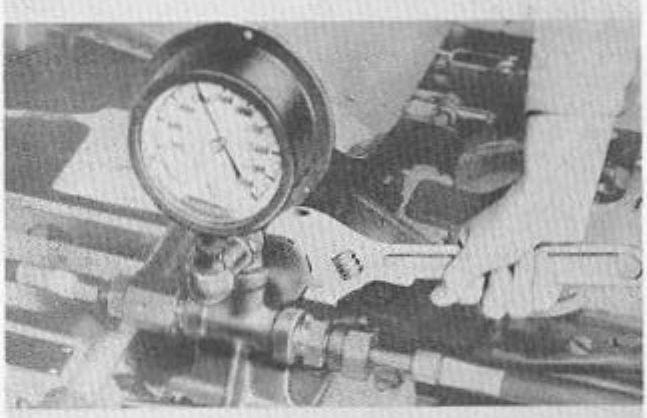


With the gun in the position of extreme recoil, clean and lubricate the exposed parts of the slide and the breech housing. . .

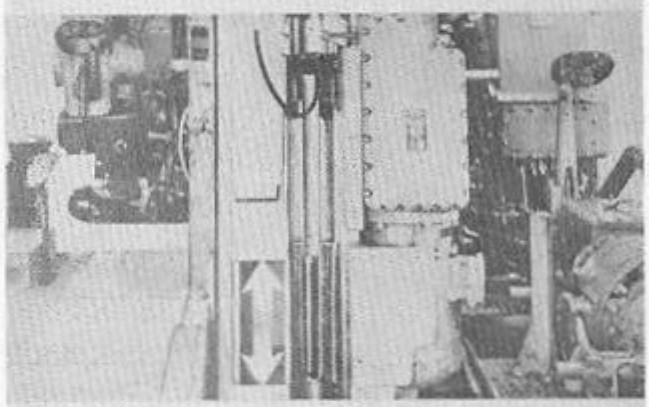
. . .and the exposed forward ends of the bearing strips. Dirt and gummy deposits on these parts will prevent the breech housing from moving freely within the slide during recoil and counterrecoil. Remove all gummy deposits from these parts, inspect them carefully for burrs or scratches, stoning them down as required.



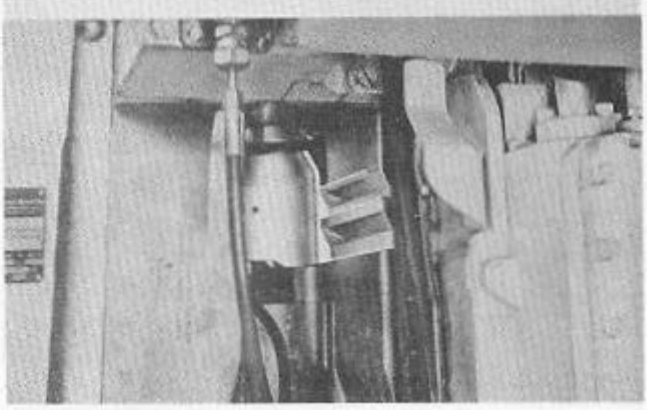
To run the gun back into battery, first make sure that the bleeder hole on the adapter is closed and open the air supply valve. Then open the air valve on the adapter to charge air into the counterrecoil chamber. Charge the air slowly and carefully, watching the pressure rise on the air gauge.

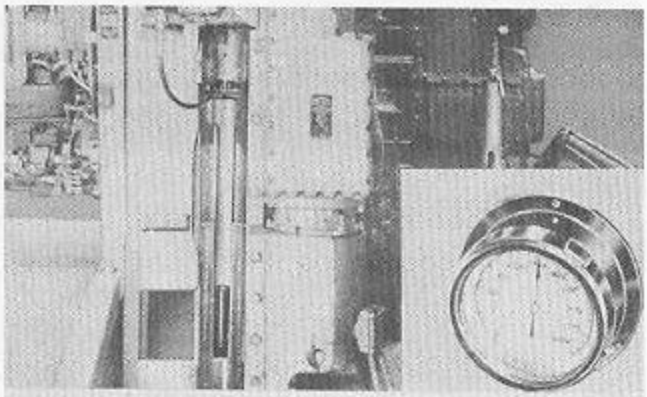


Run the gun into and out of battery in this manner several times to work in lubricant and to make certain all parts function smoothly.

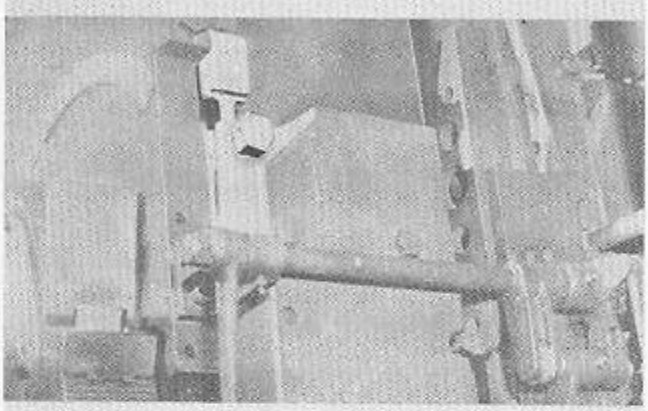


As the gun is run in to battery with the cam plate retractor set to AUTOMATIC, the breechplug should lower smoothly and latch in the open position.

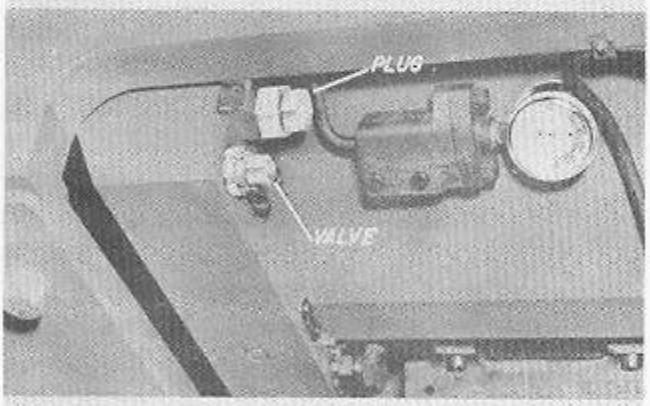




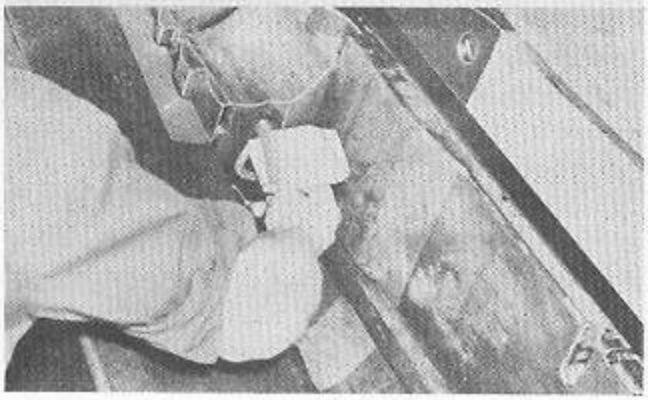
When the gun is operating smoothly, run back in battery, building the air pressure up 1,550 pounds per square inch. Then closeth air valve on the adapter, shut off the a supply,. . .



. . .and secure the safety link to lock th gun in battery. Then depress the gun to zer position so that you can get at the bottom o the breech housing to close the counterrecoi chamber air valve.



With the valve closed, bleed the air pressur out of the line from the counterrecoil air lin connection. Remove the line and replace th plug. Check the reading on the counterrecoi air gauge to make sure that the pressure i up to 1,550 pounds per square inch.



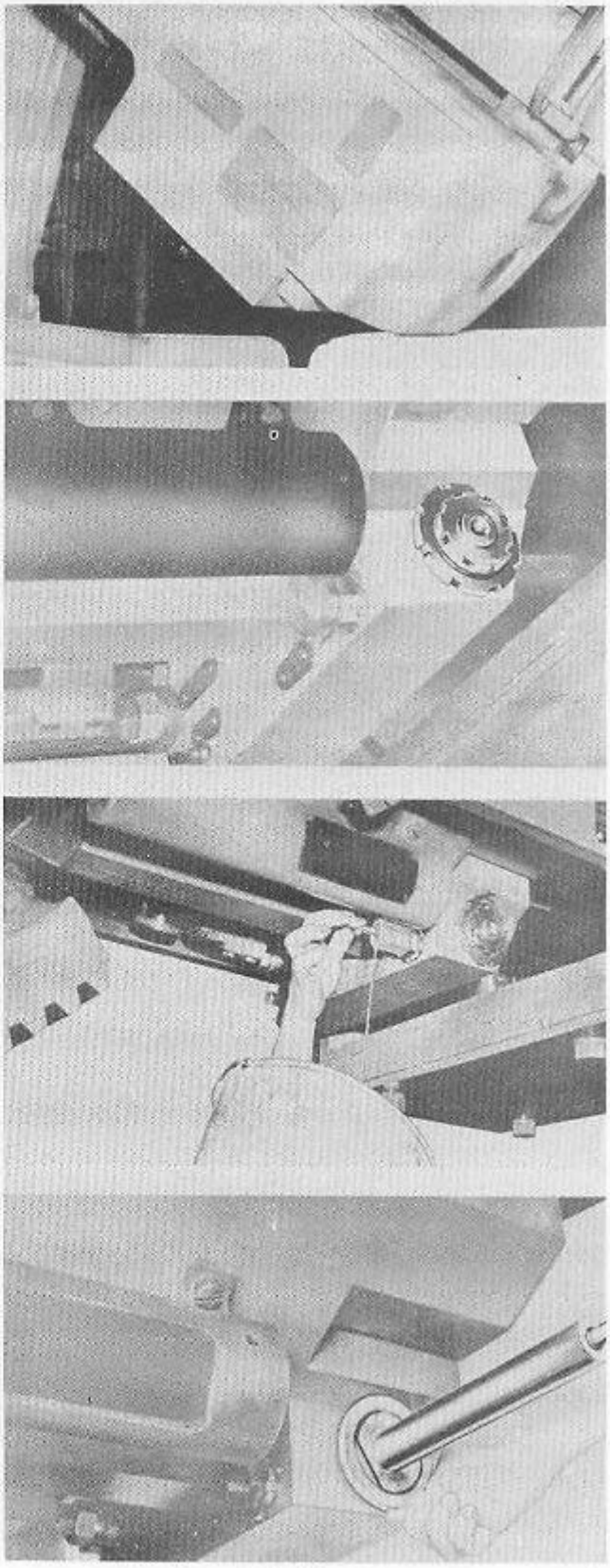
After removing the adapter, replace th breechplug shelf extension and the firin mechanism.

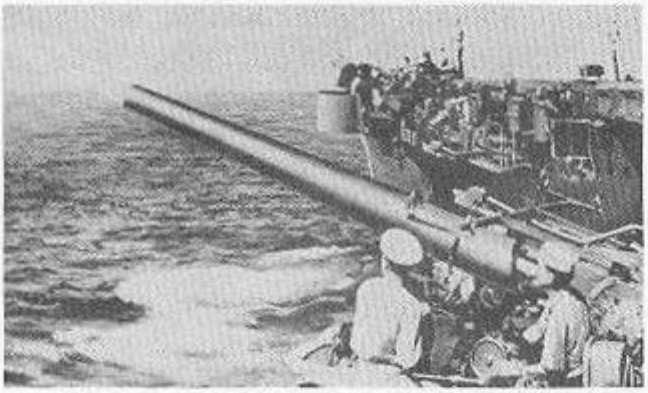
If your ship does not have an adapter aboard, and unless type commander's or other instructions direct otherwise, at the discretion of the weapons officer the gun can be run in battery at a lesser angle than 85 degrees in order to get at the air controls underneath. When this is done, the proper safety precautions must be observed. The rear end of the slide must be supported by a heavy wooden block inserted between the slide and the mount platform to prevent further elevation of the gun. With this precaution, the air supply line can be connected directly to the counterrecoil air line connection, and the gun run in and out of battery in the manner we have already described using the bleeder and valve on the air flask.

We are now ready to take up the third maintenance procedure in port—bleeding the differential system. This is done to see that the plunger is not frozen, that the packings are not leaking, and to inspect the oil in the differential cylinder.

With the gun at approximately zero elevation, the differential cylinder is readily accessible, and the oil can be bled out with a bleeder tube.

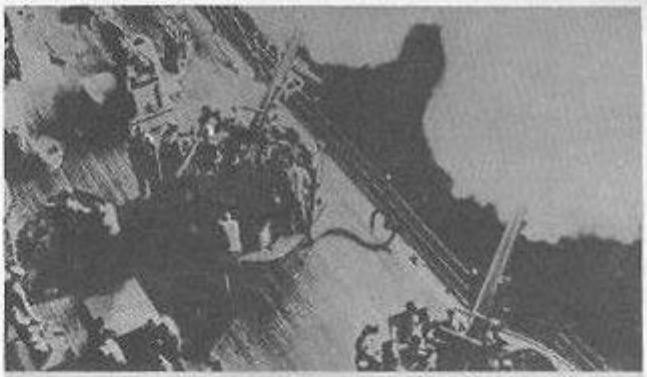
With full air pressure in the counterrecoil chamber, the plunger should move out freely as the oil is run out. Any sticking should be investigated. When the plunger is fully extended and all oil bled from the system, the air should be released from the counterrecoil chamber before refilling the differential cylinder. The heat of friction developed during the gun's operation sometimes causes gummy deposits to form in the cylinder. The oil should be changed, as necessary, to prevent the formation of sludge. While recharging the cylinder with oil, check to see that there is no leakage around the plunger.



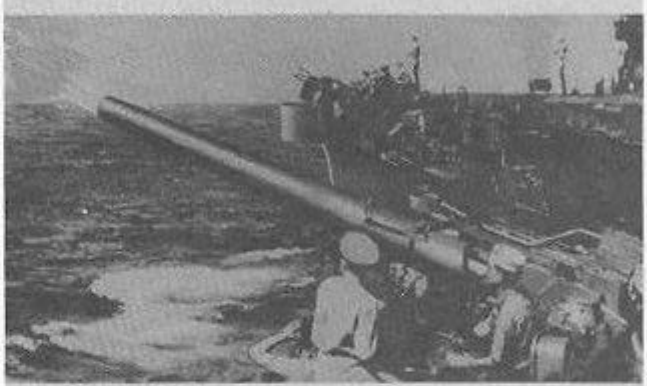


The time spent in carrying out these maint
nance procedures thoroughly and careful
when the ship is in port, will pay large div
dends in the form of smooth operation of t
gun when it is returned to combat du

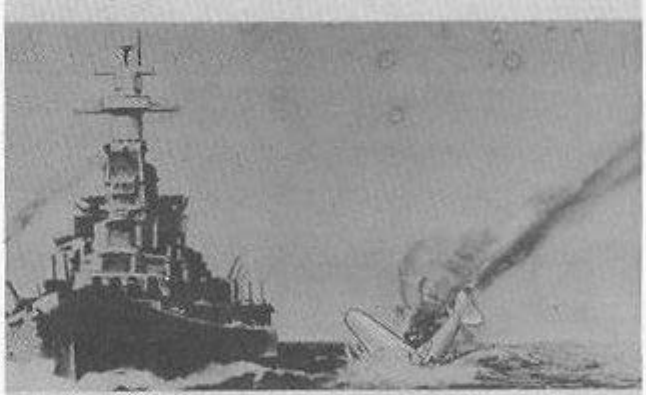
The ultimate purpose of the 5''/38 gun is to fire effectively in actual combat. This means maintaining the high rate of fire, of which the gun is capable, so long as the enemy is within range.



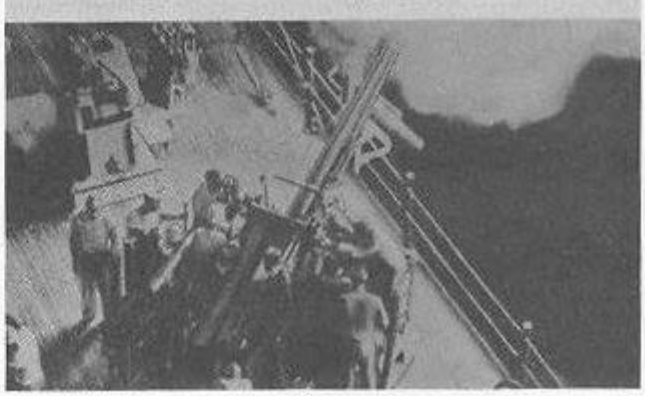
The gun crews are constantly drilled in loading, aiming, and firing; and the gunner's mate spends endless hours maintaining, checking, and testing. The purpose of this intensive training. . .

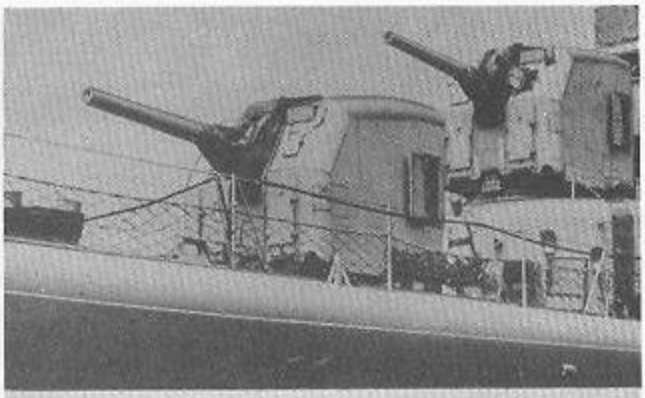


. . .is to make certain that each gun will function smoothly and effectively in combat. When the enemy is spotted, the fire power of each gun is vitally needed. Enemy aircraft must be fired upon as soon as they are within range of this far reaching gun. Since the field of each 5''/38 is limited by its position on the ship, it is extremely important that every single gun must go into action and must be kept in action. For this reason, the gunner's mate must be an expert troubleshooter, ready to cope with any casualties which may occur.

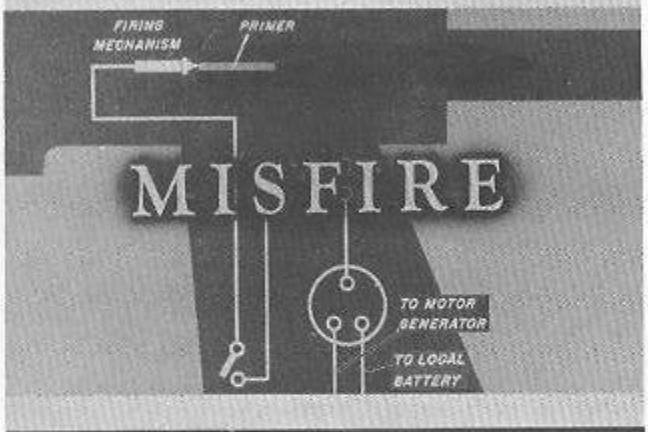


In the event of casualty, you'll have to think and act automatically to get the gun firing again in the shortest possible time.

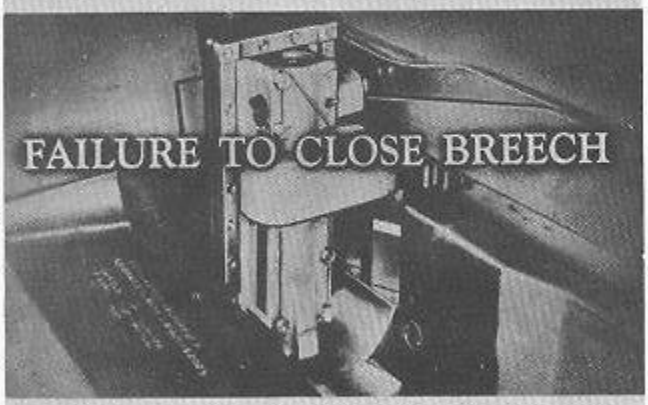




In a properly maintained gun, the major of casualties that do occur are caused by car lessness on the part of the gun crew, or mechanical failures resulting from breaka or weakening of parts, or from the introdu tion of foreign matter. We shall concern ou selves mainly with the cause and correcti of those casualties that result from mecha ical failure in the gun and mount assemblie paying particular attention to those whi result in failure to load and fire the gu



One common casualty is misfire which may caused by a defective firing system or mech anism or by defective ammunition.



Another common casualty is failure to clos the breech because the plug is not raise fully.

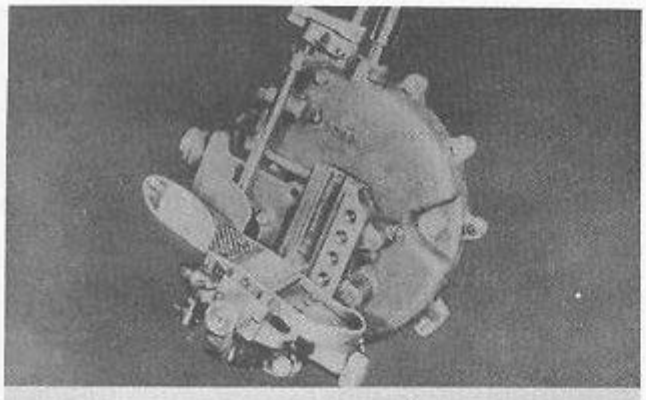
A third cause of casualty is stoppage in the rammer mechanism which prevents proper loading of the round into the chamber.

We shall consider, also, leakage in the recoil or counterrecoil system which will cause these movements of the gun to be violent and may result in damage to the gun and mount.

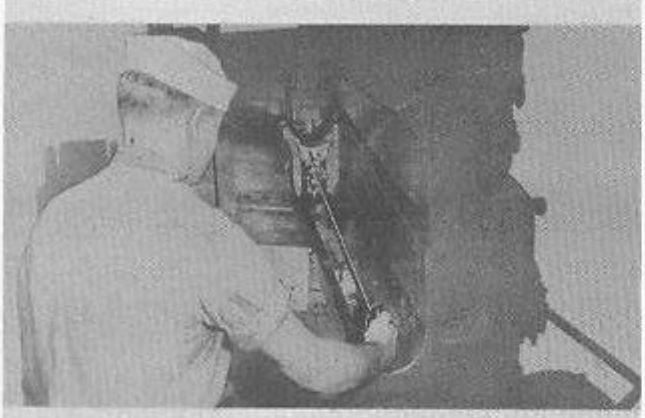
Two serious casualties may be caused by broken extractors. The breechplug will not be latched in the open position, and the fired case will not be extracted. When a fired breakdown occurs, our first concern is how to keep the gun firing during the engagement. Consequently,. . .

. . .we shall study first the steps to be taken for immediate casualty action. We shall discuss later how the cause of the casualty is removed after the engagement has ended. To get the gun firing again within the shortest time the gunner's mate must know first, how to locate the cause of stoppage, and second, how to keep the gun firing until the attack is over. A rapid, accurate, and logical system is the best assurance of calm and effective casualty action under fire. If, with the plug in the closed position, the gun fails to fire electrically, the immediate action is to fire it by percussion. The electrical misfire may be caused by failure to have the key completely closed. The pointer should make sure that, when he squeezes the key, he actually closes it.

Current for firing normally comes from the motor-generator circuit. If the gun will not fire on this circuit, the pointer should turn the transfer switch to local battery and again close the firing key. If the gun still fails to fire electrically. . .

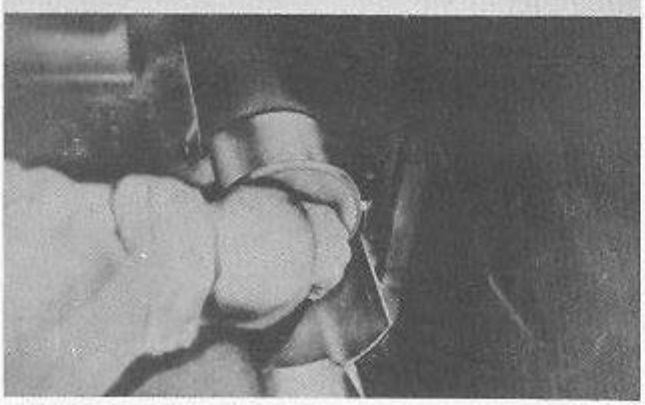


. . .fire by the standby method, percussion until the engagement is over. It may be that the gun will not fire even when the foot-firing treadle is depressed.



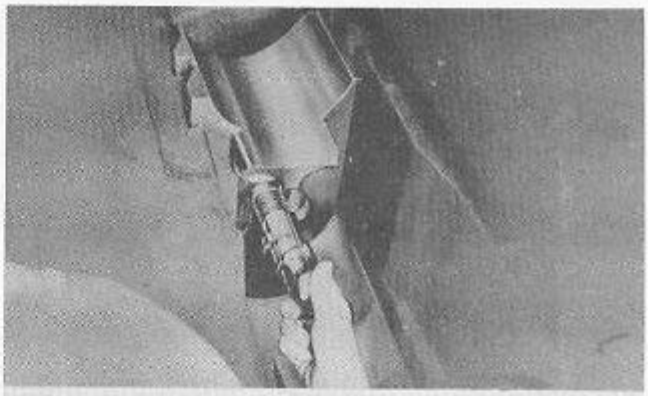
If the gun fails to fire either electrically or by percussion, the casualty is probably faulty ammunition. If time permits, try recocking the firing mechanism by pulling back the cocking handle with the recocking tool. Then push the treadle down again. If the gun still fails to fire,. . .

. . .there is danger of a delayed explosion of the round. Navy Regulations state, "in event of misfire, do not open the breech for thirty minutes after the last attempt to fire." This, at the discretion of the commanding officer, is not obligatory in time of action. When ordered unload the cartridge and immediately throw it over the side. Since the gun uses semifixed ammunition, the projectile will remain seated in the bore. To clear the bore, the projectile must be fired out through the muzzle.

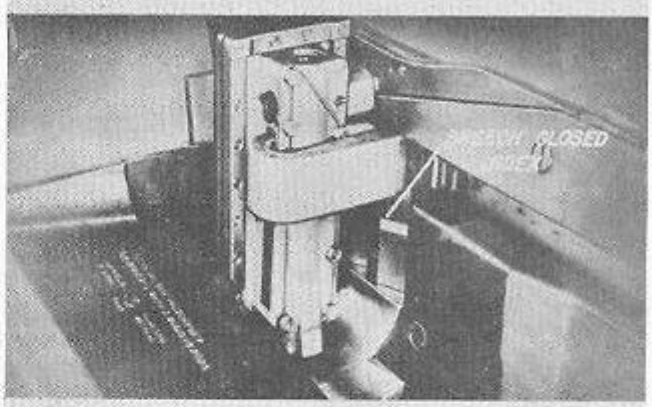


With the projectile seated in the bore, it would be difficult to load a regular cartridge, so a short cartridge is rammed manually and fired to propell the projectile out of the bore.

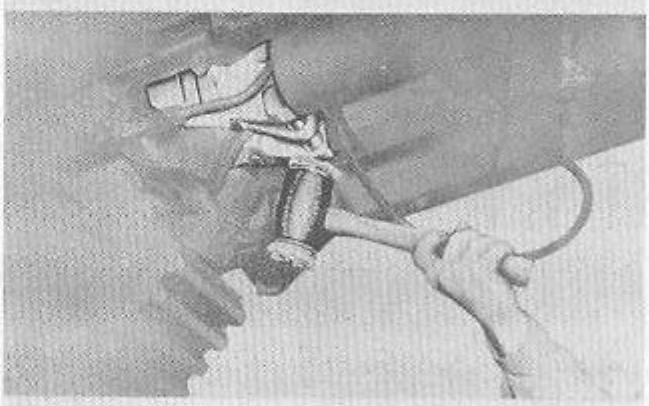
If continued firing failure is experienced, remove the firing mechanism and replace it with a spare.



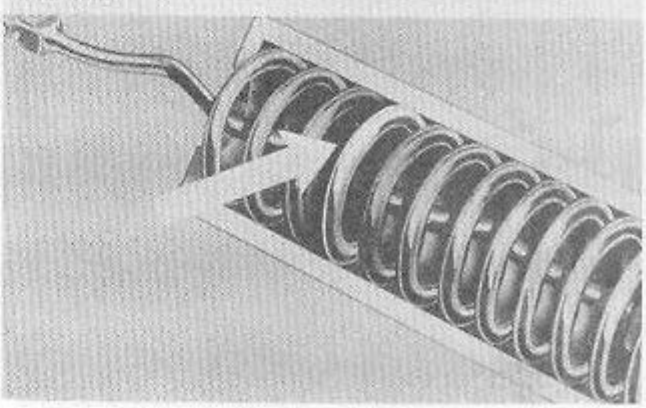
When the gun is loaded, the first loader looks at the breech mechanism. To enable him to determine quickly if there is a breech closing casualty, a red line is painted on the breechplug guide plate to indicate the breech closed position. If the plug does not rise to this position, the casualty is located at the breech mechanism. A systematic immediate action procedure will help to locate the cause of the trouble and to get the gun firing again in the shortest possible time.

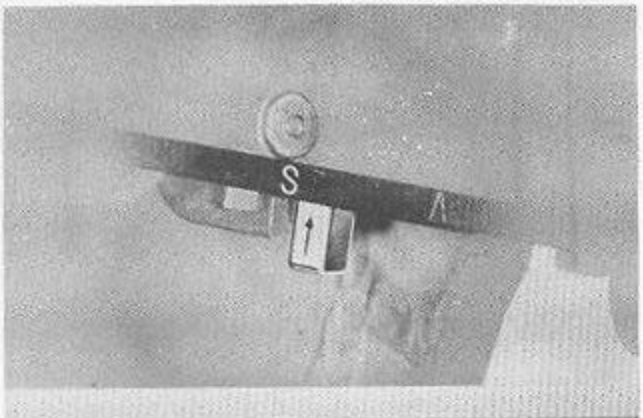


The first step in this procedure is to tap the bottom of the breechplug smartly with a rawhide mall. If the breechplug can be raised to close the breech by this action, the cause of the stoppage is probably foreign matter in the breechplug guide grooves or a broken or weakened operating spring assembly.

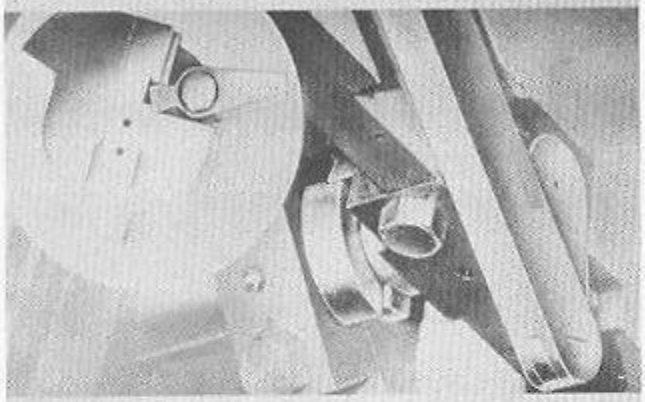


If the operating spring is merely weakened, it may be possible to keep the gun firing faster by continuing automatic operation and tapping the breechplug with the mall whenever it fails to close the breech. However, this procedure can be used only when the gun is firing at surface targets or low flying aircraft. If the spring is broken or if the gun is fully elevated. . .

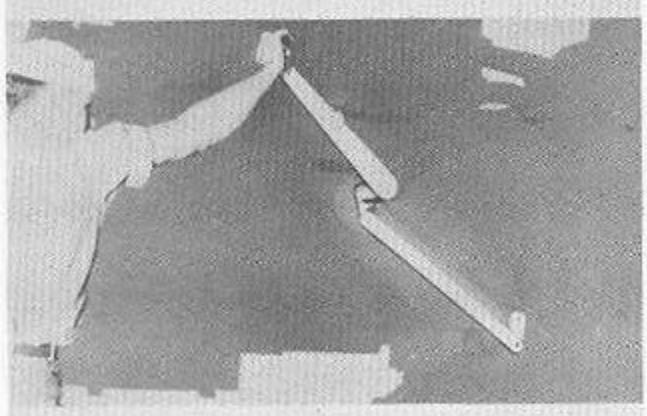




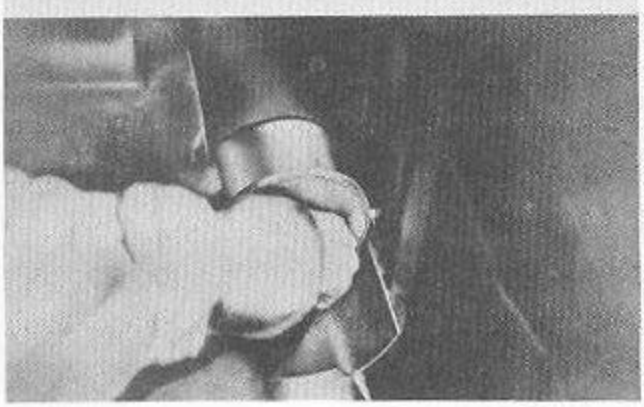
. . .it will be necessary to resort to single fire operation to keep the gun in action. For single fire operation the cam plate retractor must be pushed forward to the single fire position. . .



. . .and the hand-closing latch key must be engaged. . .

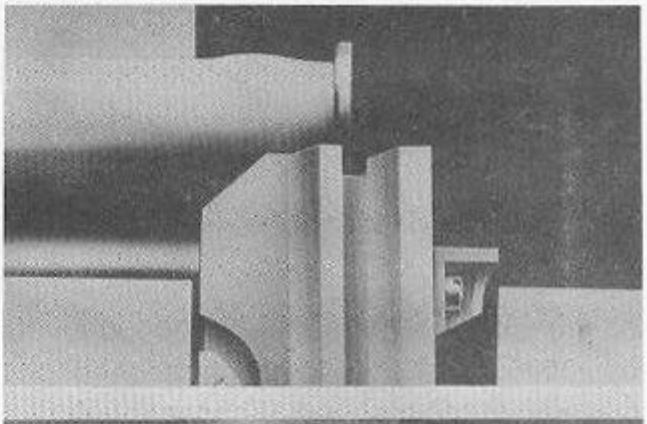


. . .so that the breechplug can be raised and lowered manually with the hand-operating lever. A well trained crew can deliver a comparatively high rate of fire in single fire operation. If the breechplug could not be raised by tapping it with the mall, attempts should be made to raise it with the hand-operating lever immediately. Do not force the plug up if it cannot be raised with a reasonable amount of pressure on the lever. Otherwise, a more serious jam may result. If the breechplug cannot be raised it should be lowered with the hand-operating lever,. . .

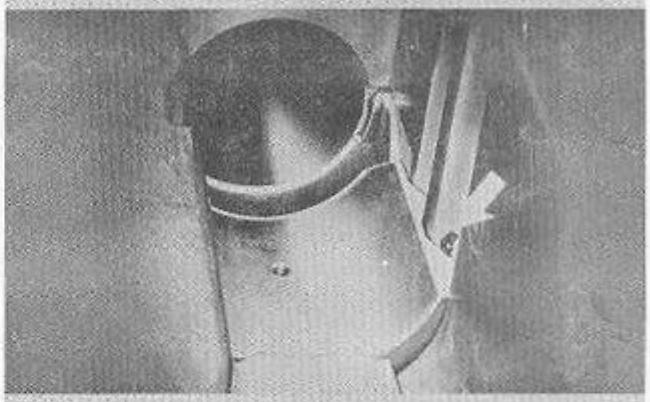


. . .and when the cartridge has been extracted, attempt to ram a short round into the chamber by hand to clear the bore. If the breech can be closed on the short round, it can be assumed that the stoppage was caused. . .

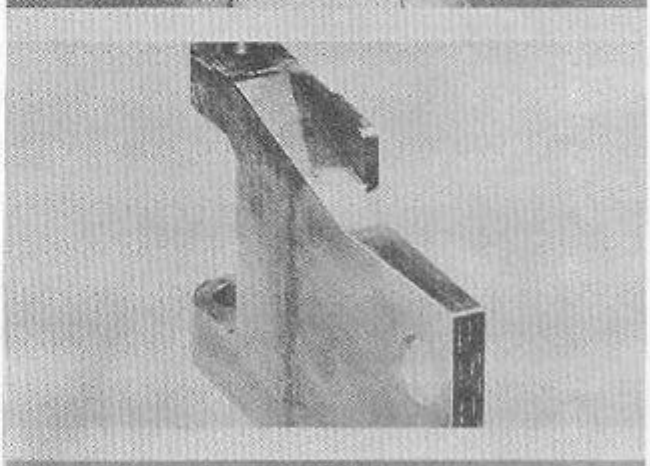
. . .by a damaged or oversize cartridge case. A case of this kind will prevent the breechplug from coming up to close the breech because the case cannot be wedged into the chamber. This same type of stoppage may be caused by defective or oversize corks in the cartridge. Damaged ammunition is a frequent cause of failure to close the breech. When the defective case has been removed, the projectile is unloaded with a short case and firing can be resumed.



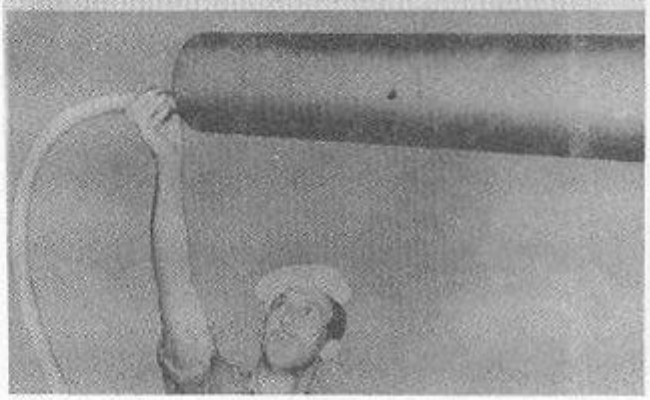
If the breechplug fails to close the breech when the short round has been rammed into the chamber, the stoppage is very probably caused by foreign matter or burrs in the breechplug guide grooves. The gun will then have to remain out of action until the foreign matter can be removed.

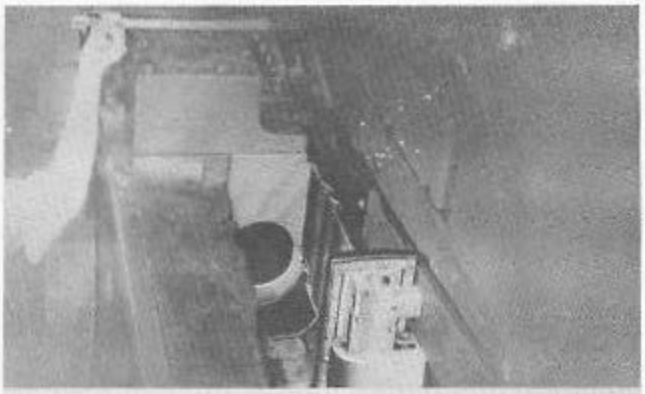


If the breechplug is found to be jammed in such a way that it can neither be raised nor lowered with the hand-operating lever, no immediate action can be taken. This casualty may have been caused by a burred operating shaft cam plate. A burred cam plate may jam the operating shaft inboard so that the bearing blocks freeze in the cam ways of the breechplug to prevent movement of the plug. The gun cannot be fired again until the cam plate has been replaced. This will obviously require some time, and there is great danger that the cartridge may explode inside the gun if the gun is hot.

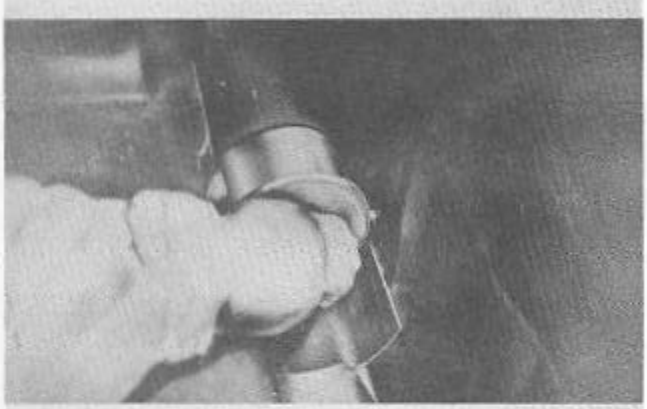


If this stoppage occurs when the gun is hot and the round cannot be cleared normally through the muzzle, place a hose well down the gun muzzle and elevate the gun in order to keep the nose fuze cool. Also, play water over the gun from the outside. Keep all other personnel clear.

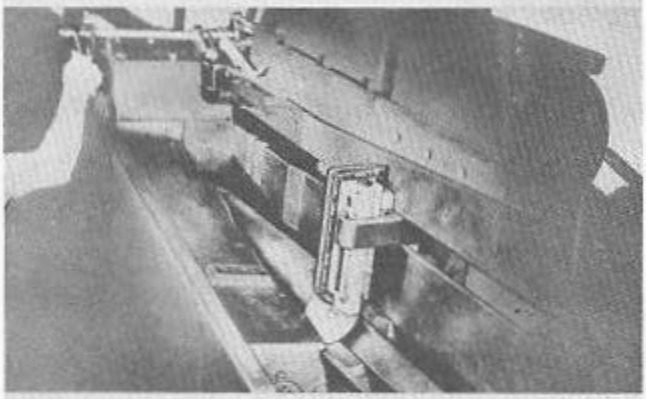




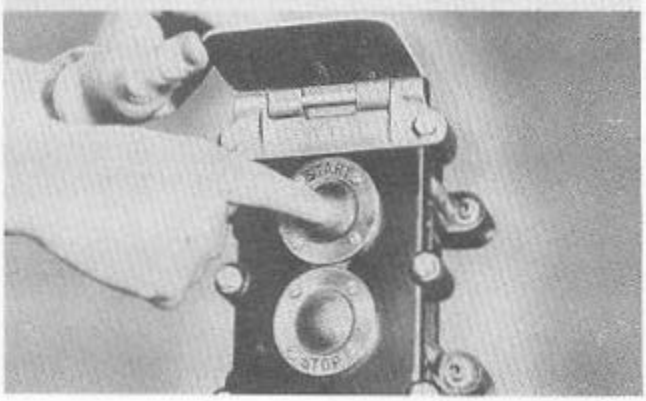
Rammer failure results in stoppage because the rounds are not loaded into the gun chamber. The rammer will stop on the ram stroke if the crosshead is binding in the crosshead guide. To keep the gun firing, the spade must be retracted, if possible,. . .



. . .and rounds rammed into the chamber by hand until the attack is over.

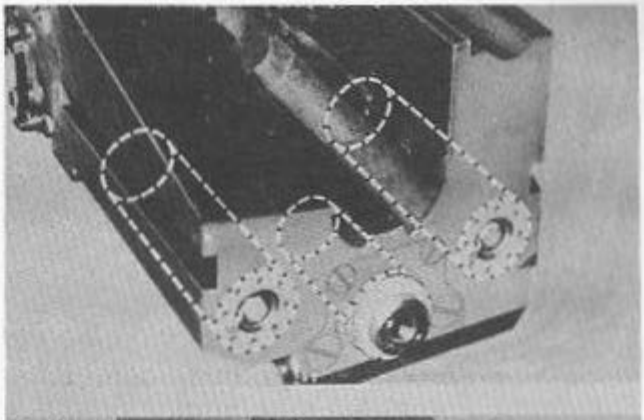


If the rammer motor should stop while a round is being rammed, the cause is probably due to an overload in the rammer mechanism.

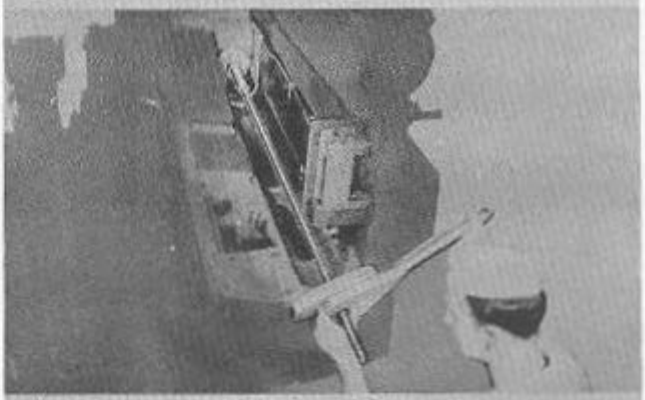


Start the motor with the emergency run button as often as necessary, to keep the gun in action. While these are the most common casualties that interfere with the loading and firing of the 5''/38, there are several others which may stop the gun or slow down its rate of fire.

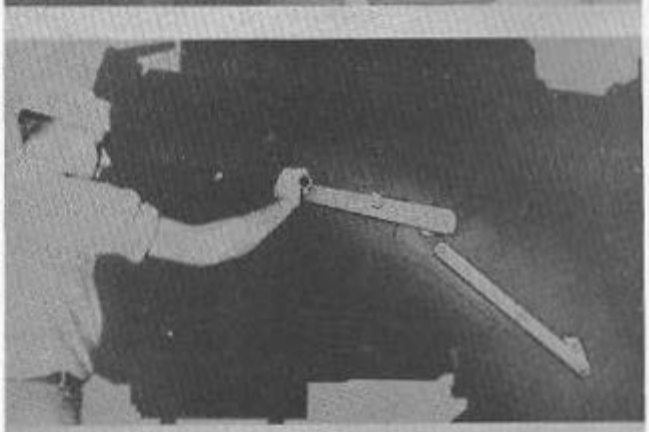
Violent recoil of the gun is caused either by too low a pressure in the counterrecoil air chamber, or by lack of liquid in the recoil cylinders. Lack of liquid in the recoil cylinders will also result in violent counterrecoil, whereas too low a pressure in the counterrecoil air chamber results in slow counterrecoil. A good gunner's mate will never permit this condition to exist.



In addition, failure to extract the fired cartridge case is caused by broken extractors. To remove the case, use this hand-extracting tool. If the extractors also fail to latch the breechplug in the lower position,. . .

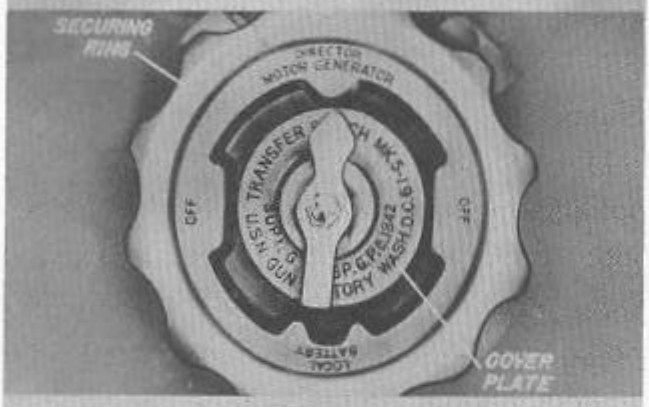


. . .it will be necessary to resort to single fire operation so that with the hand-closing latch engaged the plug can be held in the lower position with the hand-operating lever until the round has been rammed into the chamber. In the event of extractor failure, no other immediate action is possible until the extractors can be replaced.

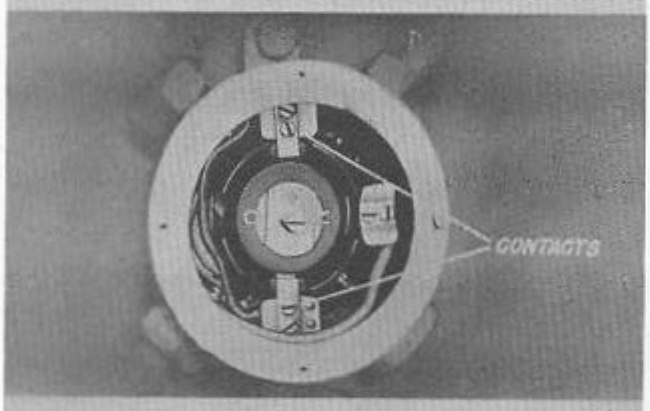


Since it is so important to keep each gun punching at the enemy in the event of air attack, these immediate actions must be taken quickly and accurately whenever a casualty interrupts the firing of a 5"/38. The gun's fire power must be kept in action as long as possible even though it may be at a reduced rate of fire.

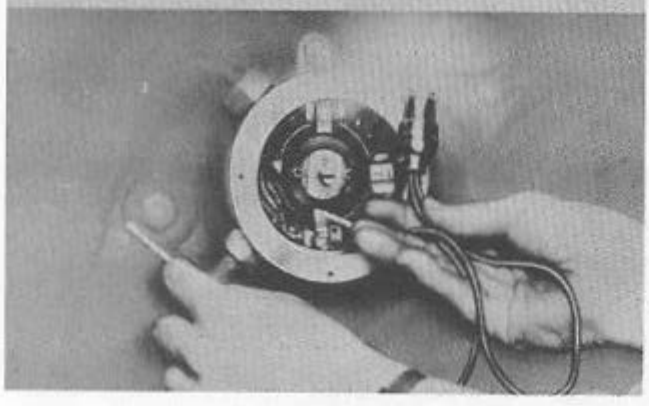
As soon as time permits, remedial casualty action must be taken to put the gun back into full automatic operating order. Frequently, only a very limited time is available for remedial action. To get a thorough job done, tests and repairs must be done systematically and efficiently.



If the gun has failed to fire electrically, on the motor-generator circuit, but could be fired on the local battery circuit, obviously the trouble was in the motor-generator circuit. With the transfer switch set to motor generator, and source of power to the gun, unscrew the securing ring and remove the cover plate on the transfer switch.

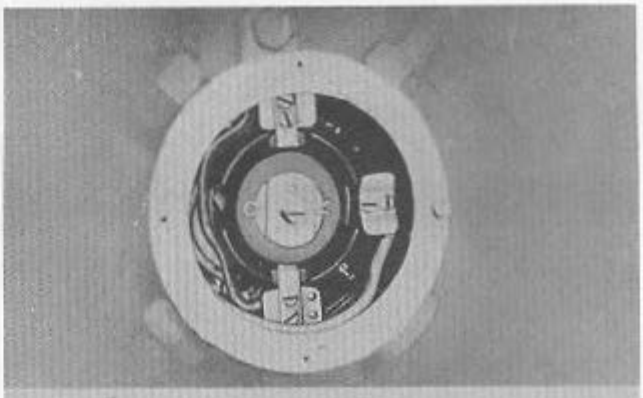


This will expose the contacts. One set of these contacts is linked together and is connected to the firing key lead. The set directly opposite has one contact connected to the lead from the motor-generator circuit, and the other to the lead from the local battery circuit.

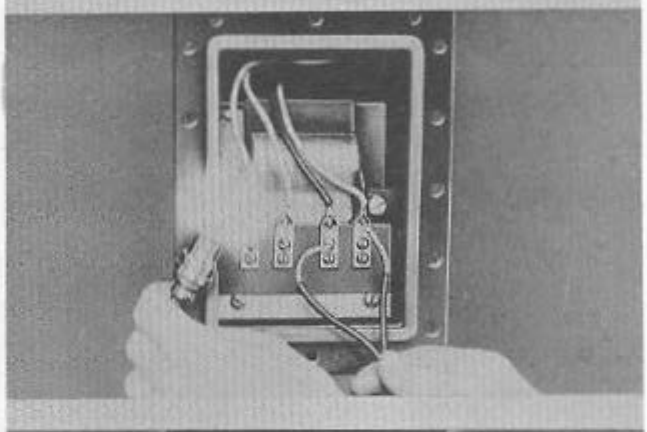


To check the motor-generator circuit, attach one lead of a 20-volt test lamp to the motor-generator contact and the other to ground. Always wiggle electrical leads when testing in order to detect loose connections. If the lamp glows, the trouble is within the transfer switch. With trouble indicated here,. . .

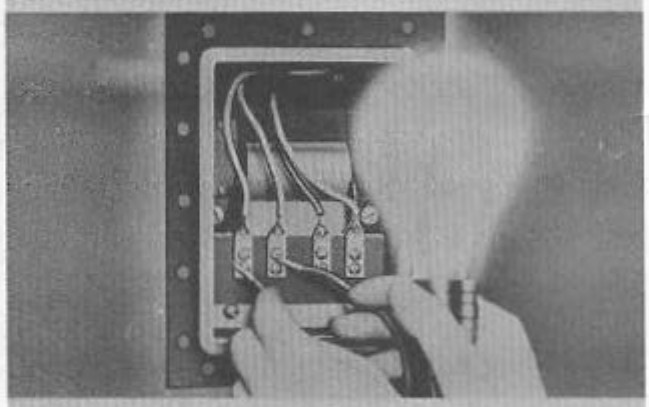
. . .clean or repair the contacts in the switch, and make the test again. On the other hand, if the lamp does not glow on the motor-generator lead contact, the trouble is between the switch and the power source. In this case,. . .



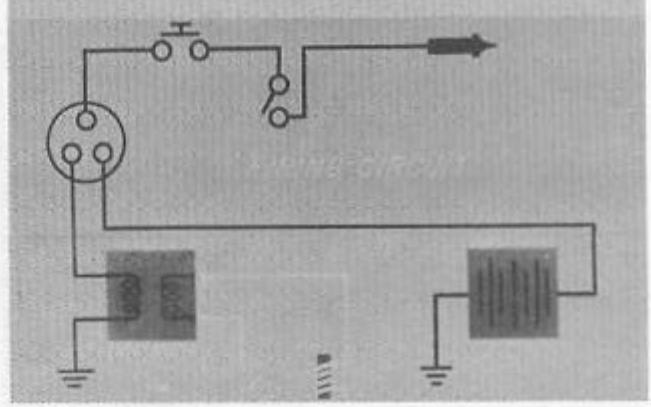
. . .we must next test the gun firing transformer located in the upper handling room. Connect the leads of a test lamp across the 20-volt output terminals of the transformer. If the lamp glows, the indication is a broken lead between the transformer and the transfer switch, or a loose ground connection on the transformer. Locate and replace the lead or repair the loose connection. Then test the circuit again at the transfer switch. If the lamp did not light at the 20-volt output terminal,. . .

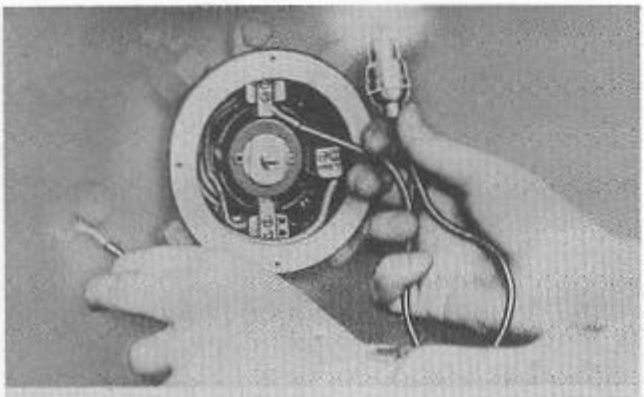


. . .test the power input to the transformer. This is done by connecting a 110-volt test lamp across the input terminals. The lamp lighting here indicates that the trouble is a faulty transformer which must be replaced. Failure of the test lamp to light here. . .



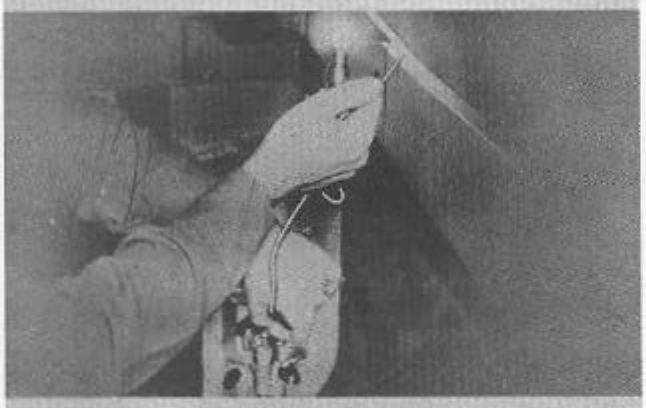
. . .indicates that the trouble lies between the transformer and the plotting room. This fact should be reported to the weapons officer. If the gun could not be fired electrically on either the motor generator or the local battery circuit, it will be necessary to test the entire circuit to locate the trouble. To test the circuit,. . .



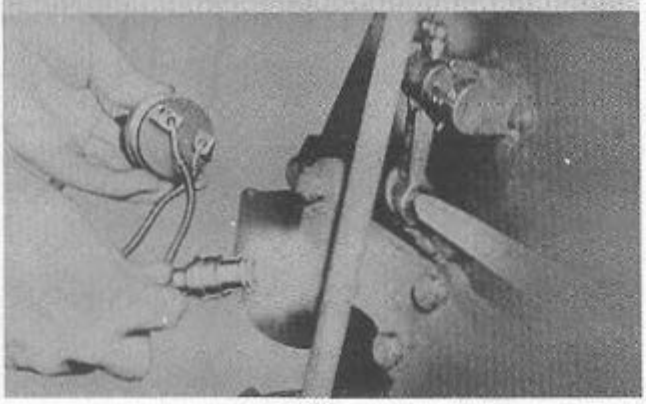


. . .first turn the transfer switch to motor generator. Attach one lead of the 20-volt test lamp to the firing key contact within the transfer switch and the other lead to ground. If the lamp does not glow, check the circuit from the transfer switch to the power source as previously described. Test the local battery circuit from the transfer switch in similar manner. If the test lamp does glow at this point, however, power is available to the transfer switch and the difficulty must lie between the transfer switch and the firing mechanism.

To check the circuit from the firing mechanism to the transfer switch, first close and lock the firing key.

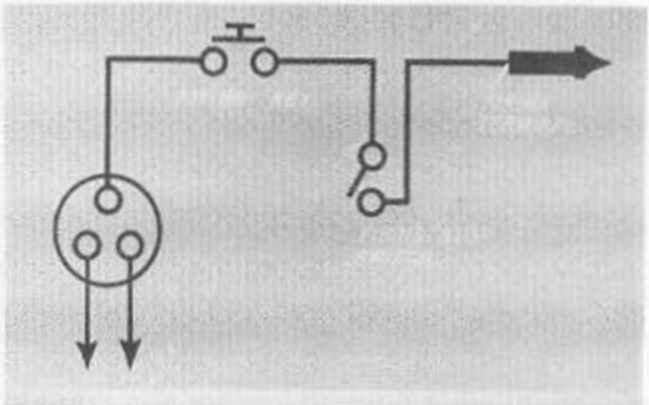


Then attach one lead of the 20-volt test lamp to the firing terminal on the end of the firing pin and the other lead to ground. The lamp glowing here indicates trouble in the firing mechanism. So replace the mechanism with a spare. Clean out any grease which may have gotten into the breechplug. If the lamp is only dim here, a partial ground or a loose connection is indicated in the circuit. If the test lamp does not light at all,. . .

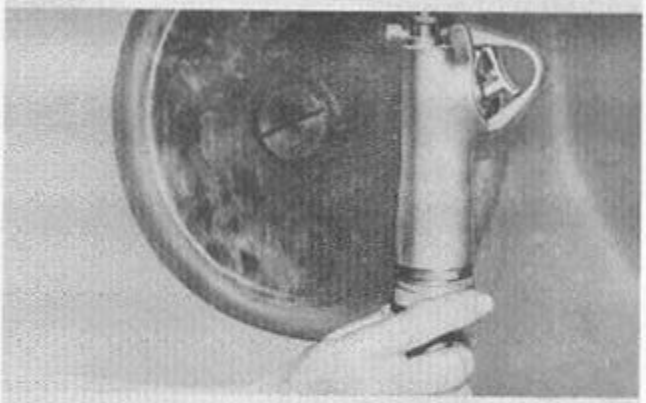


. . .check the firing-stop switch in the firing-cutout mechanism. Pull out the contact plug and connect the test lamp across its terminals. Then ground the firing terminal by attaching it to the rammer cam plate or some other clean metal surface on the gun. If the lamp lights, the trouble is in the switch and the firing-stop mechanism must be disassembled and grease and dirt cleaned out of the switch. It is to prevent this trouble that you were cautioned earlier not to use too much grease in the firing-stop mechanism. Failure of the test lamp to light here. . .

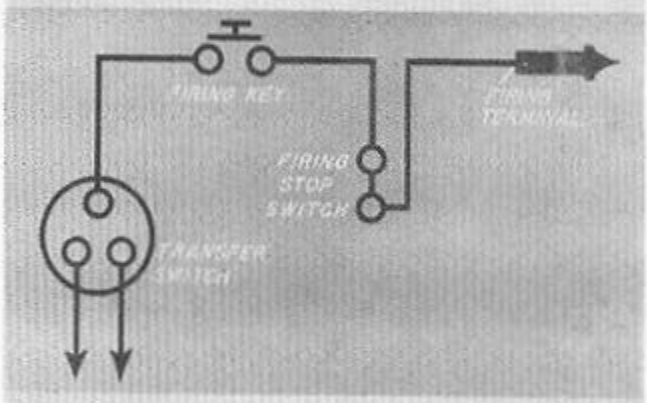
. . .indicates that the difficulty is either a broken lead from the firing key to the firing-stop switch or one from the switch to the firing terminal. To locate the trouble we must determine whether current is reaching the switch. To do this, bridge the test lamp between one contact and ground and then between the other contact and ground. If current is reaching the switch, the lamp will glow here and the trouble can be located in the lead to the terminal. But, if the test lamp does not light, current is not reaching the switch and the next test. . .



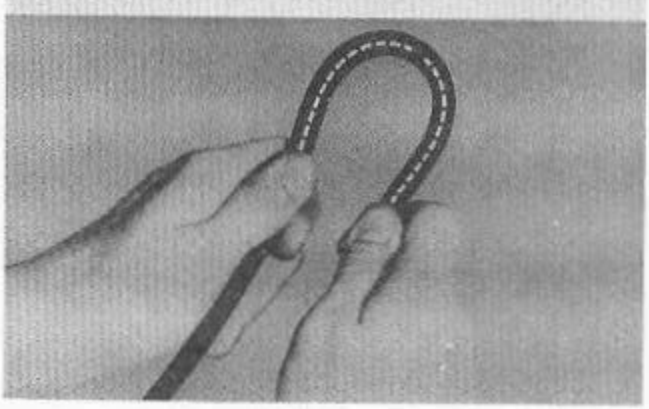
. . .must be made at the firing key. Unscrew the securing gland at the bottom of the key casing.



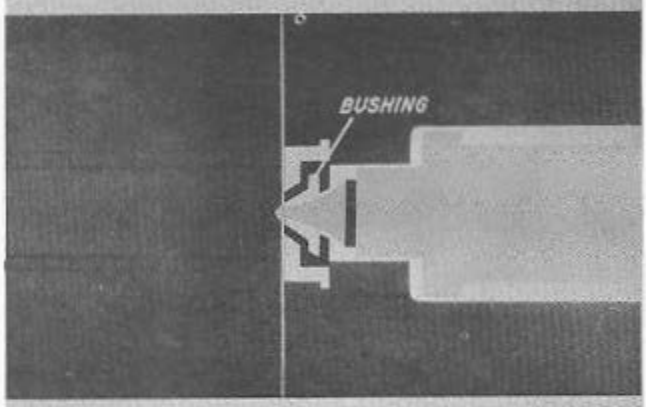
Pull out the switch mechanism and, with the firing terminal grounded, connect the test lamp across the firing key contacts. This bridges the switch gap and, if there is no other break in the circuit, the lamp will glow. Trouble is therefore indicated in the firing key switch. If the lamp does not light it is because there is a break in the circuit either between the firing key and the firing stop switch, or between the key and the transfer switch. To determine where the break is, we must see if current is reaching the switch. To do this, place one lead of the test lamp on one contact and the other on ground. Then place one lead of the lamp on the other contact and ground the second lamp lead. If there is a glow in the test lamp when connected to the power side of the switch, the trouble is between the key and the firing stop switch. If the test lamp does not light at the switch, no power is reaching the switch, because. . .



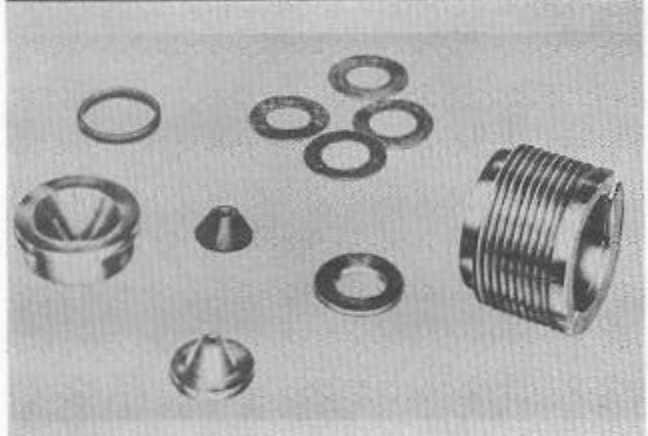
. . .there is a broken lead or loose connection between the firing key and the transfer switch. This can now be located and remedied.



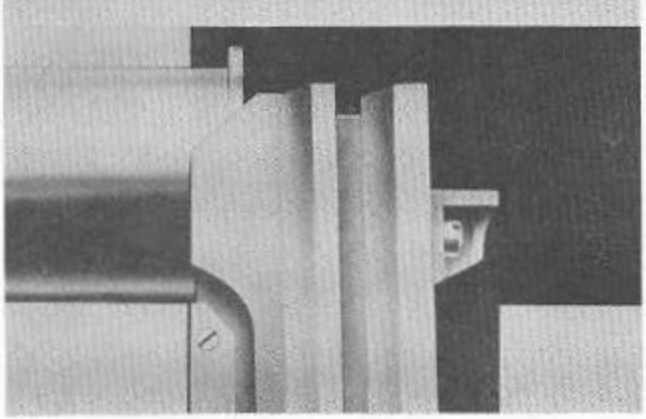
If the electrical failure was in the firing mechanism, or if the gun failed to fire by percussion, the firing mechanism was replaced with a spare, and the faulty mechanism must be disassembled for inspection and repair.



A frequent cause of failure to fire may be a solid packing of grease lodged in the bushing at the forward end of the firing mechanism chamber in the breechplug. Grease should be kept out of this space, as it will prevent the firing pin from coming forward properly to contact the primer, and may break down the insulation in the bushing. If the insulation in the bushing fails, the firing pin would be short circuited and it will be necessary to remove the bushing from the breechplug.

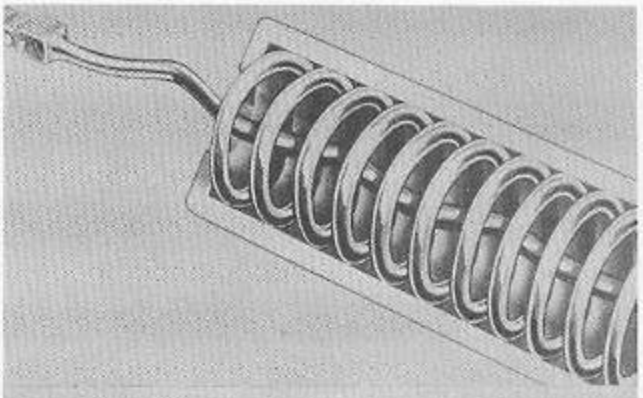


Then, disassemble the bushing to replace the faulty insulation parts. A systematic, step-by-step check of the firing circuit in this manner will almost invariably locate trouble in the shortest time so that it can be corrected to provide positive firing action.

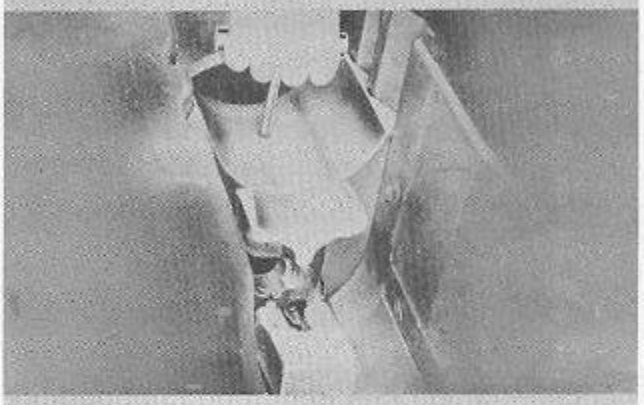


Failure of the breechplug to close the breech completely results, as we have seen, either in complete stoppage of fire, or in a greatly reduced rate of fire. The cause of the breechplug failure must be remedied as soon as action is over.

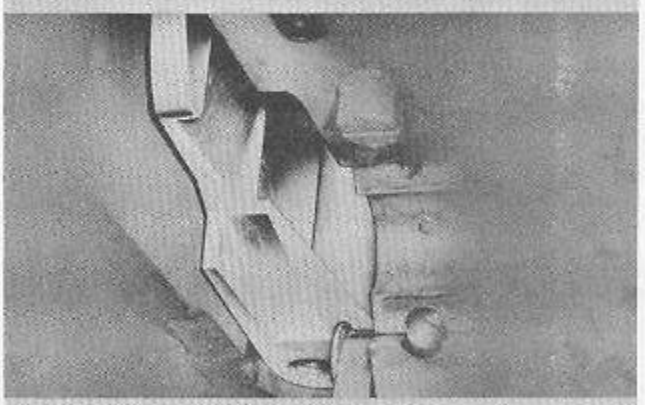
If the breechplug failure was caused by a weak operating spring or by broken spring connections, the damaged parts should be replaced, and the tension of the operating spring adjusted.



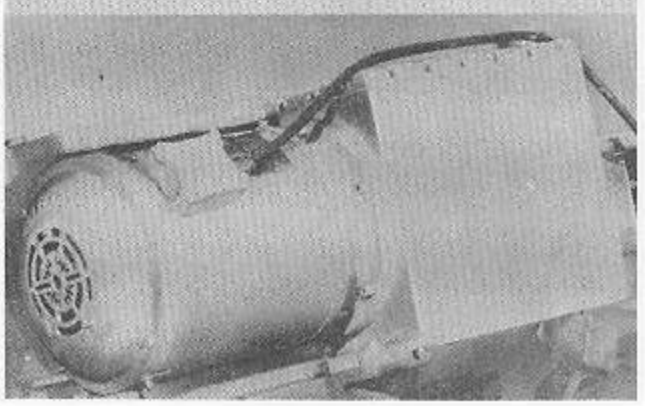
Failure caused by burrs or foreign matter in the breechplug guide plates may necessitate tearing down the entire breech mechanism so that the plug can be pulled out of the guide plates, and the obstructions removed.

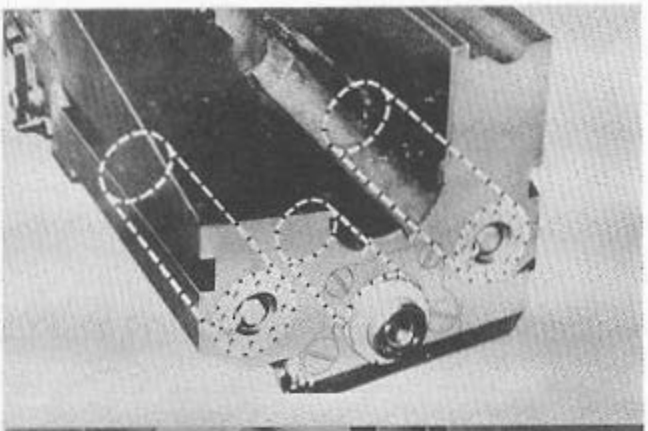


We saw that a jammed breech mechanism may have been caused by a burred cam plate. If this is the case, the entire breech mechanism must be disassembled and a new cam plate and operating shaft installed.

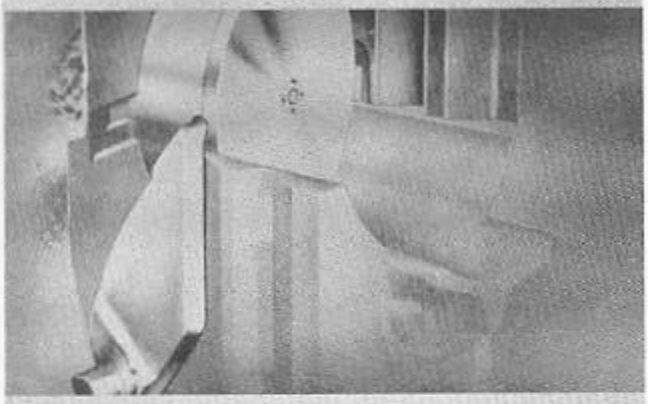


A rammer stoppage is usually caused by failure of its hydraulic or electrical system. In either case the mechanism must be completely checked, inspected, and repaired after the engagement is over.

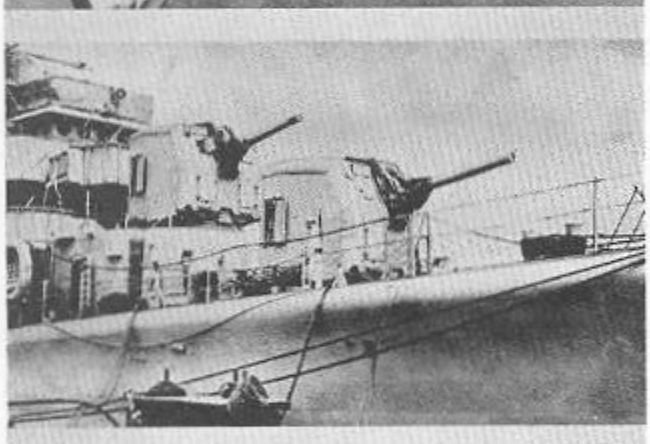




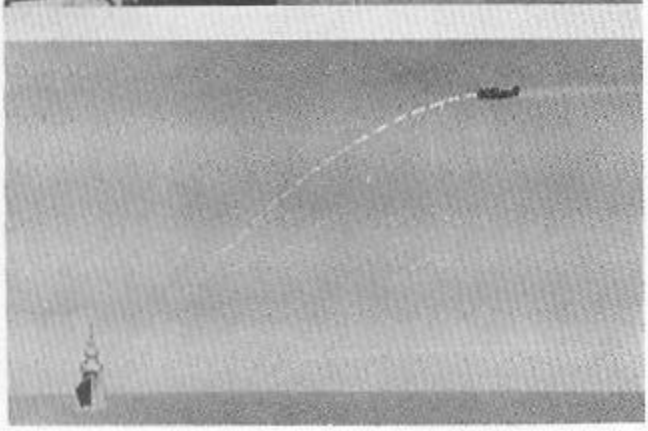
We have seen that violent recoil is caused by either lack of air pressure in the counter-recoil air chamber, or lack of liquid in the recoil system. Such conditions should be remedied in the routine maintenance procedures, and should never be permitted to exist when the gun is in action.



If the extractors are worn or broken, it will be necessary to disassemble the breech mechanism in order to replace them. In all cases where disassembly is required, permission of the weapons officer must be obtained before putting the gun out of commission.



We have now completed our study of the 5"/38 gun. We have seen that it is a ruggedly designed, dual purpose weapon.



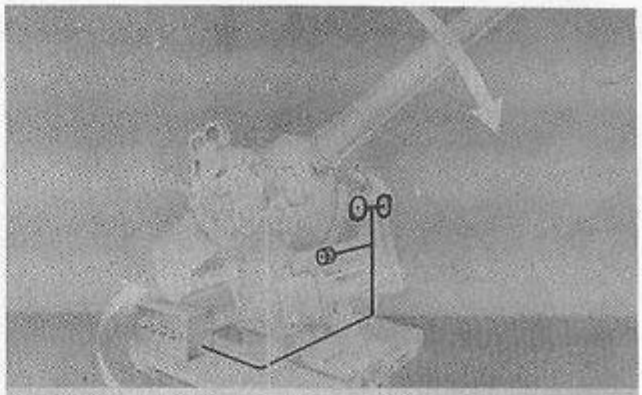
It can be used effectively both against enemy aircraft and enemy surface ships. It packs sufficient wallop to reach out and break up plane attacks before they come in. It has long range, extreme elevating ability, and delivers a rapid and accurate fire.

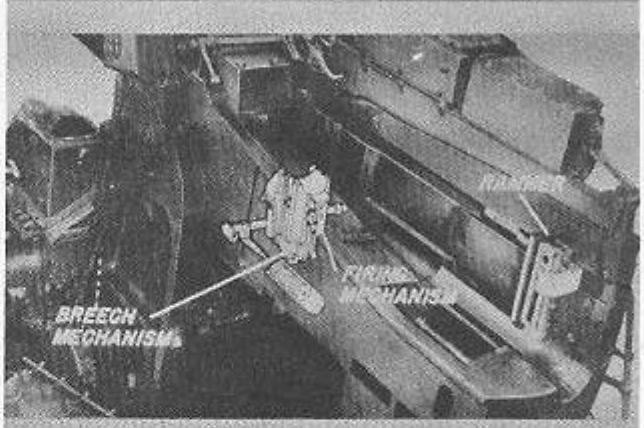
Its dual purpose character is made possible by a mount designed with high carriage cheeks to give it the required range of elevation, and by the gearing and power drive which allows rapid elevating and training of the gun in this mount to track its high speed targets.

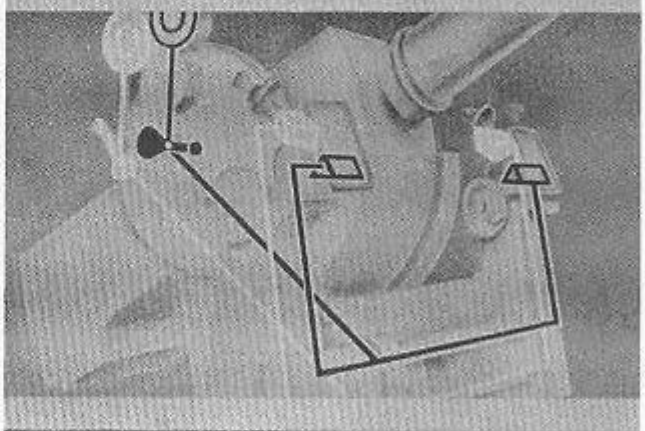
Its extremely rapid rate of fire is made possible only by the smooth functioning of its many precision mechanisms. The rammer and the breech mechanism provide for rapid loading of the gun. The firing mechanism provides almost instantaneous detonation of the propelling charge as soon as the breech has been closed.

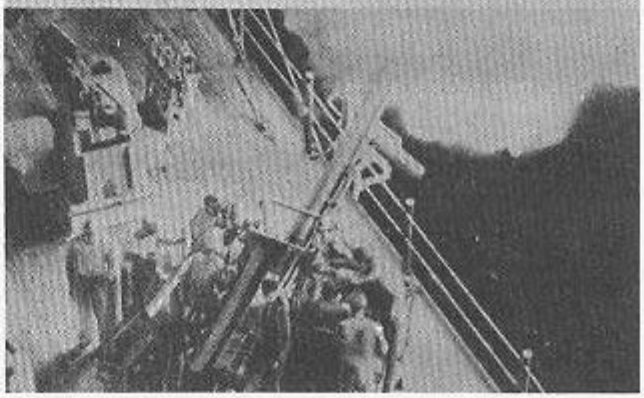
And the accuracy of its sights ensures precision aiming of the gun so that its projectile will bring down the enemy target.

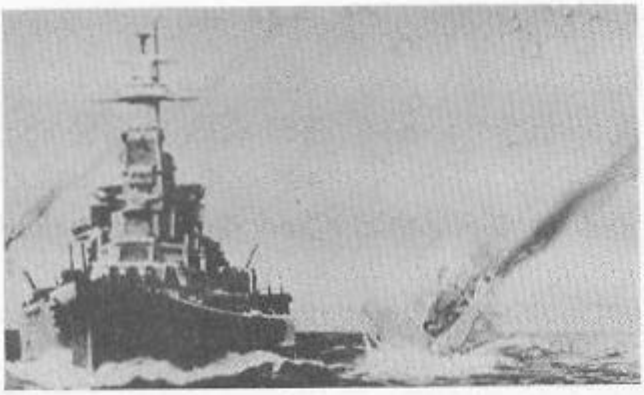
To take full advantage of the accurate, rapid fire provided by the smooth functioning of all these mechanisms, the gunner's mate must know this gun thoroughly so that he can maintain it in accurate, reliable working order, . . .





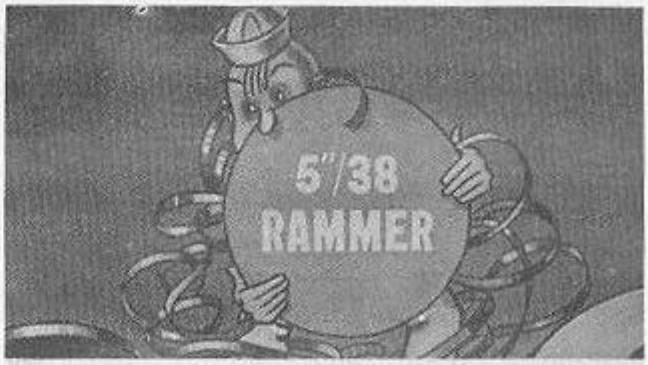




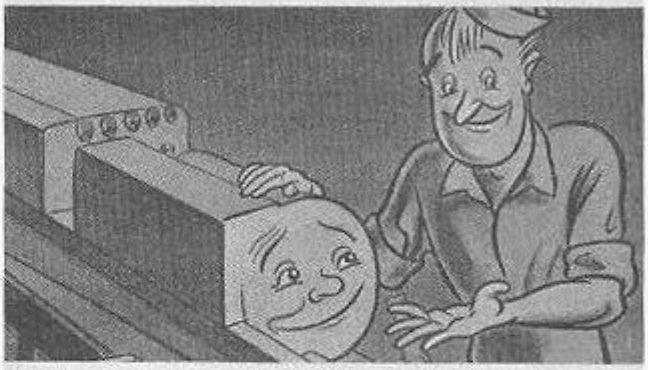


. . .and so that even in the event of casualty, he can get the gun back into action in the shortest possible time, and keep it in action so long as there are enemy targets within range.

This is the first of two chapters on the 5"/38 rammer. This film will show. . .

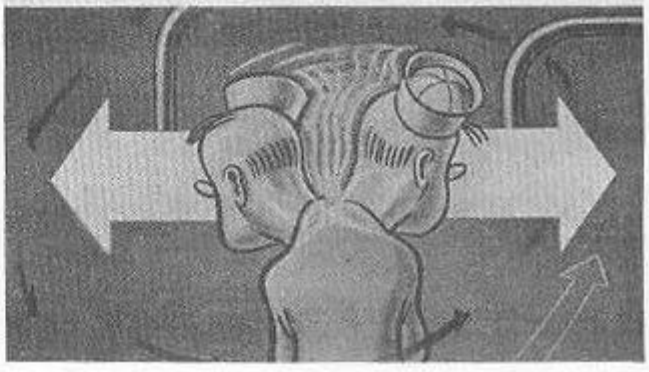


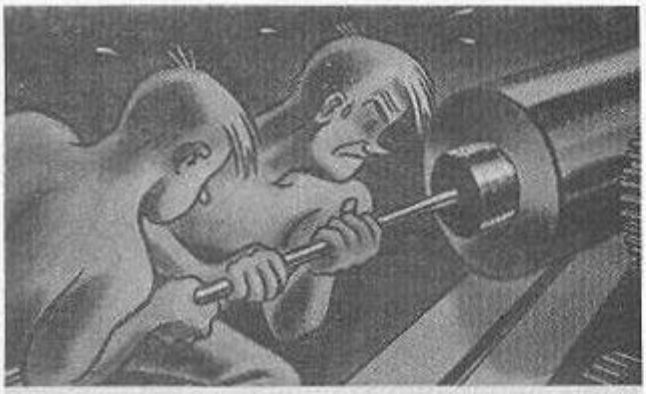
. . .what the rammer is like,. . .



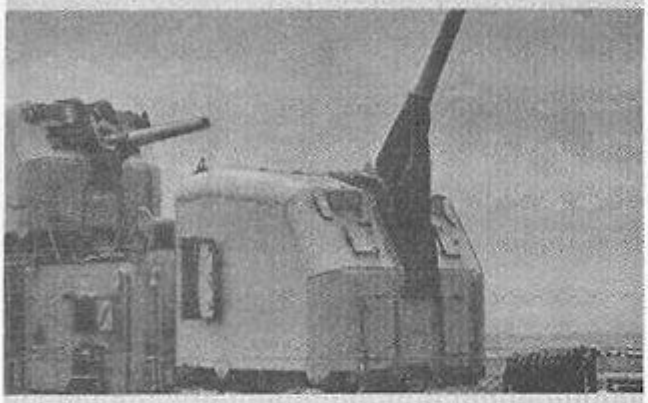
. . .will identify the parts, and will also show, in a general way,. . .

. . .how the rammer works. The second chapter will show the theory of operation in detail.

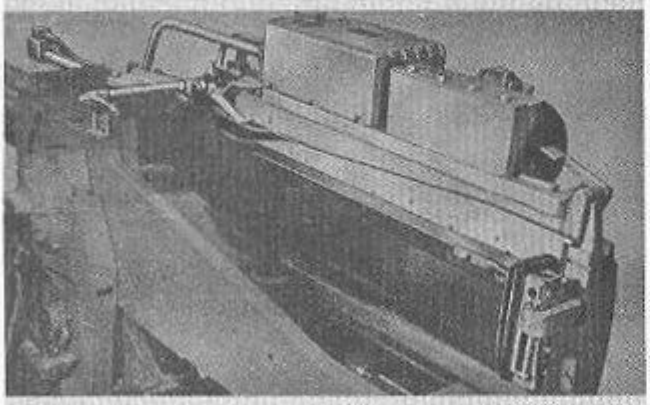




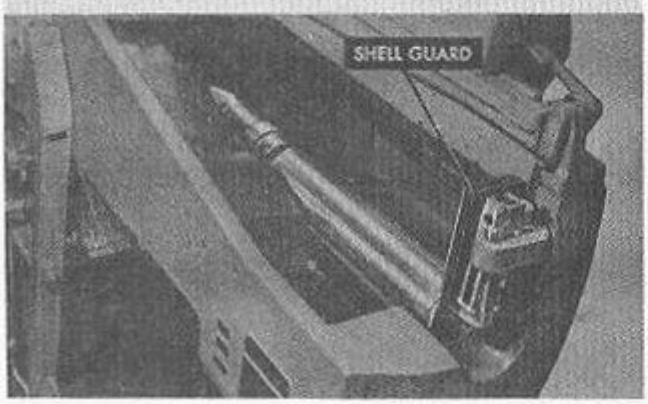
In the days of slow shooting, hand ramming was alright, but it's no good for fast action,. . .



. . .or when large caliber antiaircraft guns are fired at high elevation.



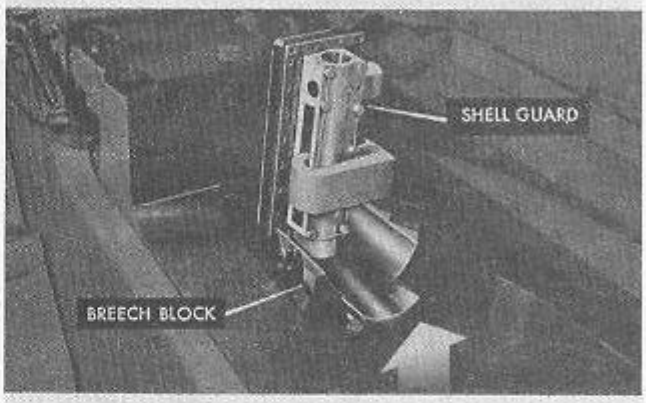
That's where the 5"/38 mount rammer comes in. Let's see what it does.



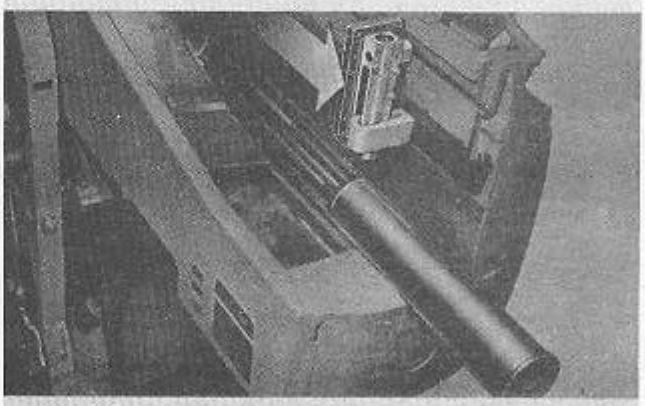
The shell guard, often called the spade, is the moving part most readily seen. The projectile and cartridge case are placed in the tray ahead of the shell guard.

Pressing the hand-control lever down starts a ram stroke. The shell guard starts a ram stroke. The shell guard rams the projectile and case into the breech.

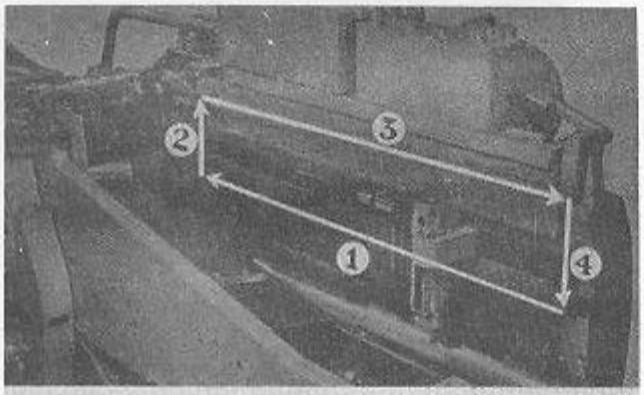
The breech block rises, lifting the shell guard. The gun is fired,. . .



. . .and the shell guard retracts in RAISED position so the empty case can be ejected.

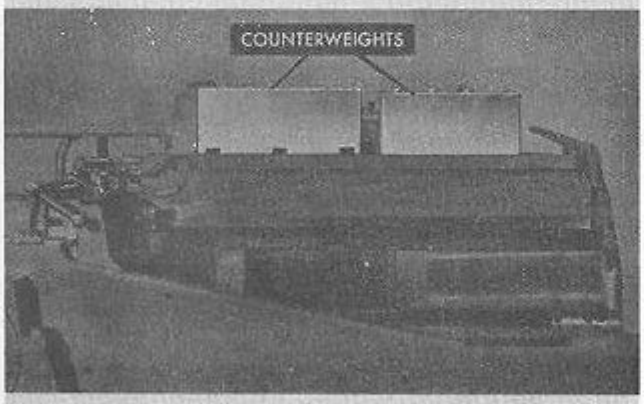


The latch release lever is tripped, and the shell guard snaps down to RAM position ready for the next ram stroke. This completes the cycle. The shell guard. . .

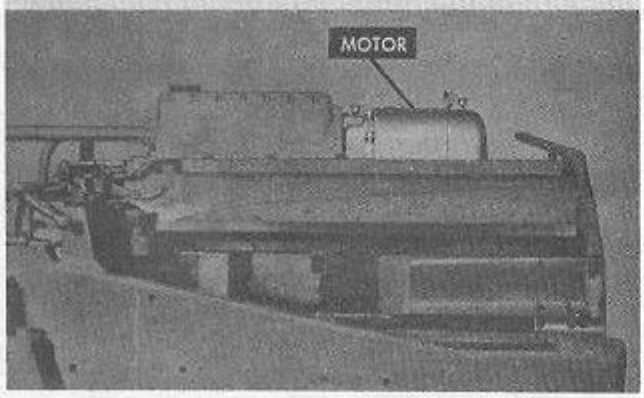


. . .follows a path that is approximately a rectangle—first, ramming; second, raising; third, retracting; and fourth, lowering. Now let's look at the rammer parts.

The cover plate is the foundation for the entire rammer assembly.



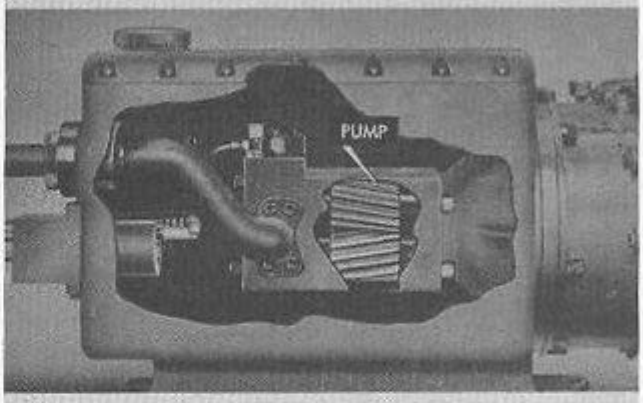
Counterweights help balance the gun. Remove them and we see. . .



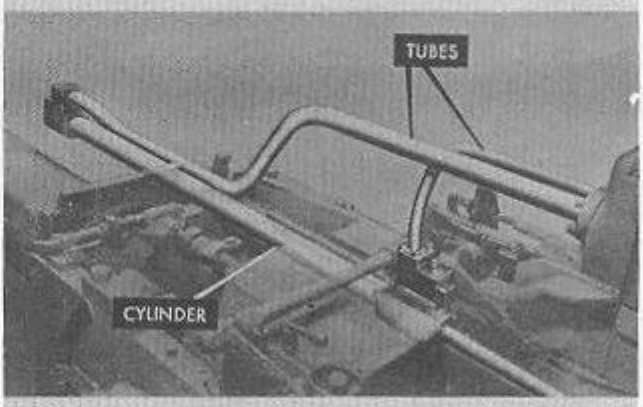
. . .an electric motor operating on 440-volts, and rated at 71/2 horsepower. We can also see. . .

. . .a supply tank which contains about ten gallons of hydraulic fluid. Also in the tank,. . .

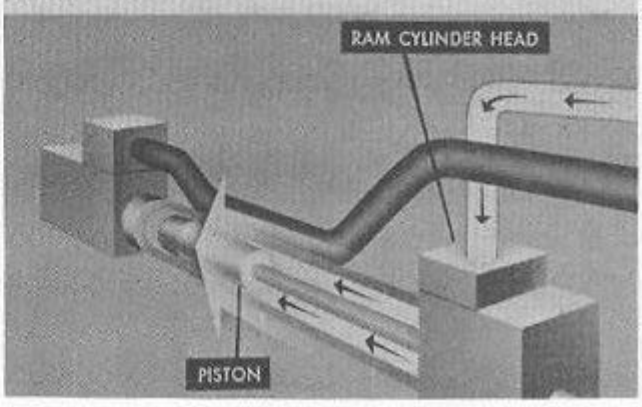
. . .is a constant delivery pump which is driven by the motor. Fluid from the pump. . .

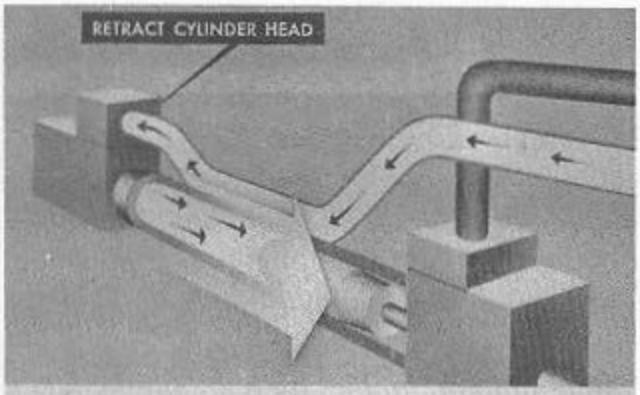


. . .is forced through one or the other of these two tubes to the cylinder. When fluid enters the cylinder. . .

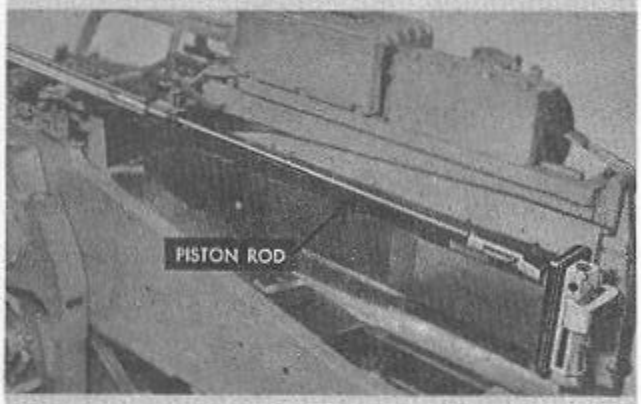


. . .through the ram cylinder head, a piston is forced forward in a ram stroke. When fluid enters. . .



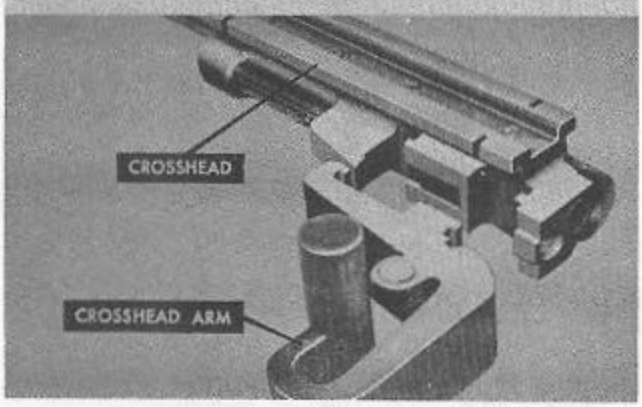


. . .through the retract cylinder head, the piston is forced aft in a retract stroke.



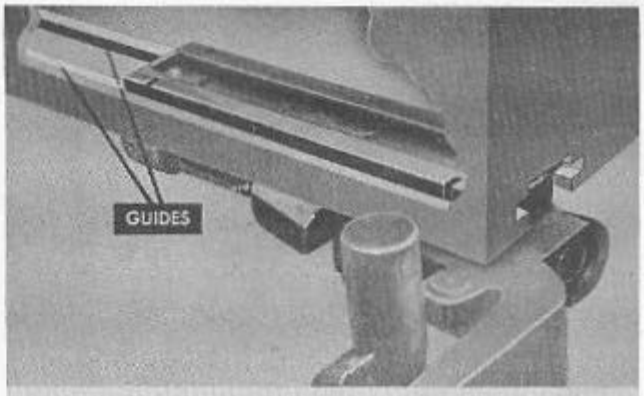
The piston rod extends aft from the piston. The piston rod is connected to the shell guard . . .

. . .by means of a crosshead assembly. This assembly is in two main parts,. . .

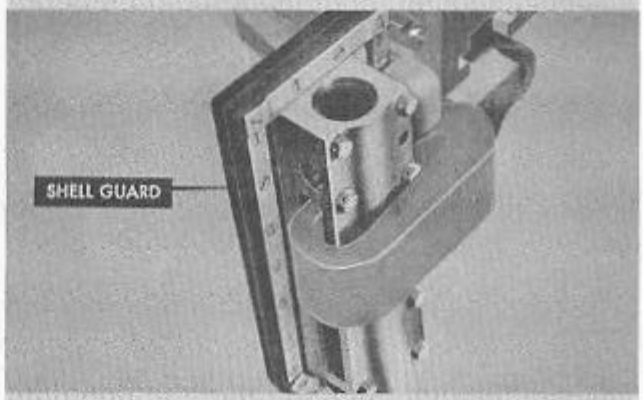


. . .the crosshead and the crosshead arm which adjoins in a locking fit. The crosshead. . .

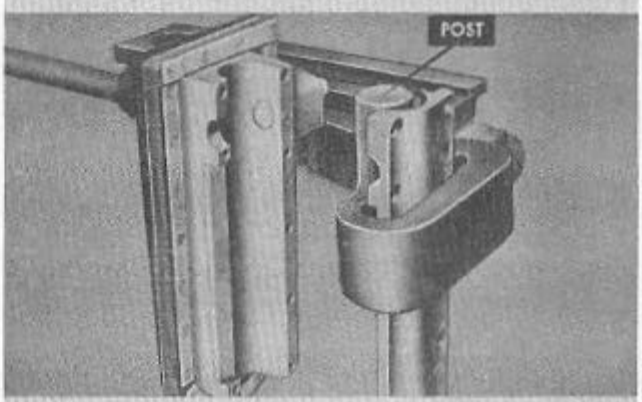
. . .rides on guides in the cover plate. The crosshead arm. . .



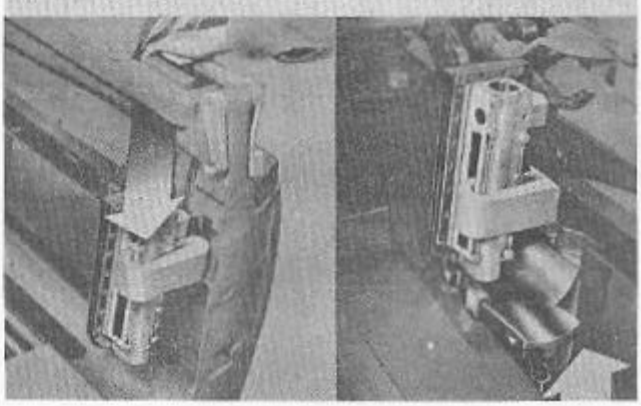
. . .supports the shell guard.

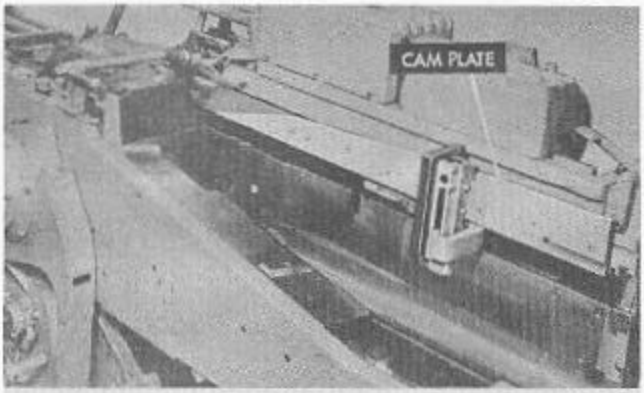


This shows how the shell guard is assembled about a post on the crosshead arm. This arrangement permits the shell guard to move up and down—. . .

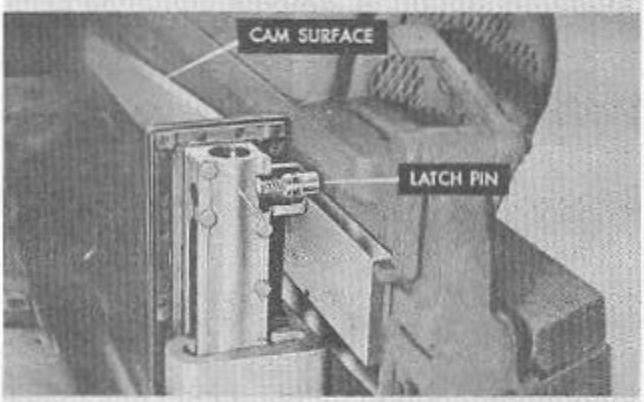


. . .down when the latch release lever is tripped, and up when it is raised by the breech block. It's kept raised during the retract stroke. . .





. . .by a cam plate, the top of which. . .

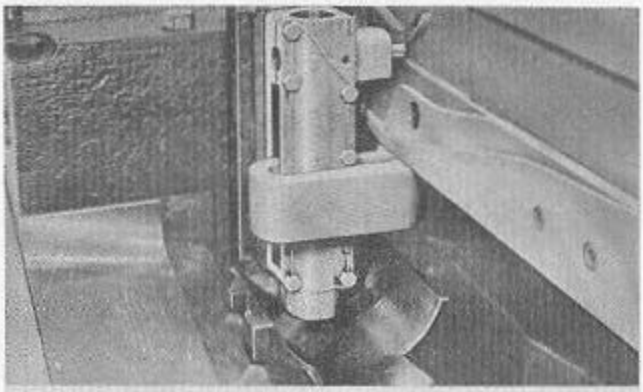


. . .is a cam surface. A latch pin, held out by a spring, rides this surface and supports the shell guard in a raised position during the retract stroke. At the end of the retract stroke, the latch pin, . .

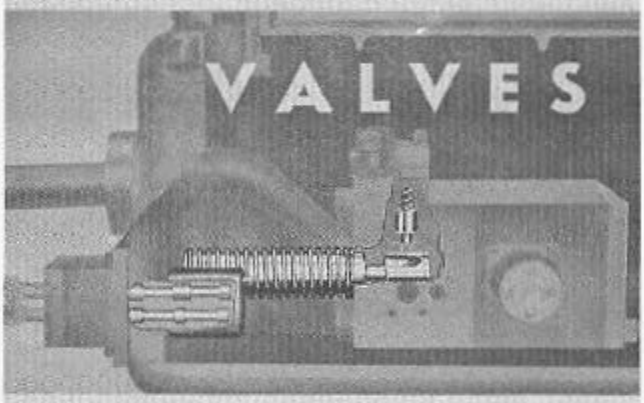
. . .comes to rest on the toe of the latch release lever. Now, pressing down on the lever releases the shell guard which then snaps down into position for the next ram stroke.

During a ram stroke, a lower cam surface forces the latch pin back into the shell guard. At the end of ram,. . .

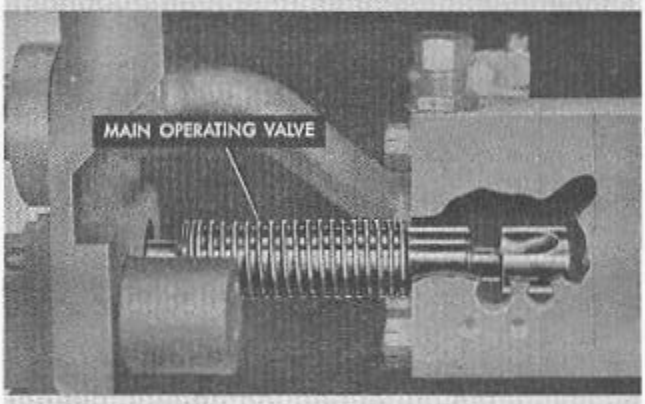
. . .when the shell guard is raised by the breech block, the latch pin clears the cam plate and snaps out. The rammer strokes are controlled hydraulically. . .



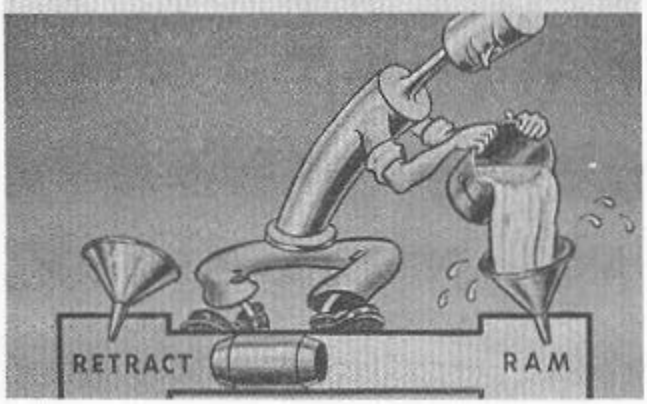
. . .by valves in the supply tank.

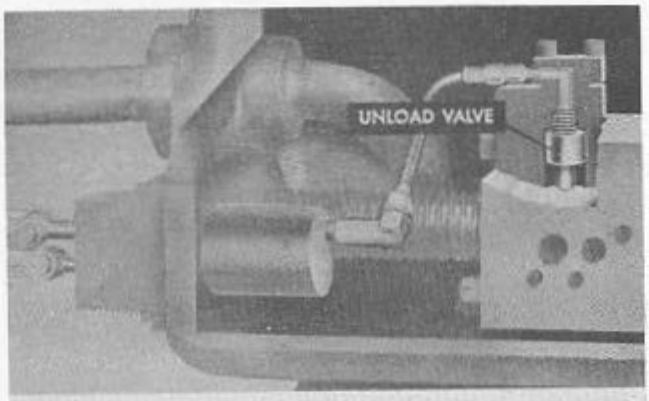


The main operating valve opens and closes channels,. . .

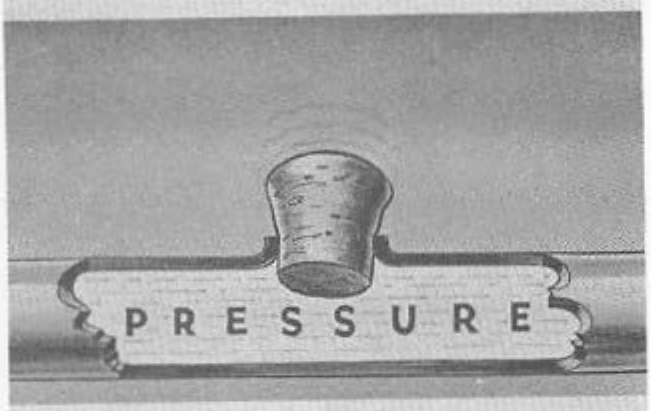


. . .and determines whether a stroke is ram or retract. That's all it does. Strokes are started or stopped. . .



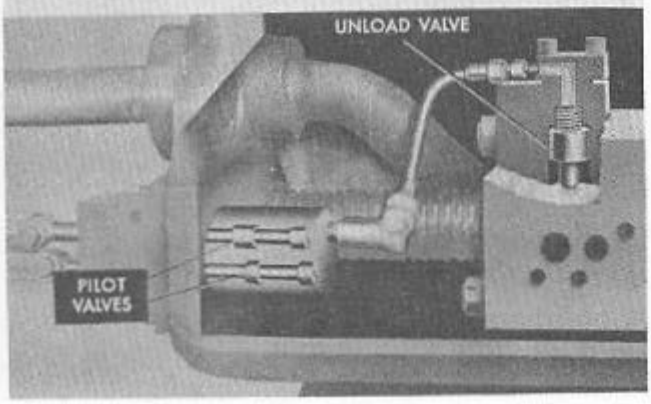


. . .by an unload valve. It acts. . .



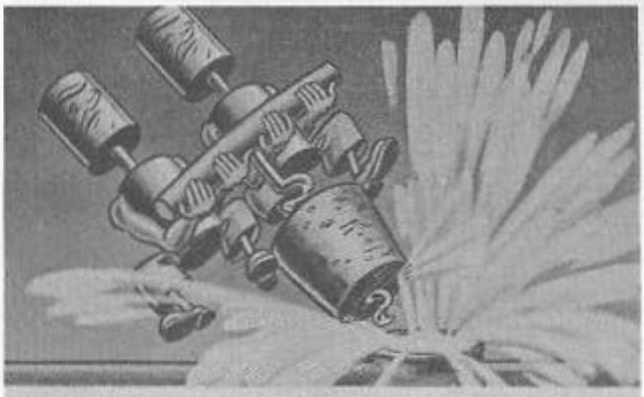
. . .as a plug. When the plug is in, pressure causes a stroke. When the plug is removed,. . .

. . .there is no pressure and, therefore, no stroke.

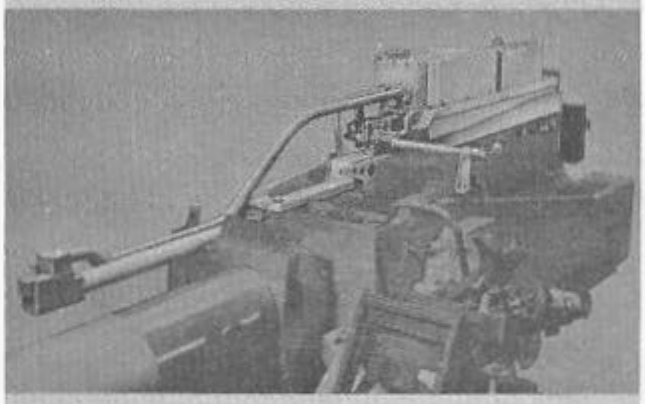


Two pilot valves, manual and automatic, hydraulically control the unload valve. Depending on the position of the pilot valves,. . .

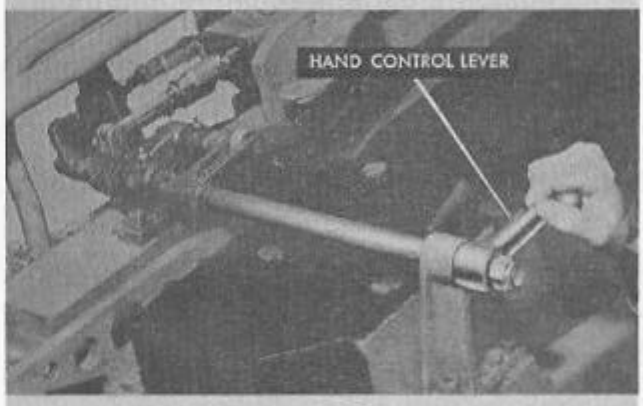
. . .the unload valve is open or closed. Now remember this, the main operating valve controls direction of stroke. And the pilot valves control the unload valve.



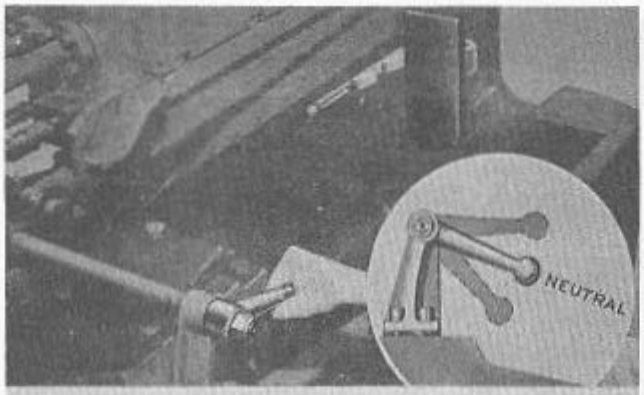
Now, let's see some of the mechanical details:. . .



. . .first, the hand-control lever. When the lever is pressed down,. . .

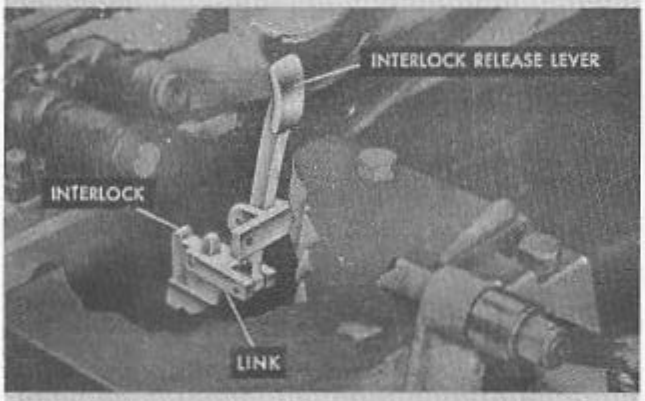


. . .the main operating valve is moved into ram stroke position where it is latched in place. And the manual pilot valve is also moved in to start the stroke. This same lever may also be used. . .

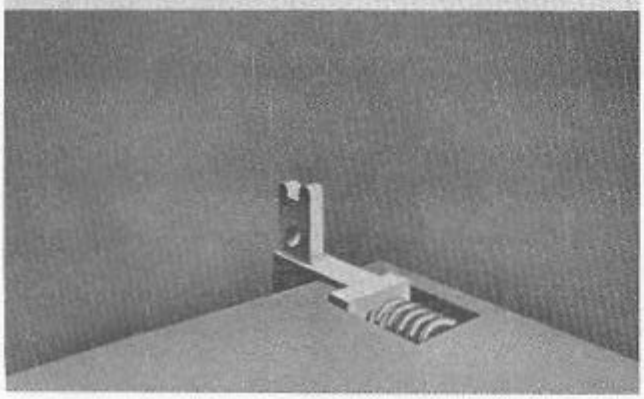


. . .to bring the shell guard to a stop at any point is the stroke path. Just ease the lever toward neutral position until the guard stops. Then, hold the lever there.

Another detail is the rammer interlock mechanism, of which only the interlock release lever can be seen in this picture. The breech housing conceals the other parts. Cut away some of the housing,. . .

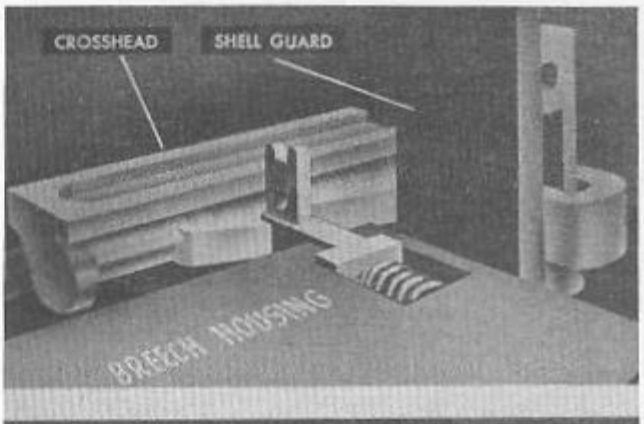


. . .and you see the interlock release lever connected to the interlock by a link. Removing the lever and link reveals the interlock. . .

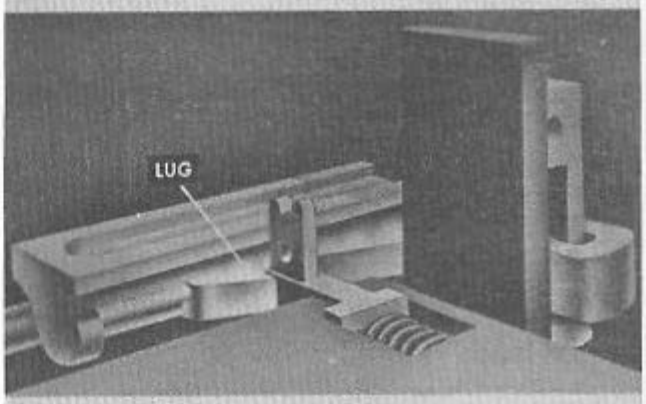


. . .as just a spring-loaded latch. The purpose of the interlock. . .

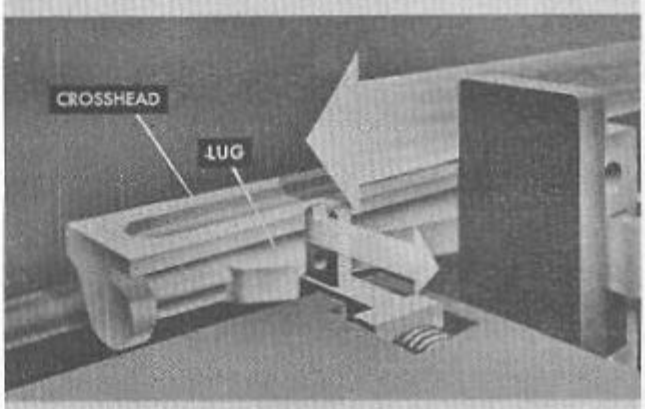
. . .is to latch the crosshead and shell guard to the breech housing at the end of ram stroke. The detail to watch now. . .



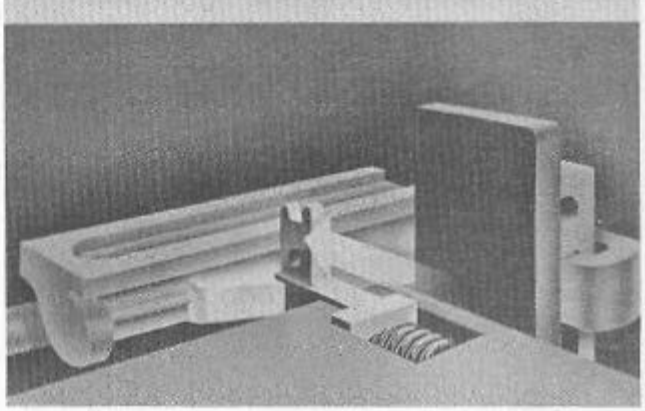
. . .is the tapered lug on the crosshead.

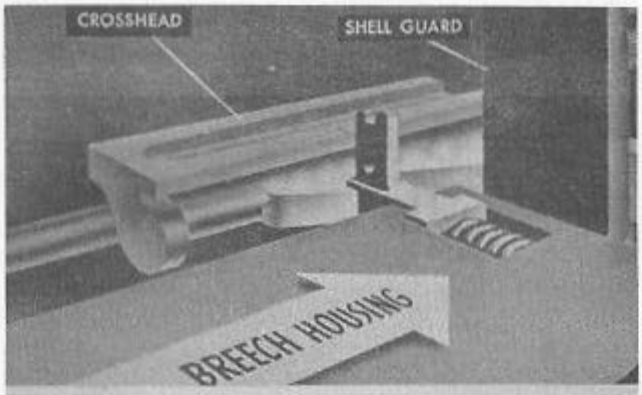


As the crosshead nears the end of ram stroke, the lug moves the interlock in against its spring. At the end of ram,. . .

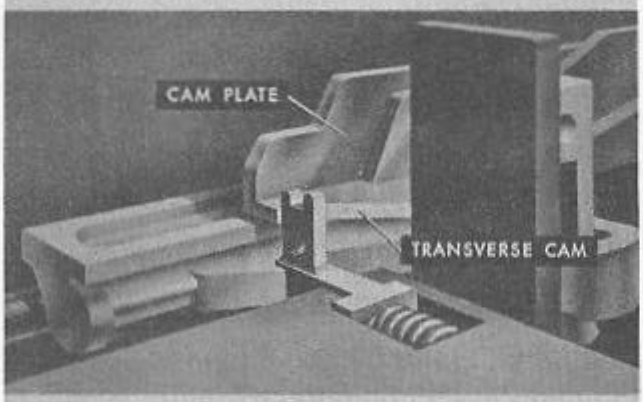


. . .the interlock snaps behind the lug locking the crosshead and shell guard to the breech housing.

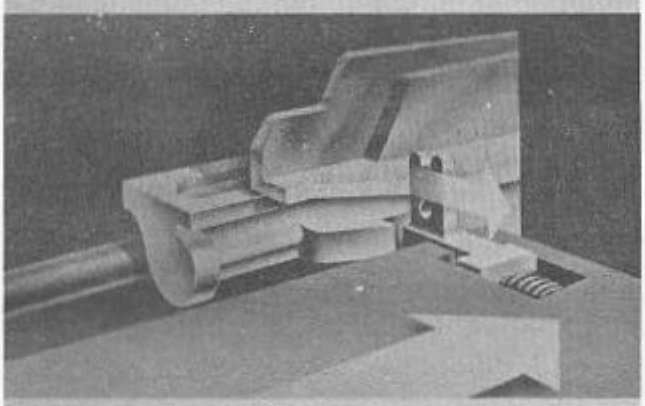




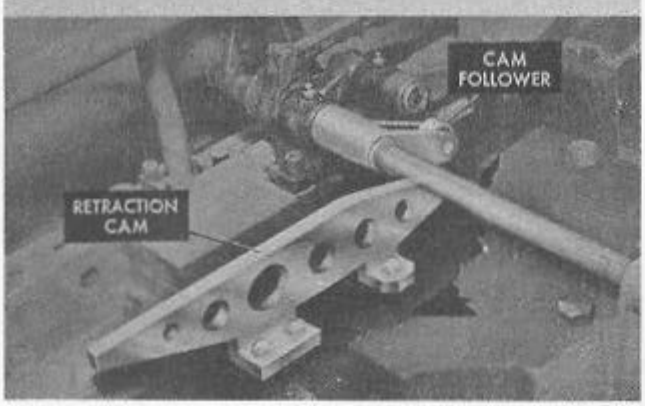
When the gun is fired, the breech housing moves in recoil and carries the shell guard and crosshead with it for part of the retract stroke. To complete the stroke by rammer action, the interlock must be unlatched from the crosshead. This is accomplished. . .



. . .at the forward end of the cam plate by the vertical surface called the transverse cam. Bear in mind that the cam plate does not move.

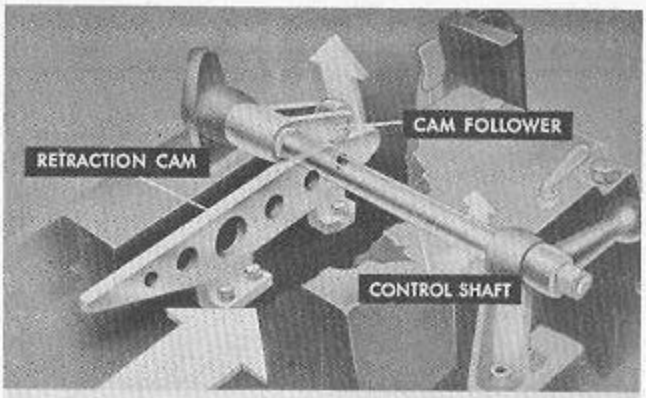


When the breech housing carries the crosshead and shell guard back in recoil, the interlock, sliding along the transverse cam, is forced away from the lug, thus unlatching the crosshead.

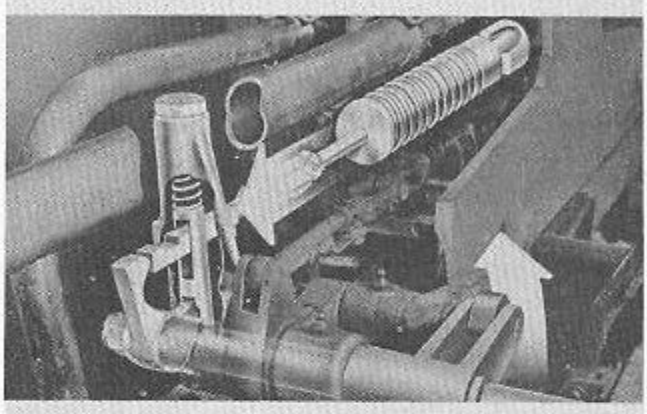


A retraction cam bolted to the housing, and a cam follower fixed to the control shaft also play a part in retract. As recoil continues,. . .

. . .the retraction cam slides under the cam follower and raises it, thus rotating the control shaft. This rotation. . .



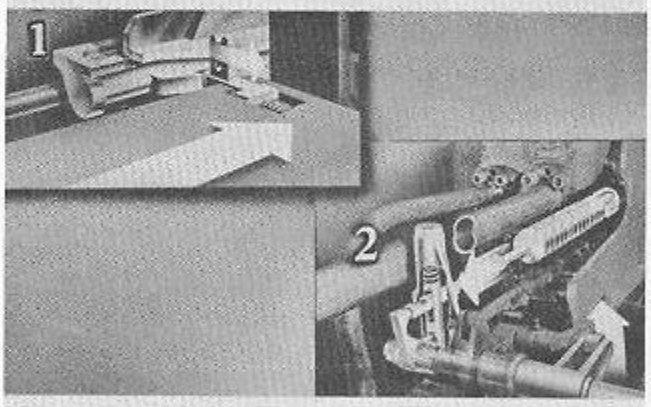
. . .unlatches the main operating valve rod permitting the spring to move the valve to retract position.



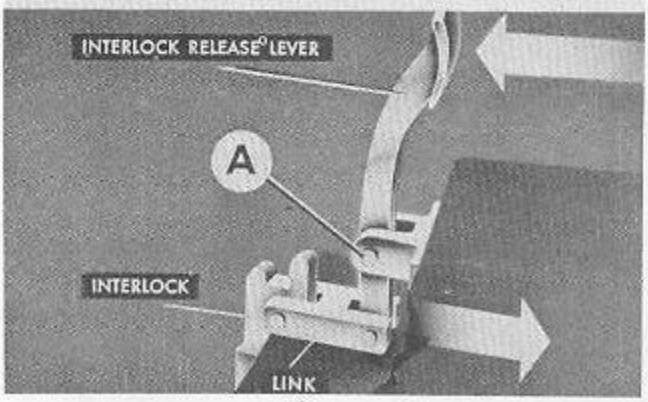
These two operations:

1. Unlatching the crosshead, and
2. Unlatching the main operation valve

must be done manually to cause a retract stroke when there is no recoil as with a misfire or loading drill. The crosshead is unlatched manually. . .

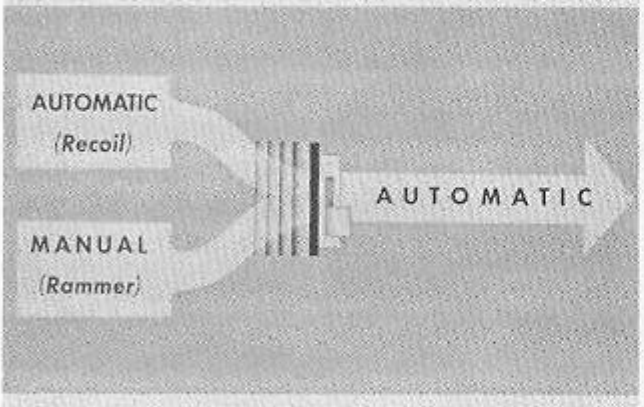


. . .by means of the interlock release lever which is pivoted at "A", and connected to the interlock by the link. Moving the lever in the direction of the upper arrow pulls the interlock in the opposite direction. In a manual retract stroke,. . .

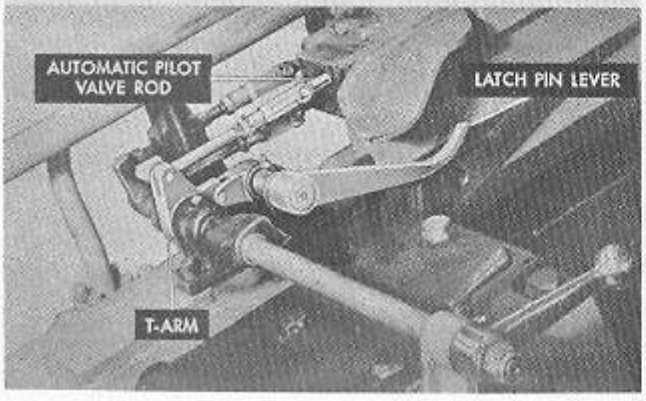


. . .the interlock release lever is held inboard to unlatch the crosshead, while the hand-control lever is raised as high as it will go. Raising the lever rotates the control shaft to do two things. . .

. . .first, unlatch the main operating valve so that its spring can move it to retract position; and second, move the manual pilot valve so that hydraulic action starts a manual retract stroke. Now, you have seen two ways of starting a retract stroke:. . .

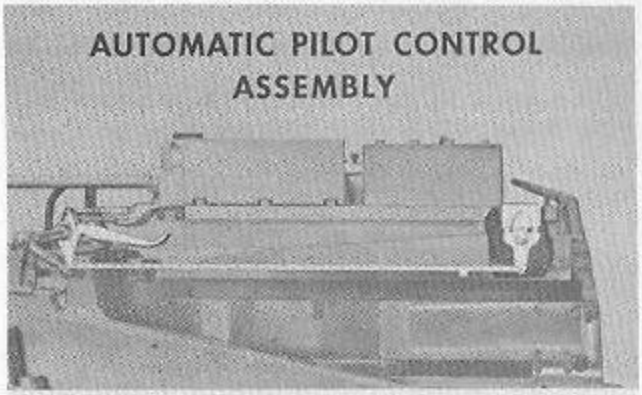


. . .automatic using recoil and manual using the hydraulic action of the rammer. In either case, the shell guard is moved a short distance and then another automatic assembly goes into action to complete either type of retract stroke. This automatic assembly. . .

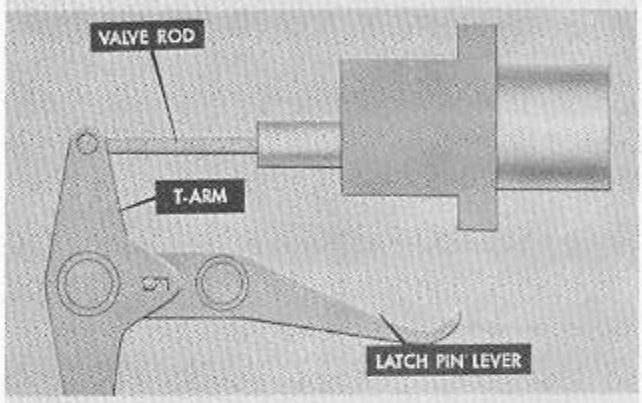


. . .is connected to the automatic pilot valve rod. The visible parts of this assembly are the latch pin lever and the T-arm. The T-arm is not ridgedly fixed to the control shaft, so either one can be moved without moving the other. The T-arm and the latch pin lever . . .

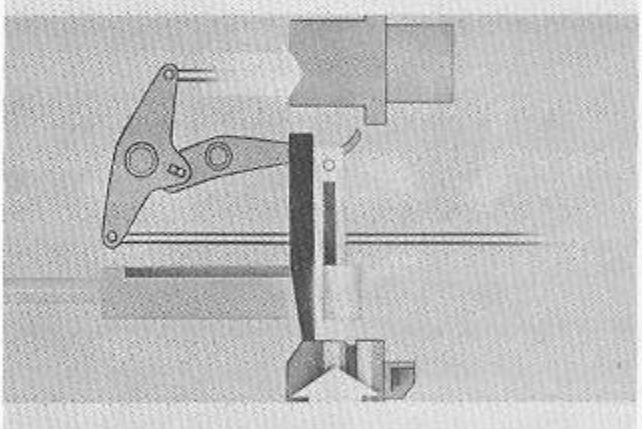
. . .are part of the automatic pilot control assembly. On the forward end of this assembly. . .



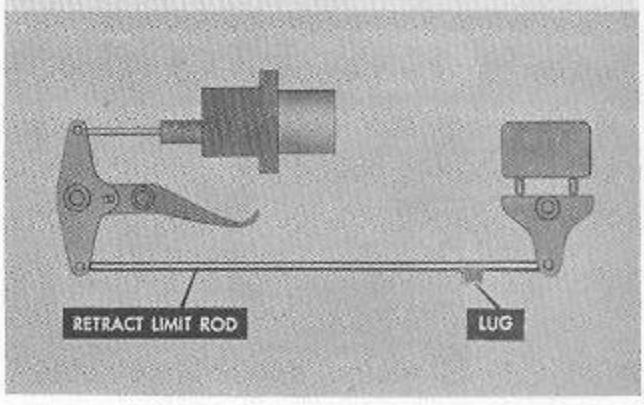
. . .are the valve rod for the automatic pilot valve, and the T-arm connection, and the latch pin lever, all of which we've seen before. At the end of ram stroke, . . .

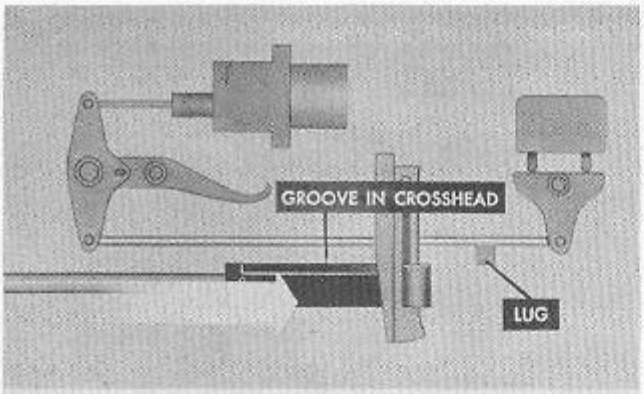


. . .the latch pin lever is forced up by the latch pin on the rising shell guard. The lever, through the T-arm, moves the automatic pilot valve so that operating pressure is released.

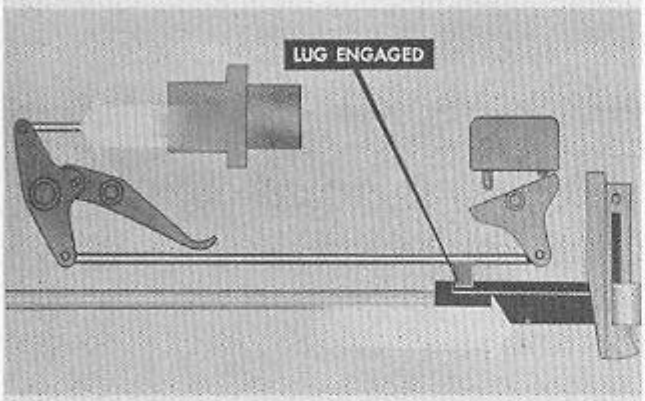


A retract limit rod and a lug are also parts of the assembly. On a retract stroke,. . .

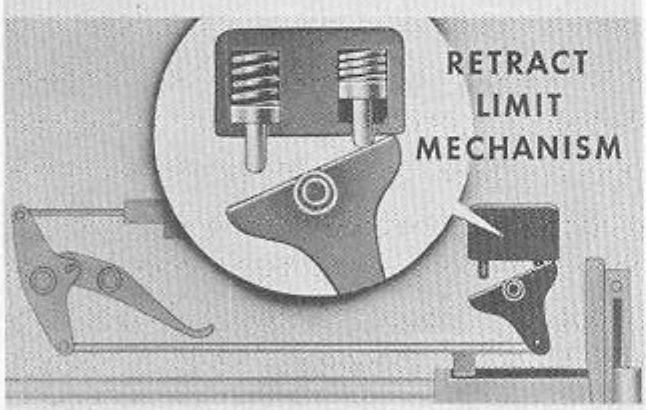




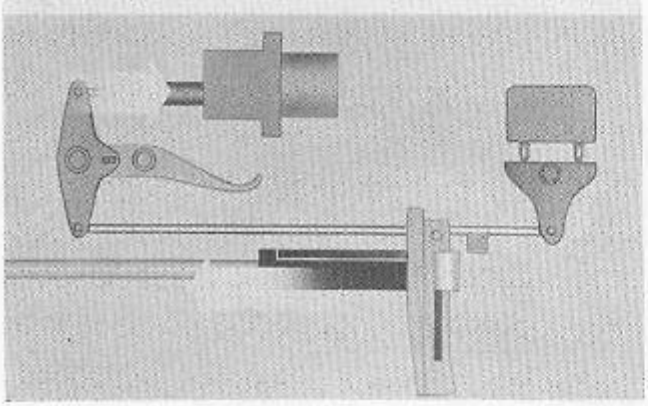
. . .a groove in the crosshead approaches the lug. Near the end of the stroke,. . .



. . .the lug is engaged by the closed end of the groove. This action pulls the rod aft, operates the automatic pilot valve, and stops the stroke. Another important part of this assembly. . .

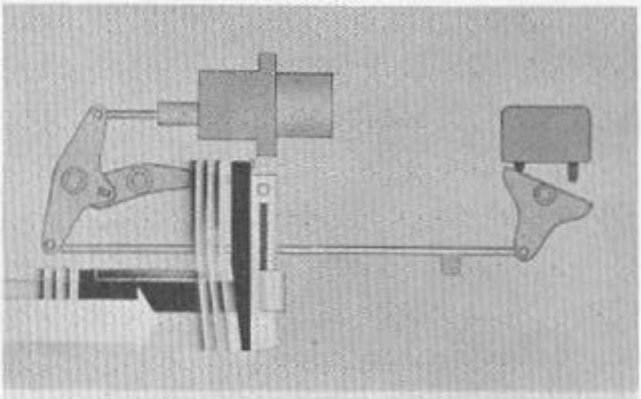


. . .is the retract limit mechanism. It plays a part in both ram and retract strokes. Tilting this device to right or left compresses the corresponding spring. When the mechanism is released, it is returned to a vertical or centered position by the spring.

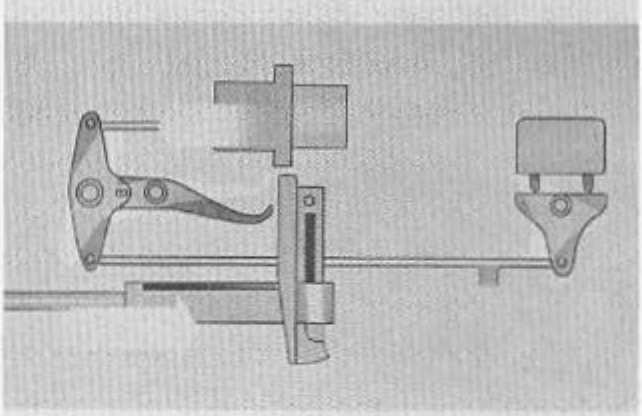


In a ram stroke, when the crosshead pulls clear of the lug, the retract limit mechanism centers itself, moves the limit rod forward, and sets the automatic pilot valve to continue the stroke.

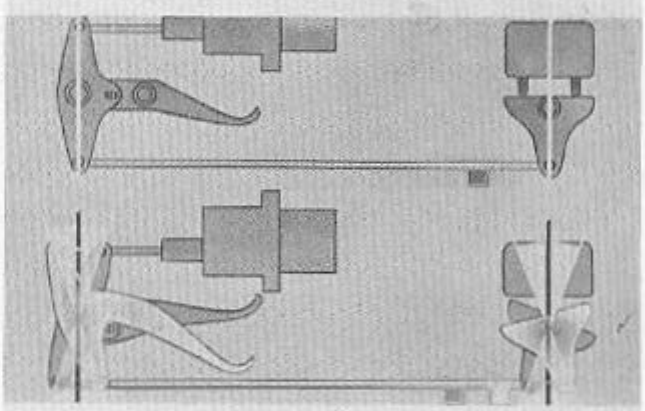
In a retract stroke the shell guard is moved aft by recoil. . .



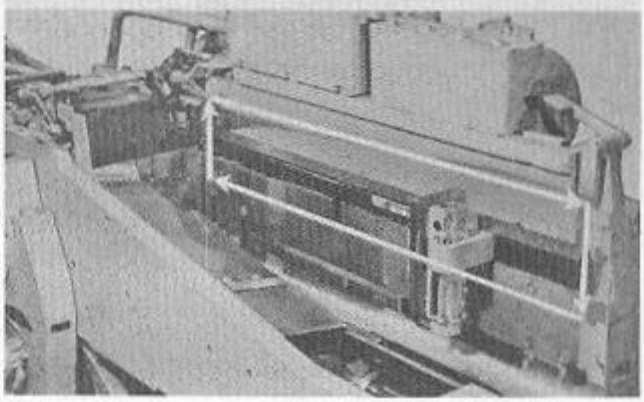
. . .until the latch pin lever is released. This allows the retract limit mechanism to center itself again, move the limit rod aft, and again set the automatic pilot valve to continue the stroke. To summarize,. . .

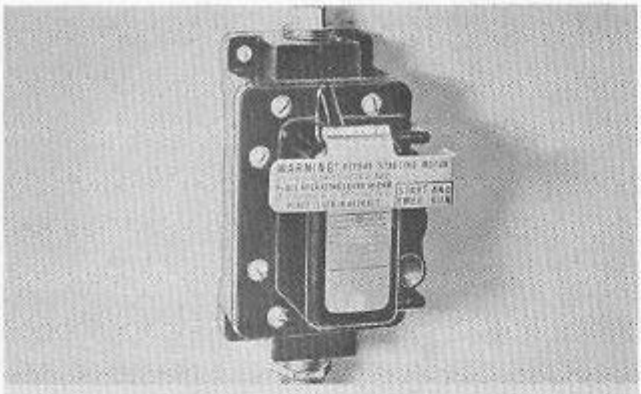


. . .when the automatic mechanism is centered, as shown at the top, the automatic pilot valve is in position to cause power operation of the rammer. When the automatic mechanism is moved off center in either direction, as shown at the bottom, the automatic pilot valve is moved to cause release of operating pressure at the end of either ram or retract strokes. To review the action of these parts,. . .

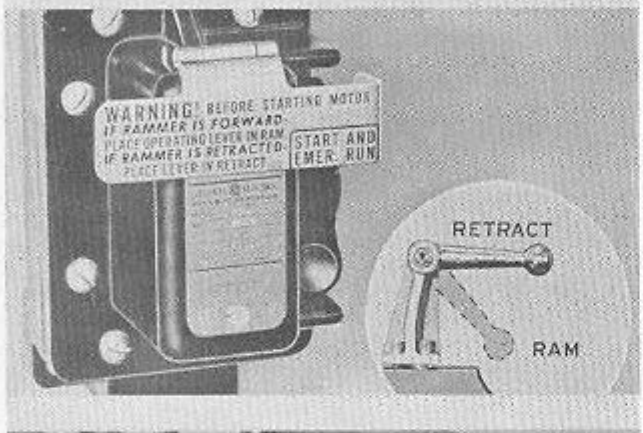


. . .let's follow through a complete cycle.

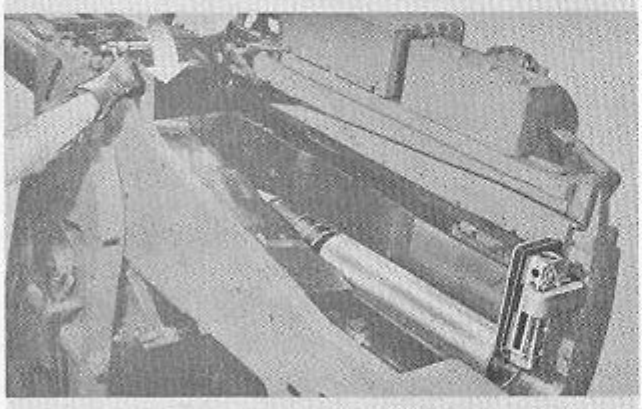




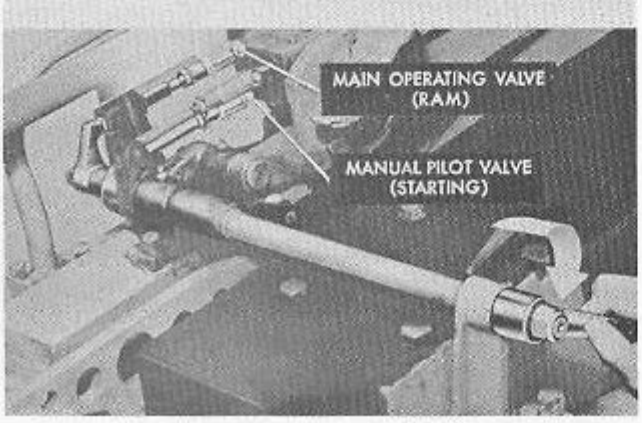
But first, before turning the motor controller switch to start, read and follow. . .



. . .this warning. Before starting the motor, if rammer is forward, place operating lever in ram. If rammer is retracted, place lever in retract. This precaution prevents a wild stroke. Then,. . .

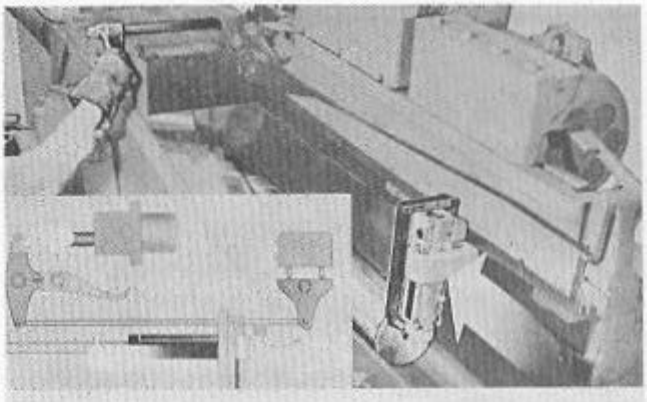


. . .with motor running and the shell guard lowered for a ram stroke, load the tray and press the control lever down.

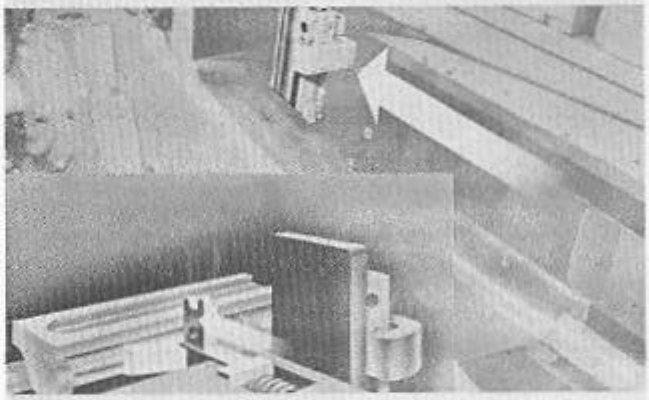


This positions and latches the main operating valve for a ram stroke, and sets the manual pilot valve for starting the stroke.

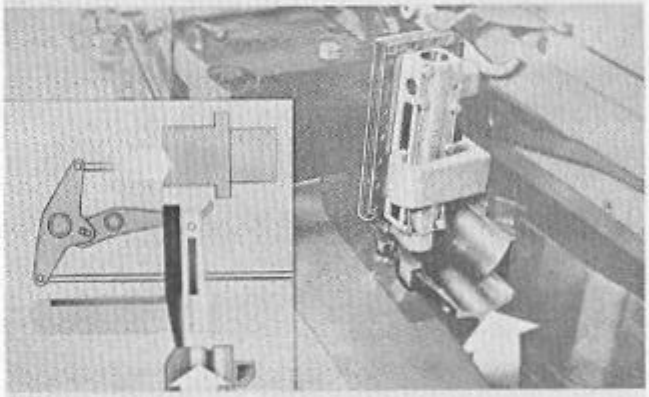
The ram stroke starts. Then, as seen in the inset, the crosshead clears the lug on the rod, and the retract limit mechanism moves the rod forward positioning the automatic pilot valve to continue the stroke.



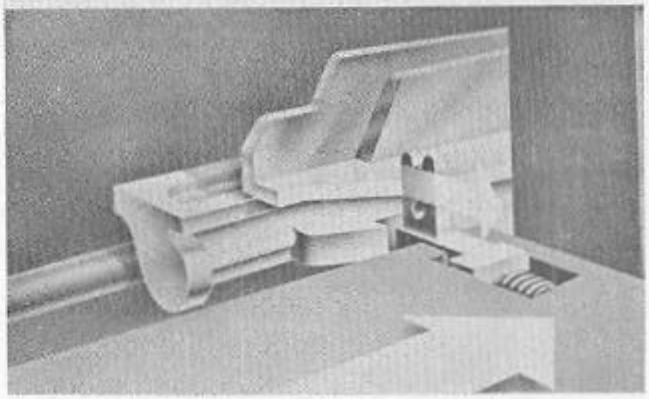
At the end of ram stroke, the crosshead moves forward until, as the inset shows, the interlock snaps behind the lug on the crosshead locking the shell guard to the housing.

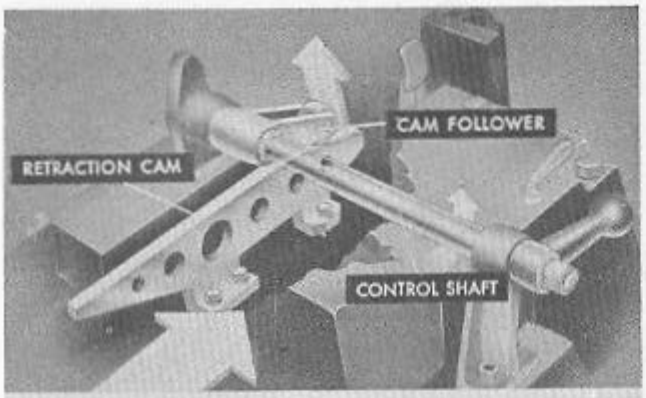


When the breech block raises the shell guard, the latch cam on the guard engages the latch pin lever, setting the automatic pilot valve to release operating pressure.



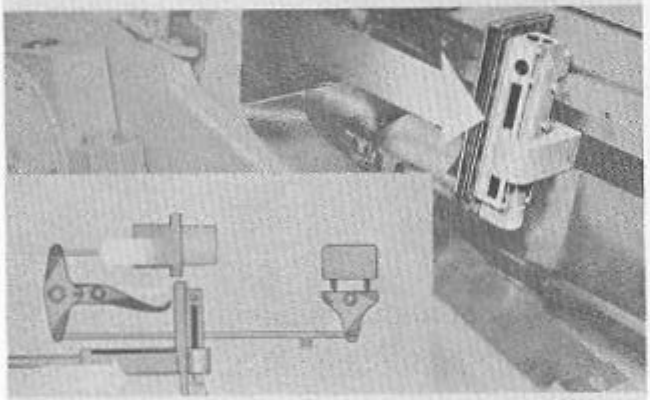
As the gun is fired, recoil of the housing carries the shell guard toward the rear. This, as we've seen, releases the interlock, freeing the crosshead and shell guard from the breech housing. As recoil continues,. . .



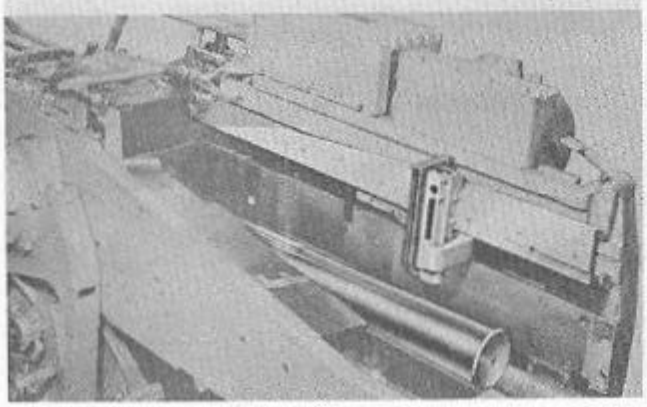


. . .the retraction cam raises the cam follower, thus rotating the control shaft. . .

. . .to unlatch the main operating valve which snaps to retract position.

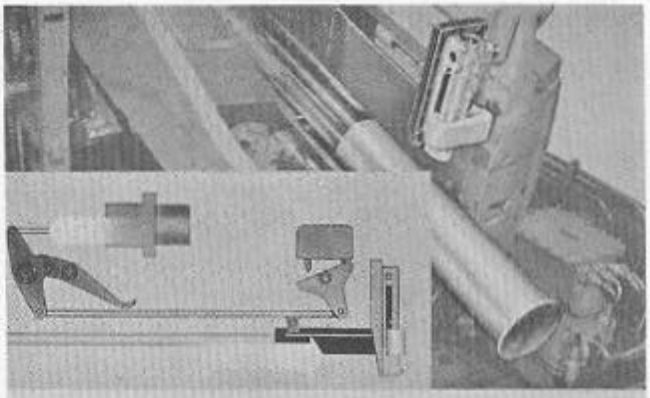


As the shell guard is moved to the rear, the latch pin passes from under the latch pin lever. Then, as the inset shows, the retract limit mechanism pulls the rod aft and sets the automatic pilot valve to continue to retract stroke hydraulically. Throughout the retract stroke,. . .

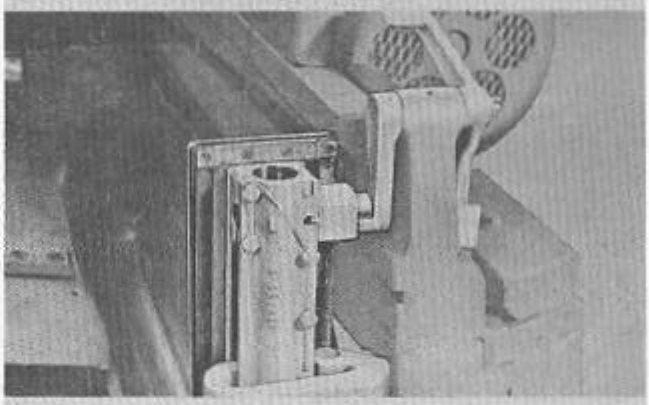


. . .the latch pin rides the top of the cam surface, keeping the shell guard raised so that the empty case can be ejected.

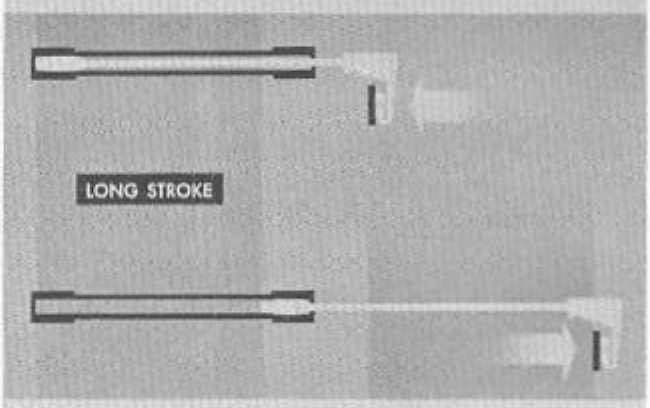
The inset now shows the crosshead and shell guard near the end of retract, and how the groove in the crosshead engages the lug on the rod pulling the rod aft, thus setting the automatic pilot valve to release operating pressure. At the end of the retract stroke,. . .



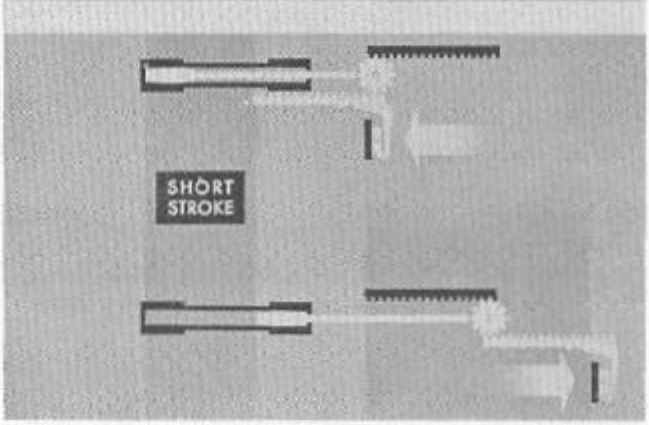
. . .the latch pin rests on the toe of the latch release lever. Tripping the lever lowers the shell guard to RAM position, and the cycle is completed. Up to this point,. . .

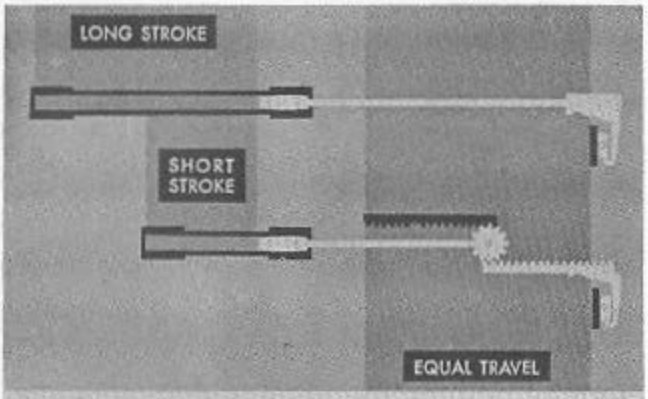


. . .we have been considering the long stroke rammer in which piston and shell guard move equal distances.



Twin mounts, however, use a short stroke rammer. A rack and pinion arrangement move the shell guard twice as far as the piston.



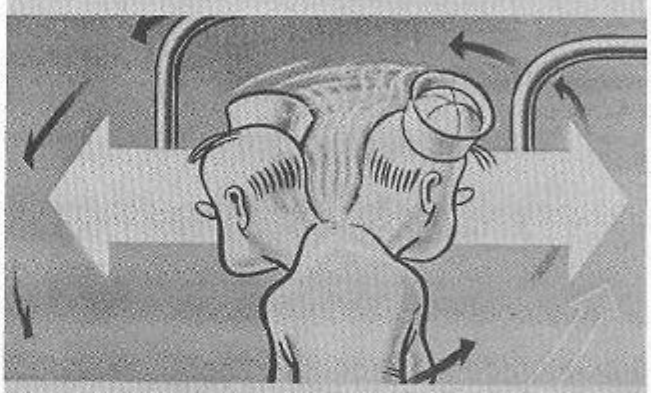


In either the long stroke or short stroke rammer, there is equal travel of the shell guard. Either one. . .

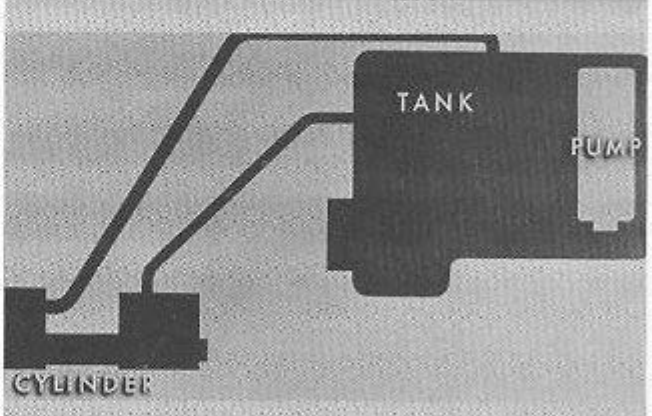
. . .does the job.

We already have a general idea of the 5''/38 rammer.

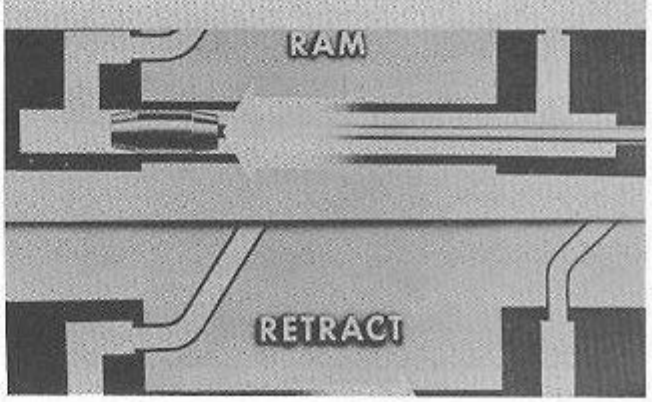
We are now ready to see what really makes it work. We'll begin with the first part of our general problem—. . .

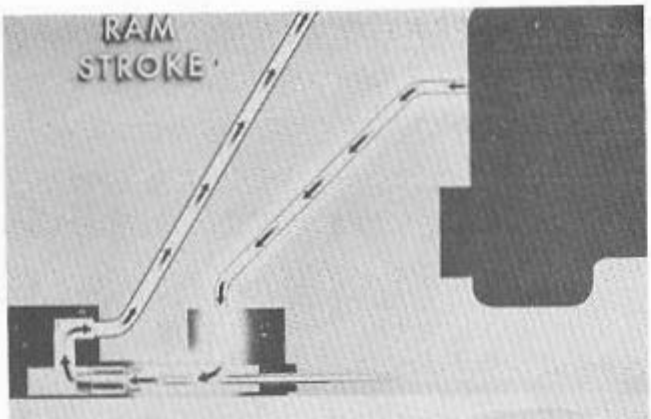


. . . how to get hydraulic fluid from the tank through the constant delivery pump to the cylinder. . .

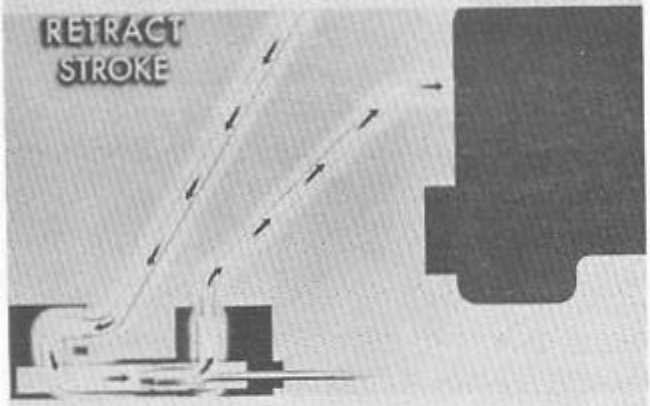


. . . to cause either a ram stroke or a retract stroke. The second part of the problem—how to stop a stroke—will be shown later.

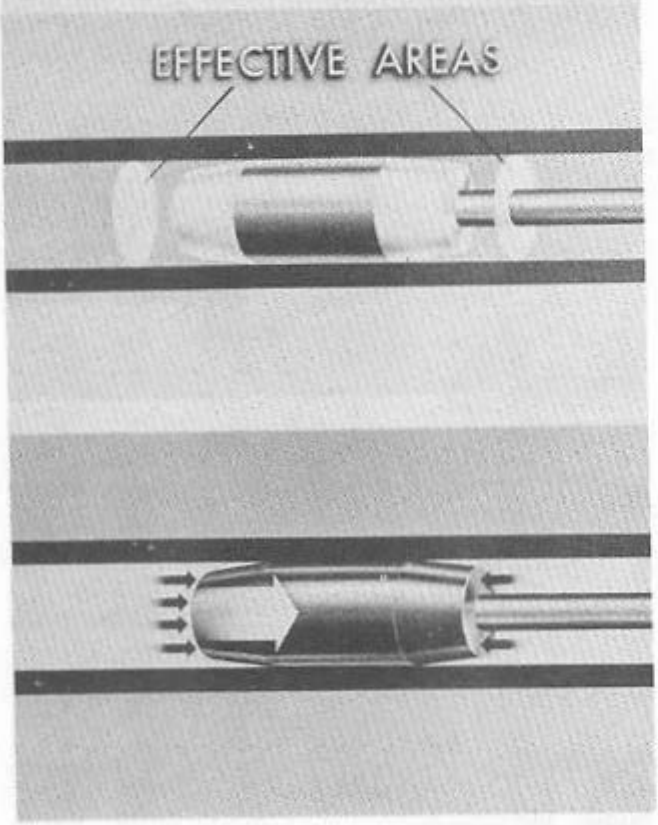




On a ram stroke, pressure forces the piston forward. The fluid ahead of the piston is not under pressure. The piston merely pushes it back into the tank.



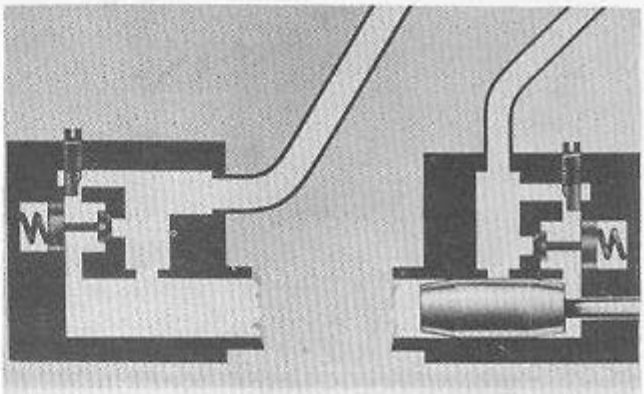
But, on a retract stroke, equal pressure is exerted on both ends of the piston, yet it moves aft. Why?



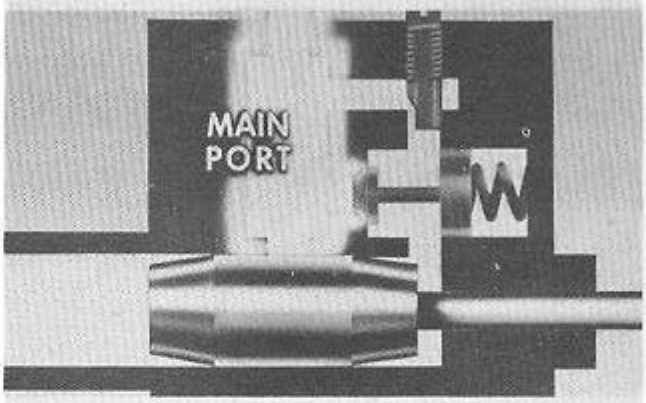
Because, the effective areas are of different size. The forward area is larger than the after area. When unequal areas are under equal pressures, . . .

. . . the greater total force is on the larger area. In this case, with the greater force on the forward end of the piston, the piston is moved in a retract stroke.

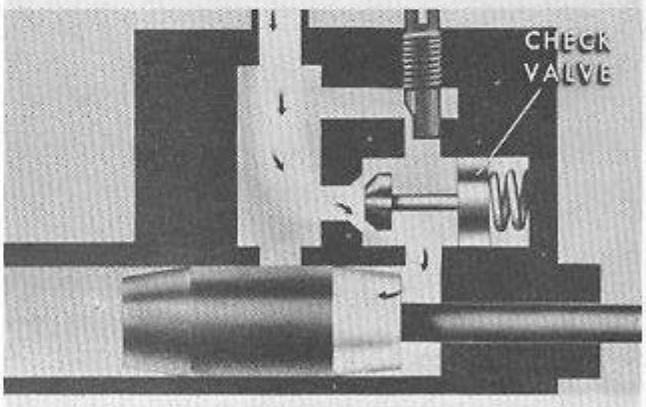
Now let's look at the retract and ram cylinder heads. We'll use a ram stroke to show the action that takes place here. At the start of the stroke, . . .



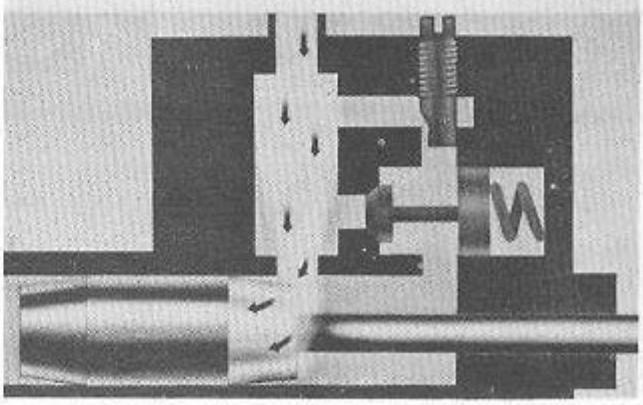
. . . passage of fluid through the main port is blocked by the piston. But, as pressure builds up, . . .

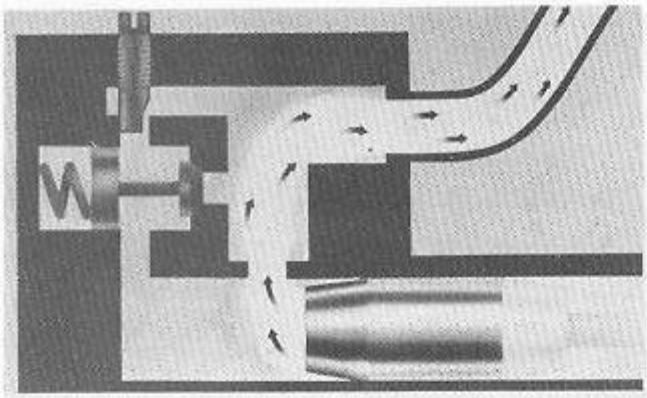


. . . a check valve is forced open allowing a restricted flow to the after end of the piston. The piston moves forward, . . .

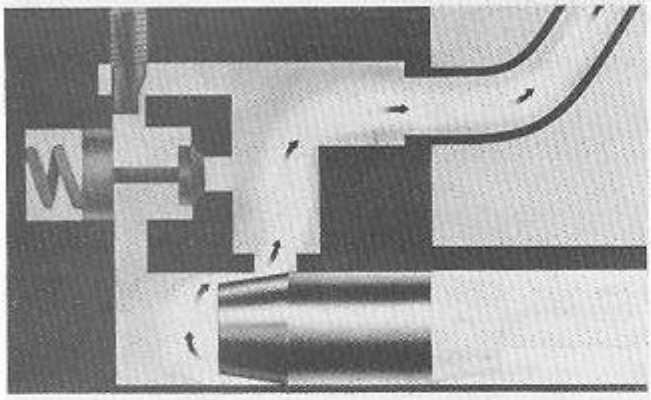


. . . opens the main port, and the stroke continues under full flow. As the piston moves forward, . . .

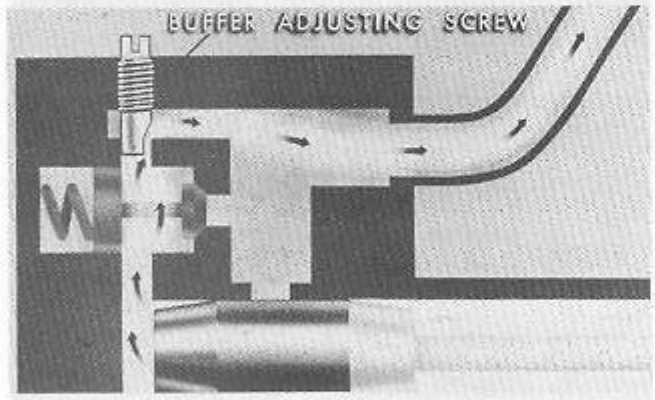




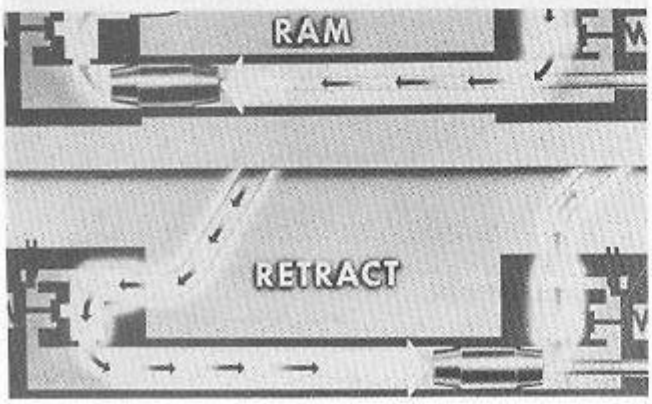
. . . the fluid in front of the piston is forced out through a similar main port in the retract cylinder head and back to the tank.



Near the end of the stroke the tapered end of the piston gradually closes the port, thus providing a slowing down action.

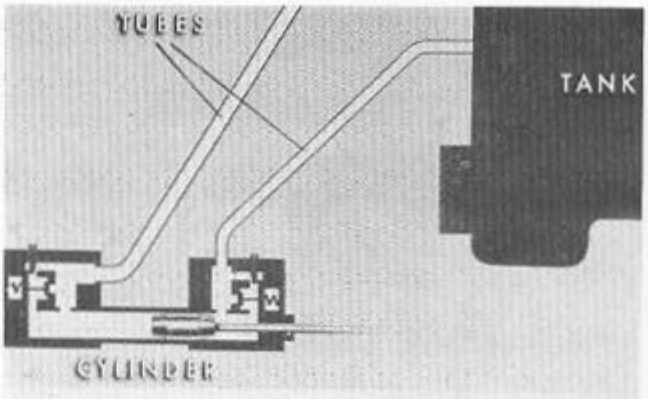


A buffer adjusting screw permits completion of the stroke at slow speed.

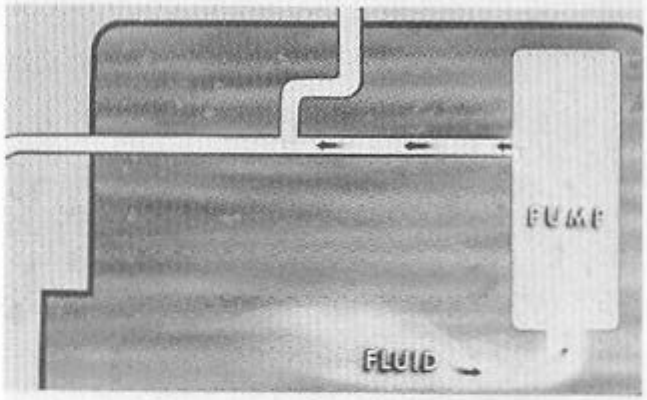


Now that you have the ram and retract action in the cylinder and cylinder heads, let's look at some of the other parts. We will add them one by one . . .

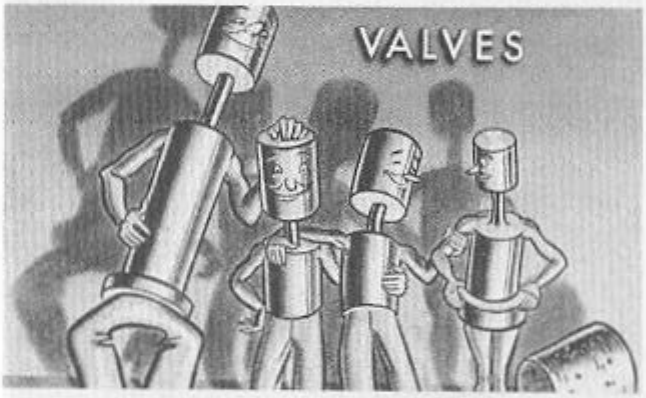
. . . to our schematic drawing which shows the tubes connecting the tank with the cylinder. The tank contains the hydraulic fluid and also. . .



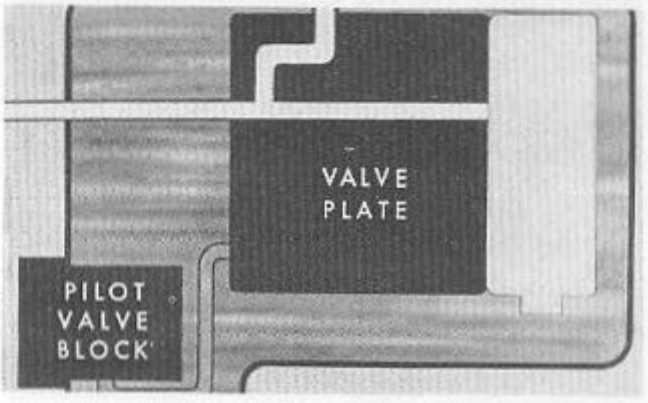
. . . the constant delivery pump. The pump operates continuously. And our next step is to show how the fluid flow is directed in a way that will control the rammer action. This is accomplished. . .

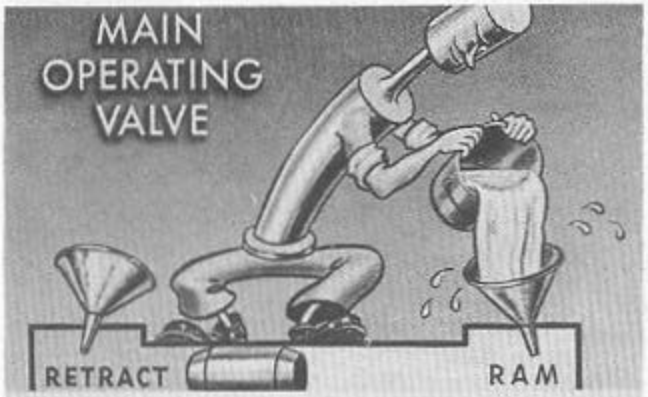


. . . through the use of valves. These valves are located. . .

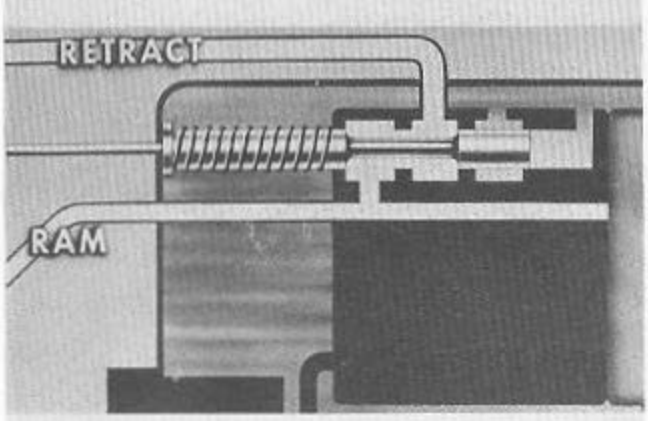


. . .in the valve plate and pilot valve block which are also in the tank. One of these valves. . .

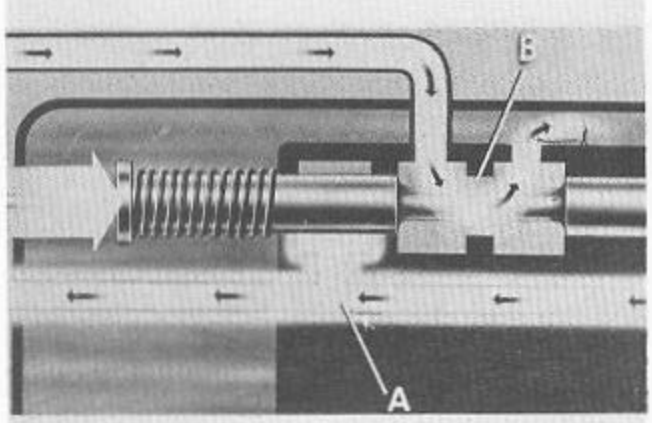




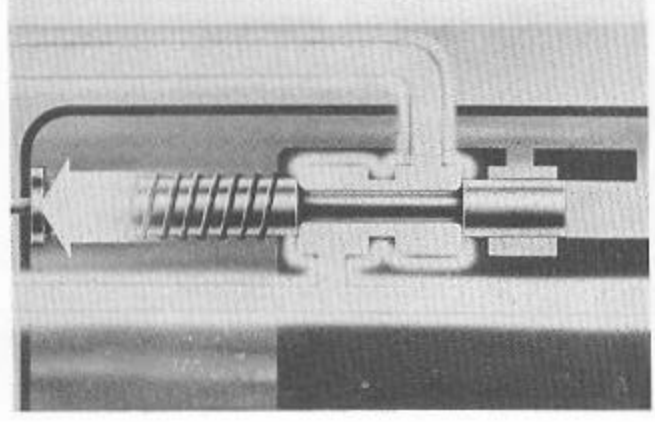
. . .is the main operating valve. It controls the direction of stroke, ram or retract. It is located. . .



. . .in the valve plate across the connection between the retract and ram lines. When the main operating valve. . .

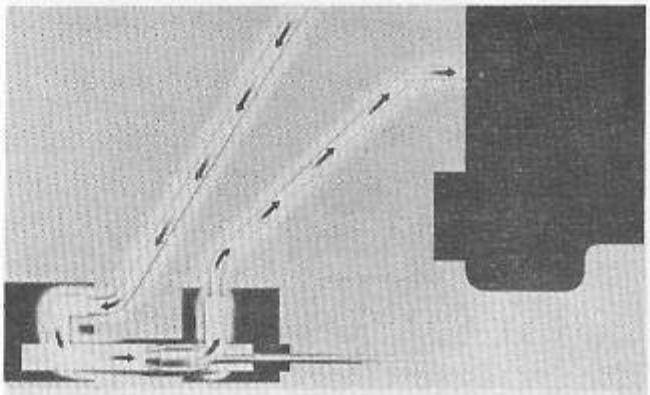


. . .is moved in, it is in RAM position. The connection between the ram and retract lines is blocked, and fluid from the pump flows through the ram line, "A", causing a ram stroke. The valve now also provides a path at "B" through which fluid from the retract line empties into the tank. When the main operating valve. . .

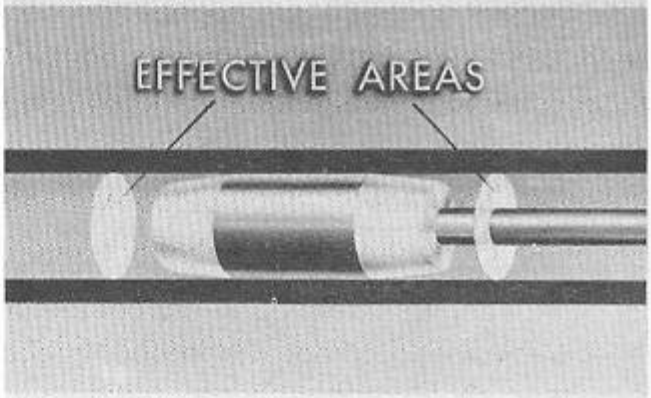


. . .is moved out, it is in RETRACT position, and there is a retract stroke because the connection between the retract and ram lines is now open and the two lines join under the same pressure. This, of course, . . .

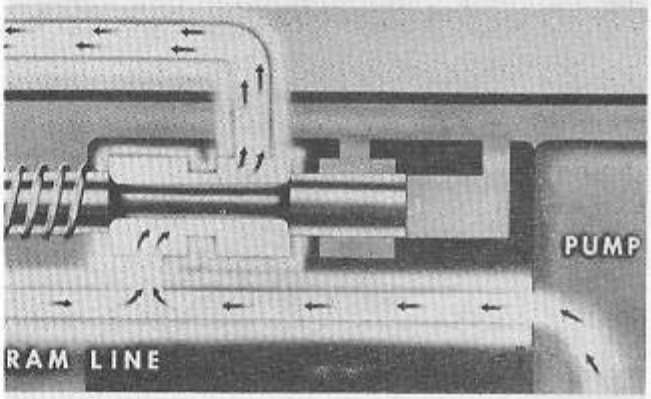
. . .brings equal pressure to both ends of the piston. You have already seen that equal pressures. . .



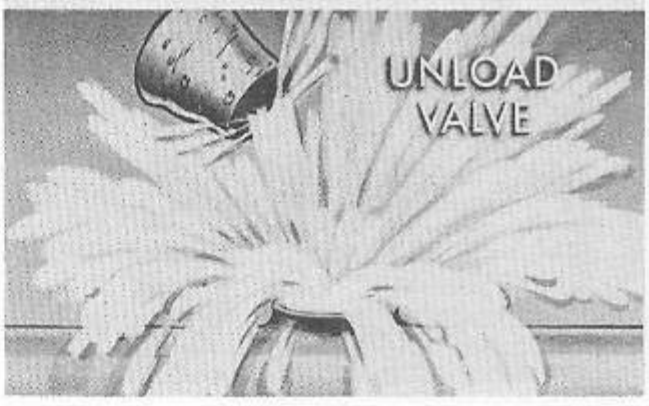
. . .on the unequal effective areas of the piston cause a retract stroke. More fluid is needed to fill the cylinder in a retract stroke because there is no piston rod to take up space ahead of the piston. The required volume of fluid is obtained. . .

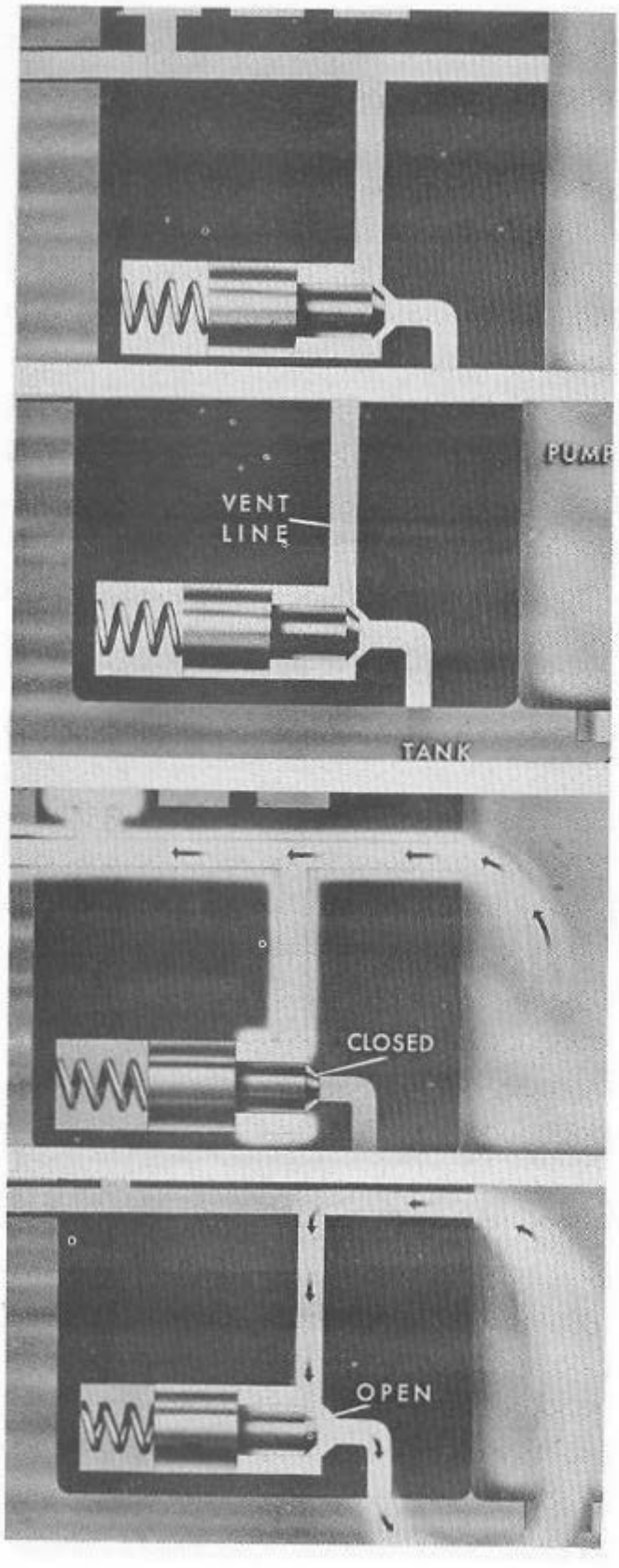


. . .by adding the fluid forced out of the ram line to the fluid delivered from the pump. Now you have seen how the main operating valve controls the direction of stroke. The next problem—how to start or stop a stroke—introduces. . .



. . .the unload valve. It starts or stops strokes by acting as a plug which opens or closes the system, and thus releases or holds the pressure. The unload valve. . .





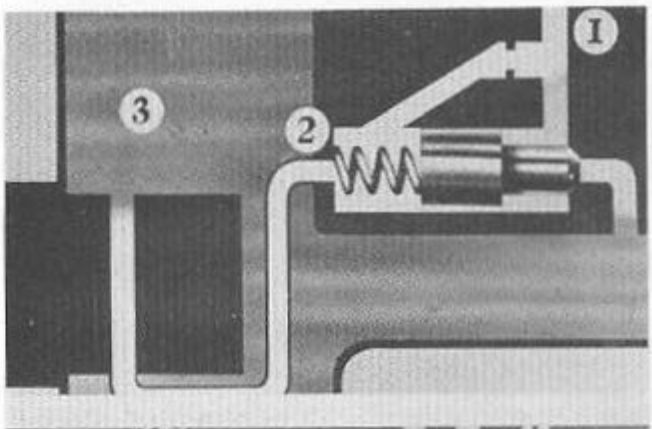
. . .is a differential area piston. It is located in the valve plate. . .

. . .where it can open or close a vent line that leads from the pump to the tank.

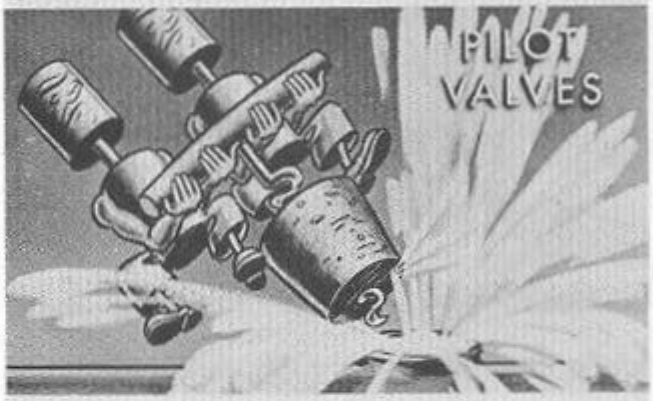
When the unload valve is closed, the vent line is plugged. There is pressure in the system and there is a stroke—ram or retract.

When the unload valve is open, the vent line is open. Fluid from the pump vents into the tank, and there is no stroke. The position of this valve. . .

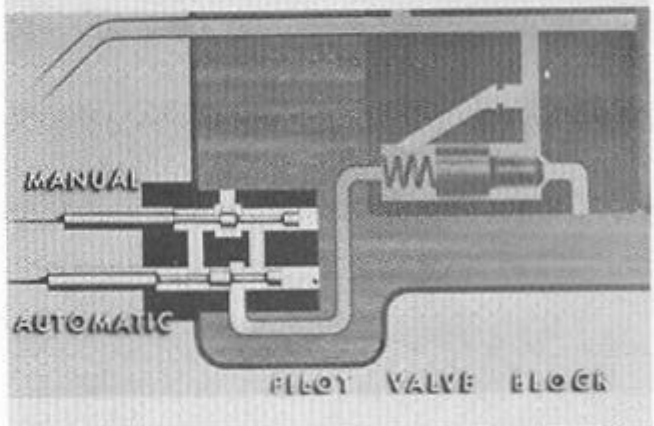
. . .is controlled by pressure in this line that connects; (1) the vent line; (2) the spring end of the unload valve chamber; and (3) the tank. Pressure in this line. . .



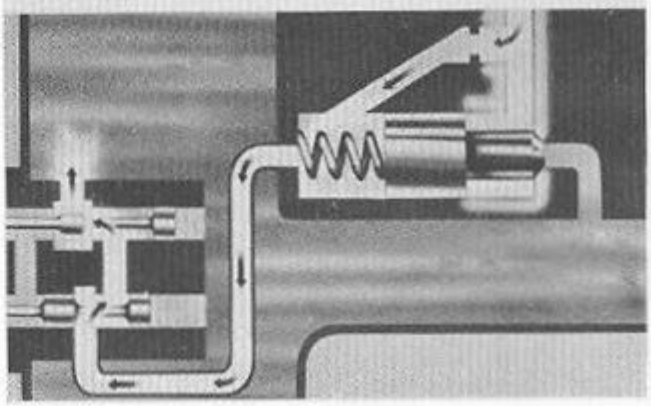
. . .is controlled by two pilot valves—. . .

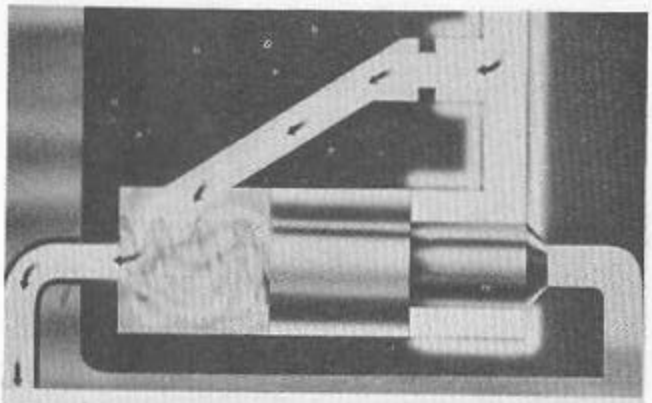


. . .the manual and the automatic. Both are in the pilot valve block.

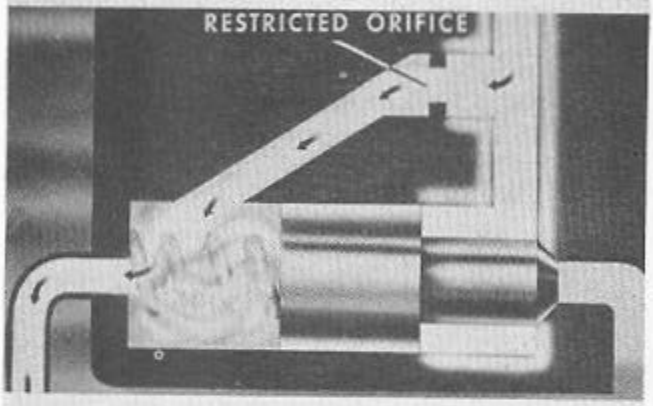


When the pilot valves are in position to open the line through the pilot valve block, . . .

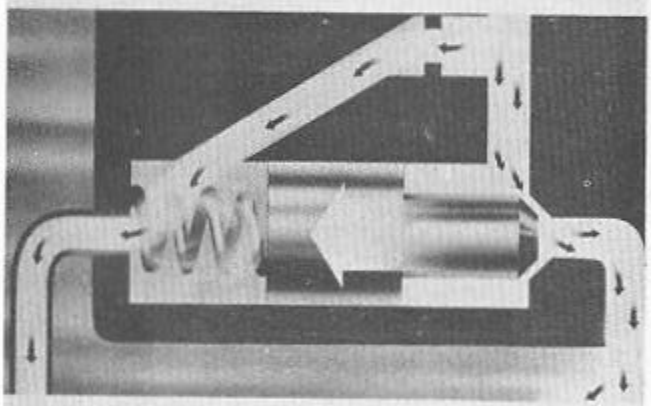




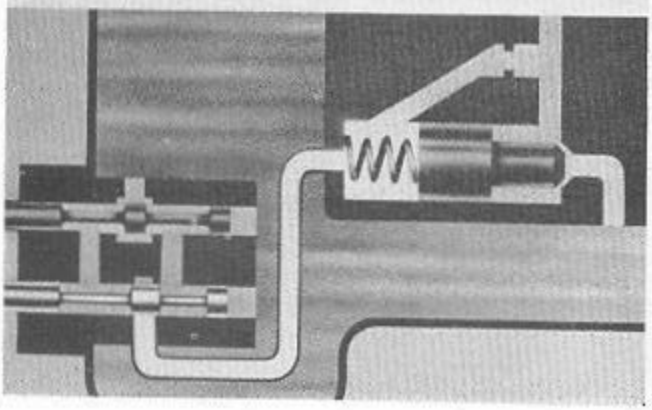
. . .fluid drains from the spring end of the unload valve chamber, and the pressure there is reduced. However, . . .



. . .because of a restricted orifice in the line, pressure on the plunger end of the unload valve is not materially reduced. Under these conditions, . . .

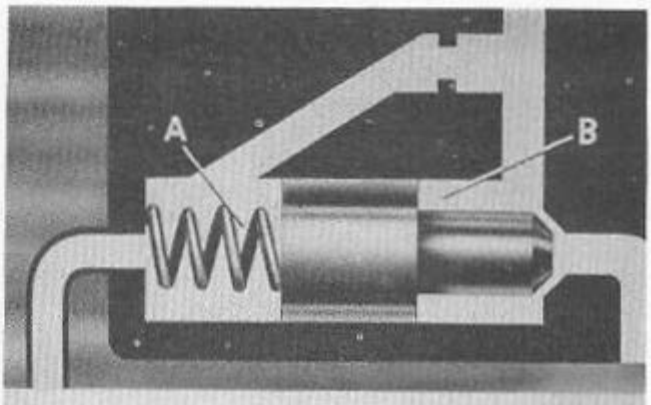


. . .the spring is overcome, the unload valve opens, and the pump output vents to the tank. To close the unload valve, . . .

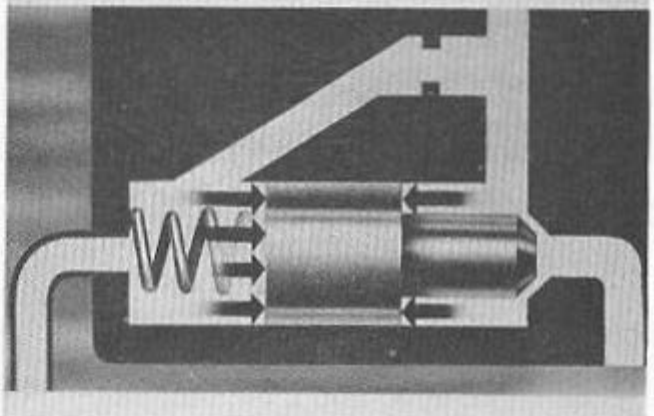


. . .one of the pilot valves (in this case the automatic) closes the line from the spring chamber.

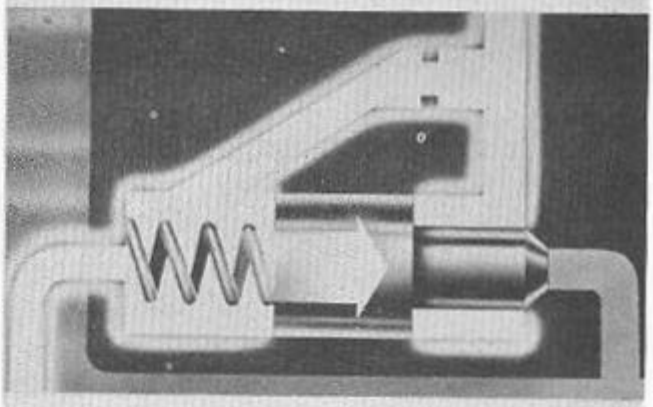
Now, pressures at "A" and "B" are equal, but the area of the unload valve under pressure at "A" is greater than the area under pressure at "B."



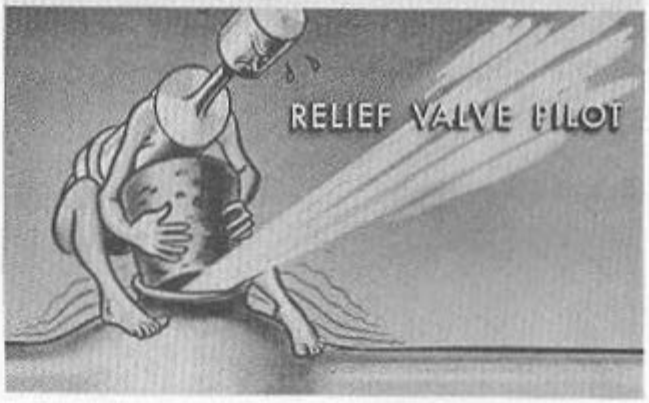
This results in a greater total force on the spring end, and. . .

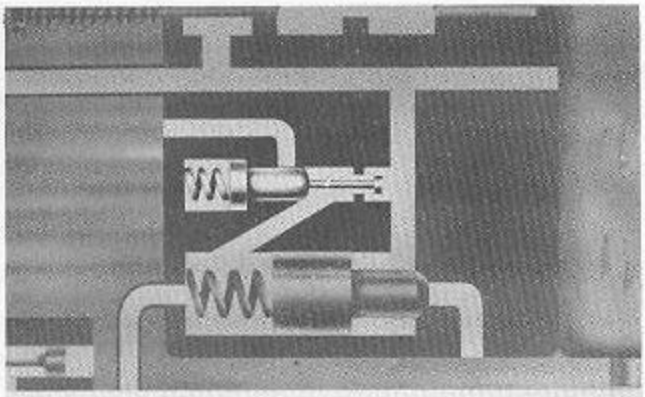


. . .the unload valve closes. Now the pump can create operating pressure in the system and there is a stroke.

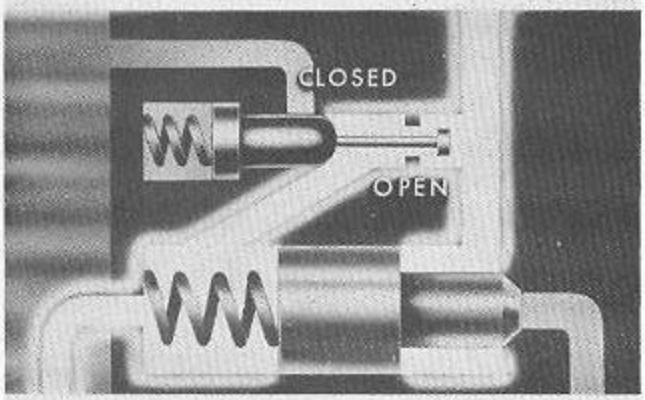


The relief valve pilot is our last valve. Its purpose is to prevent excessive pressure in the system by allowing the unload valve to open whenever pressure reaches a predetermined amount. The relief valve pilot is located. . .

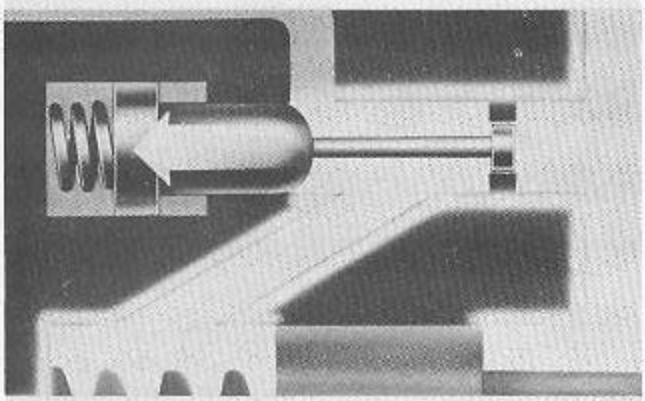




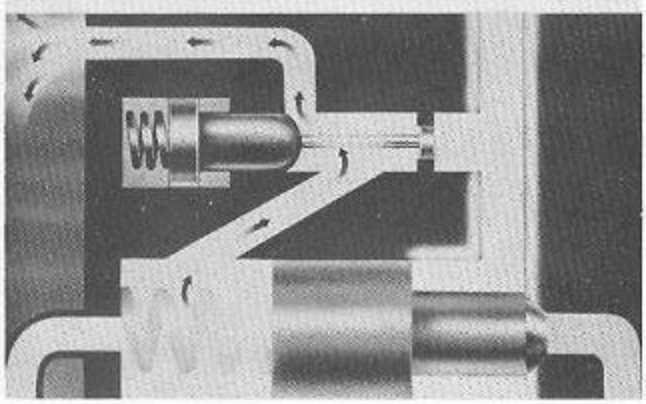
. . .in the valve plate in another line that also connects the unload valve chamber with the tank. A stem on the relief valve pilot extends through the restricted orifice. With the pilot held in this position by its spring,. . .



. . .the line to the tank is closed and the restricted orifice is open. But, whenever system pressure rises to the point for which the pilot spring is set, . . .

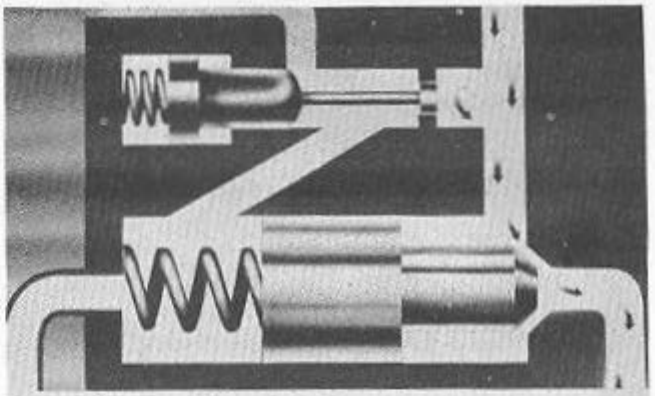


. . .the pilot is forced in against its spring. This action closes the restricted orifice, . . .

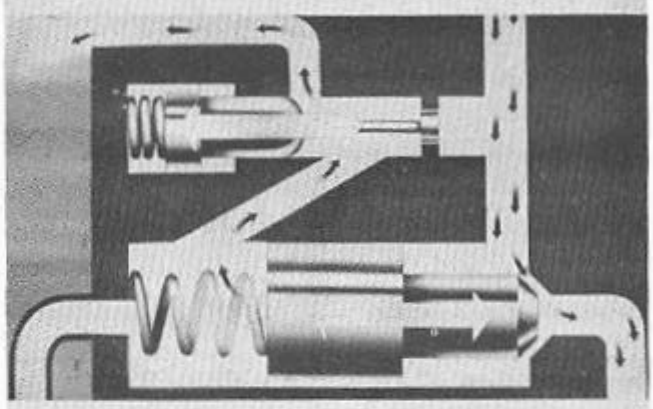


. . .and opens the line to the tank. As a result, pressure on the spring end of the unload valve is relieved, . . .

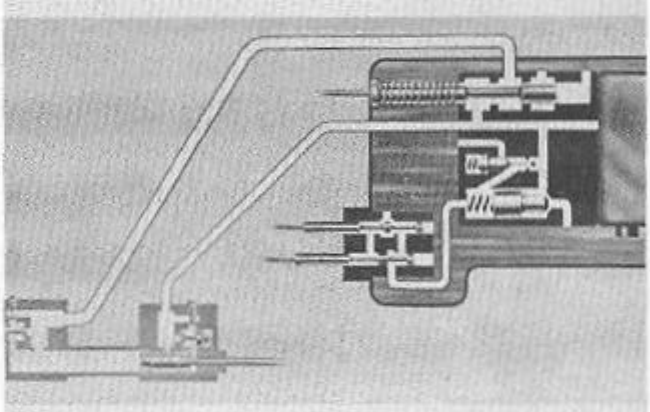
. . .and the unload valve cracks open venting fluid to the tank. Under conditions that would cause excess pressure, . . .



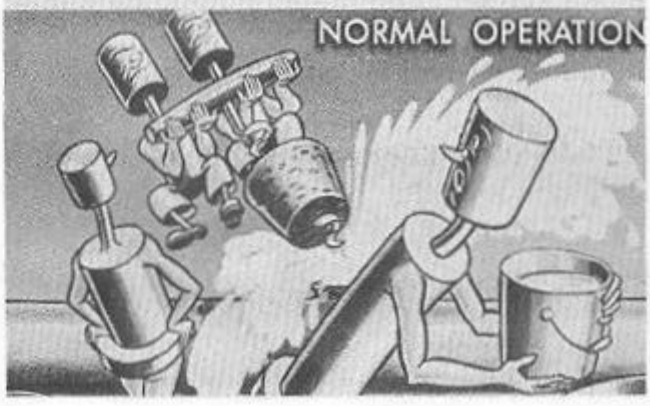
. . .the two valves work together in nicely balanced adjustment, so that pressure is maintained at the amount for which the pilot spring is set. This action continues until the cause of the excess pressure condition is removed.

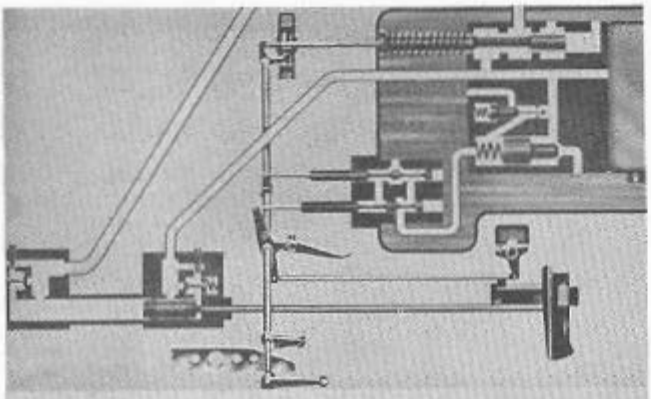


Well now, you have seen the part each valve plays in the rammer action. You have also seen how two of them, the relief valve pilot and the unload valve, are moved hydraulically. The other valves in the tank are moved mechanically. The second half of this chapter will show how, and will also trace the action of all the valves through an operating cycle.

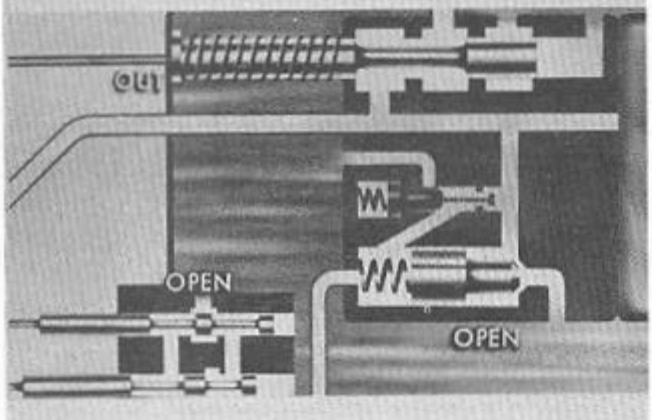


Now, let's watch the valves in normal operation. We'll start just before a ram stroke and go through a complete cycle. But first, . . .

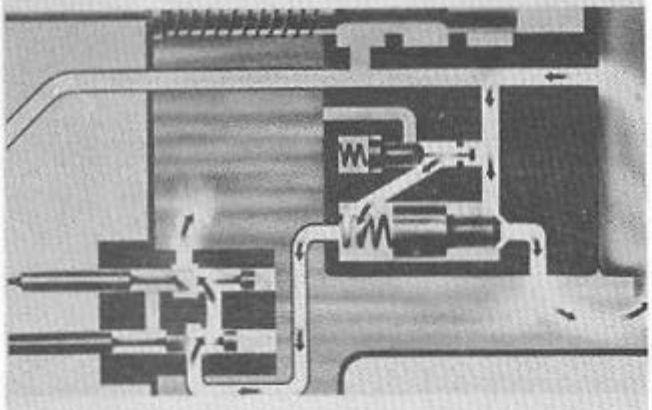




. . .let's add the control assembly so that we can tie them in with valve operation. Just before starting a ram stroke, . . .



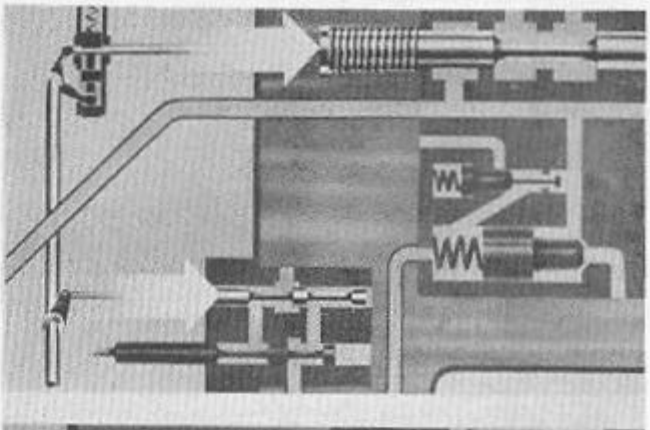
. . .the main operating valve is held out in RETRACT position by its spring. The pilot valves are open, therefore the unload valve is also open.



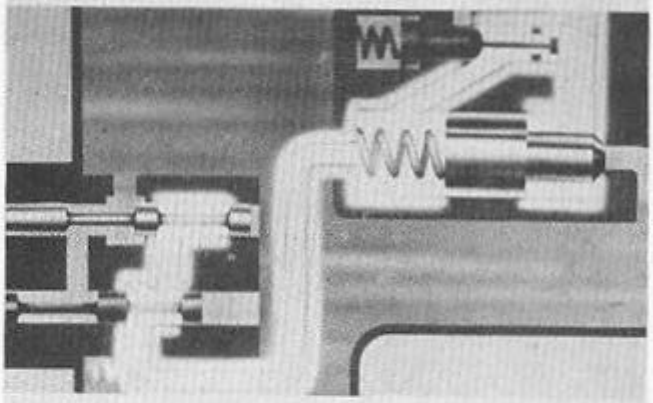
Fluid is circulating freely from pump to tank. There is no pressure in the system. This condition is retract release. To start a ram stroke, . . .

. . .press the hand-control lever down.

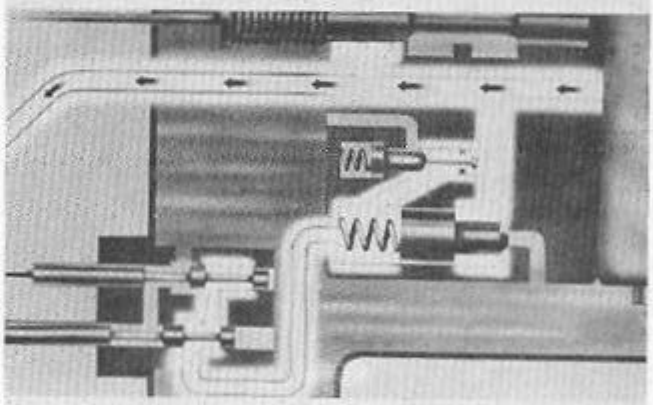
This moves the main operating valve in to RAM position where it is latched in place, and also moves the manual pilot valve. . .



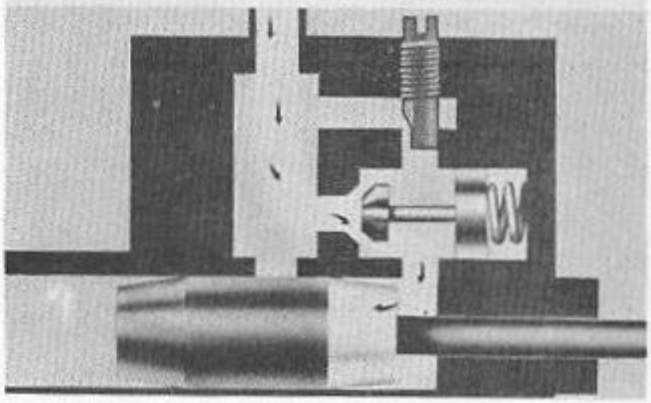
. . .to close the line through the pilot valve block. The resulting pressure closes the unload valve. Now, all vents to the tank are closed, . . .

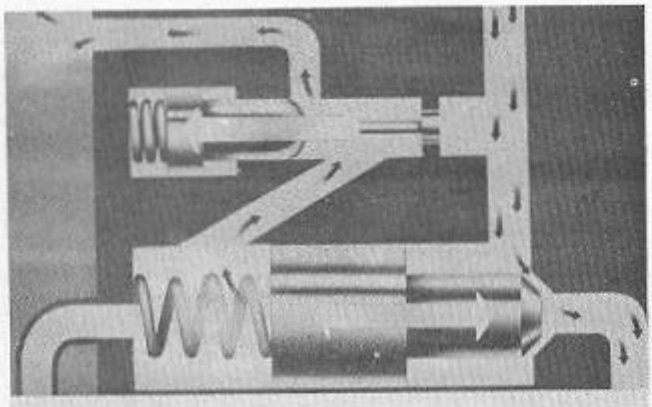


. . .and pressure is created in the ram line for a ram stroke. At the start of the stroke, . . .

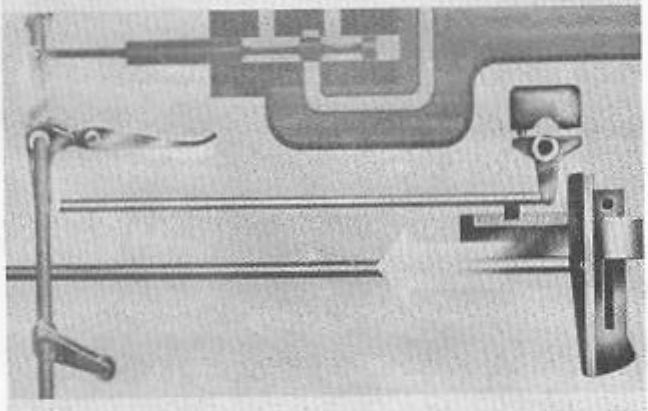


. . .the restricted flow in the ram cylinder head causes a pressure rise which is held within a safe limit. . .

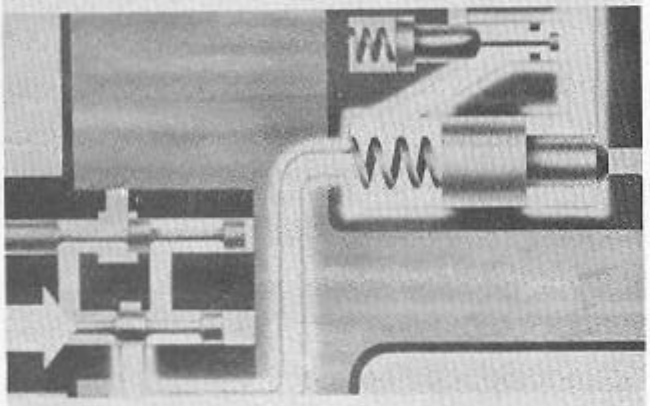




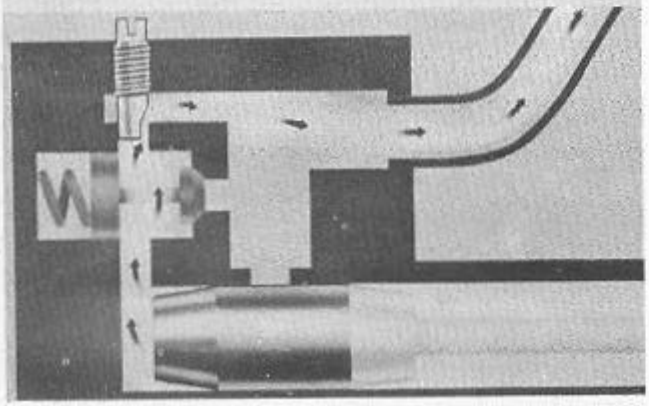
. . .by the joint action of the relief valve pilot and the unload valve. After the stroke gets underway, . . .



. . .the crosshead rides clear of the lug on the retract limit rod, and the retract limit mechanism centers itself. This action. . .

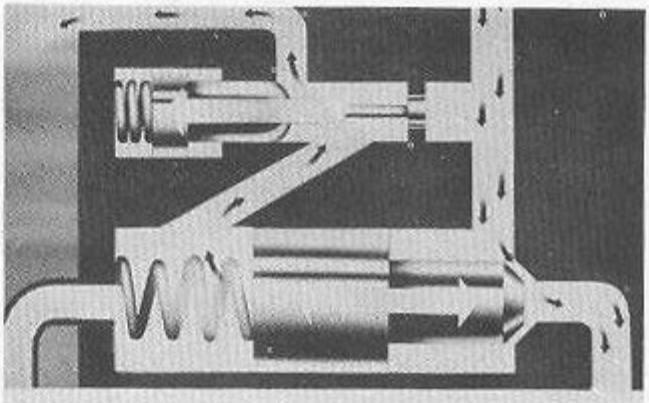


. . .moves the automatic pilot valve to block the line through the pilot valve block. This has no effect on the stroke, however, because the line is already blocked by the manual pilot valve. Near the end of the ram stroke. . .

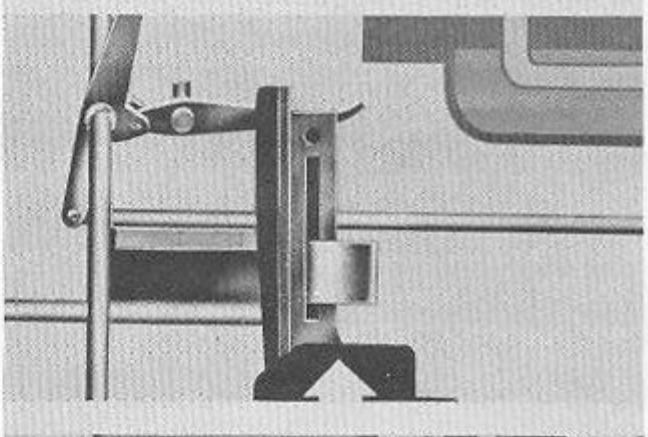


. . .the buffing action in the retract cylinder head causes a pressure increase. . .

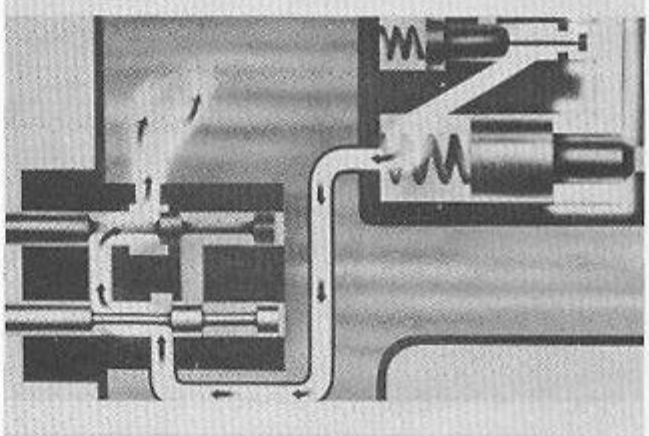
. . .which is again limited by the action of the pilot and the unload valve. At the end of the ram stroke, . . .



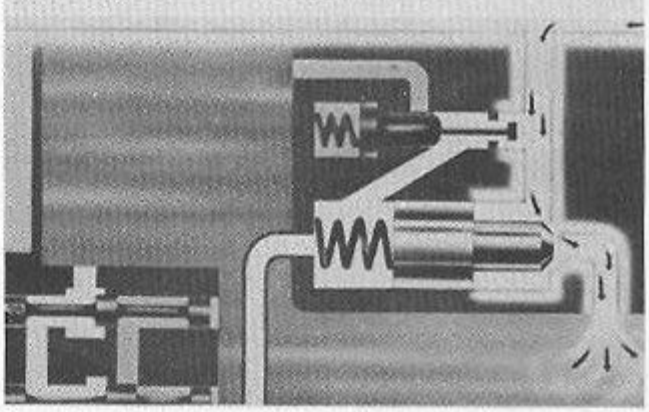
. . .the breech block raises the shell guard, and the latch pin on the shell guard lifts the latch pin lever. This action. . .

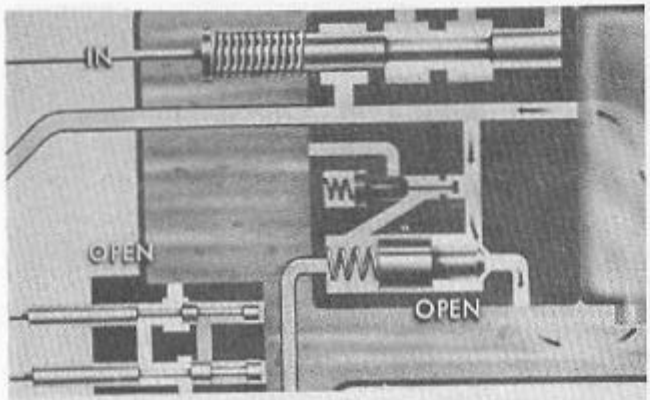


. . .moves the automatic pilot valve to open the line through the pilot valve block. Pressure on the spring end of the unload valve is thus reduced, . . .

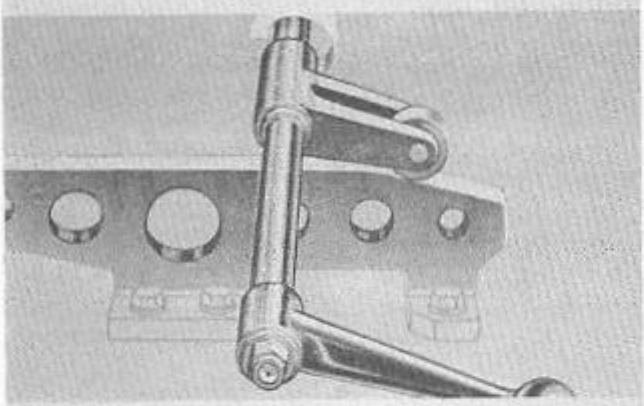


. . .and the unload valve opens, letting fluid from the pump vent into the tank. This condition. . .

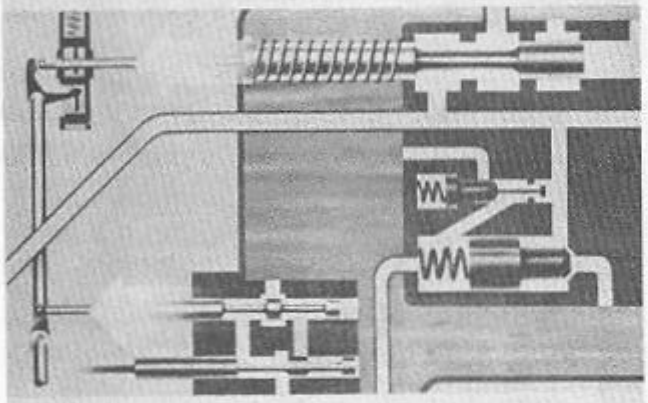




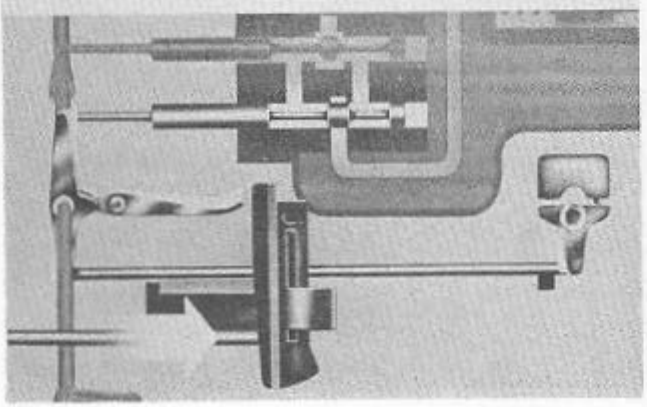
. . .is ram release. The main operating valve is in, to RAM position. In addition, the two pilot valves are open and the unload valve is open, thus, no pressure in the system. When the gun is fired and recoil starts, . . .



. . .the cam follower rides on the retraction cam, and rotates the control shaft. This rotation. . .

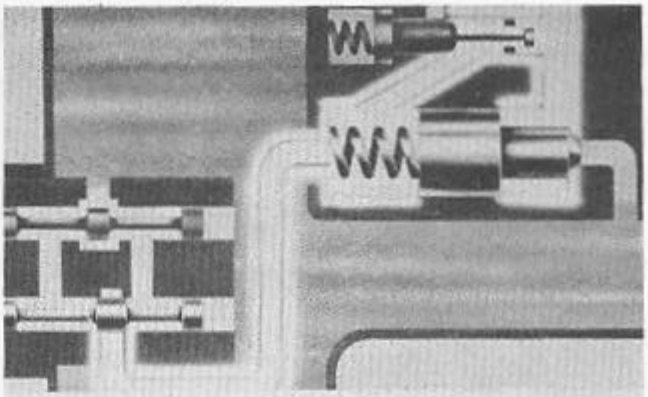


. . .unlatches the main operating valve, and the spring moves it out to RETRACT position. The rotation also centers the manual pilot valve leaving the line through the valve block open. As recoil continues, . . .

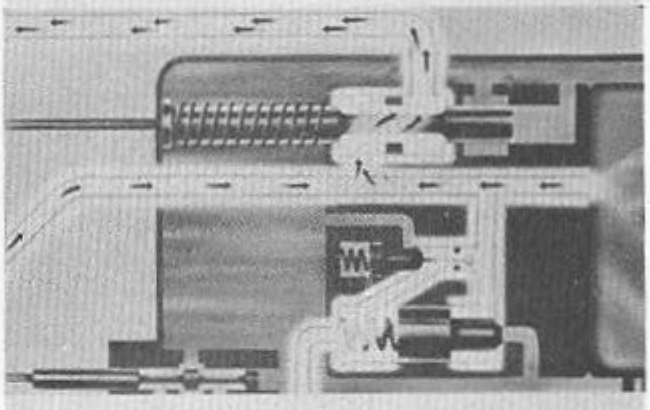


. . .the shell guard clears the latch pin lever allowing the retract limit mechanism to center itself and move the automatic pilot valve. . .

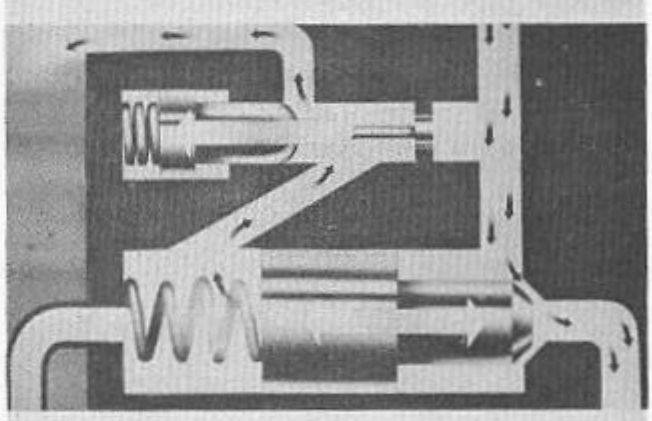
. . .to close the line through the pilot valve block. Resulting pressure closes the unload valve. All vents are closed, . . .



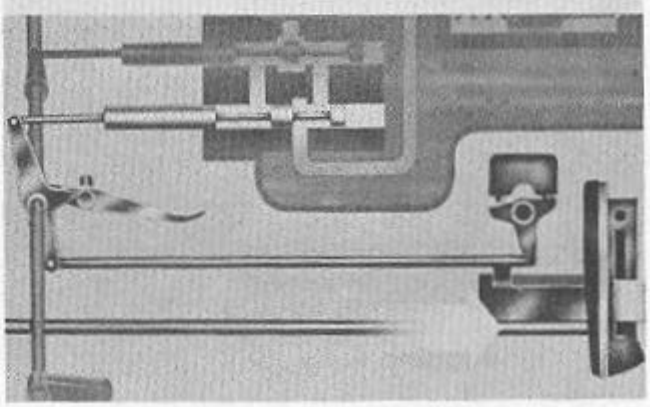
. . .the pump builds up pressure in both ram and retract lines, and the retract stroke continues. Near the end of retract, the buffing action in the ram cylinder head causes another pressure rise which also is limited, . . .

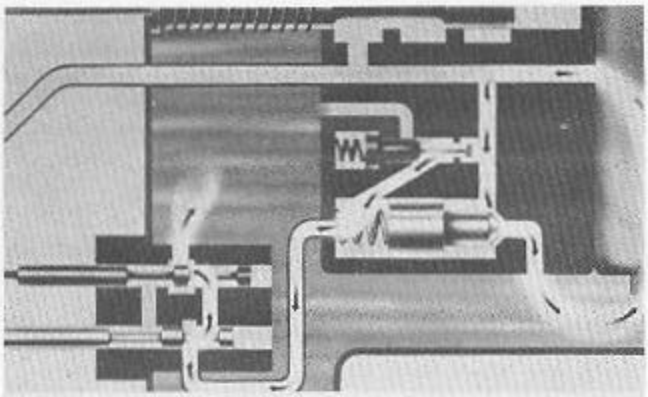


. . .by the action of the pilot and unload valves. This continues. . .



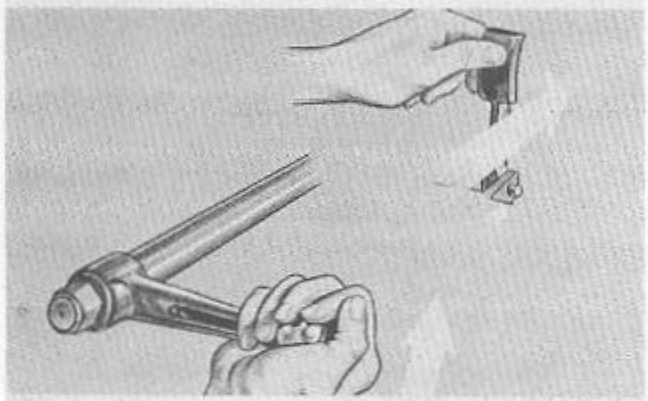
. . .until the crosshead engages the lug and pulls the limit rod aft. This moves the automatic pilot valve. . .



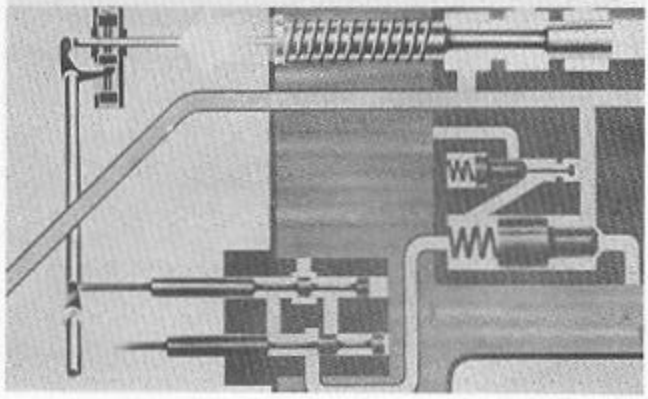


. . .to open the line through the pilot valve block. The unload valve opens and the system is vented. We are back to retract release after following through a complete normal cycle.

Manual retract is used when there is no recoil, as with a misfire or in loading drill. It works somewhat differently from normal retract.

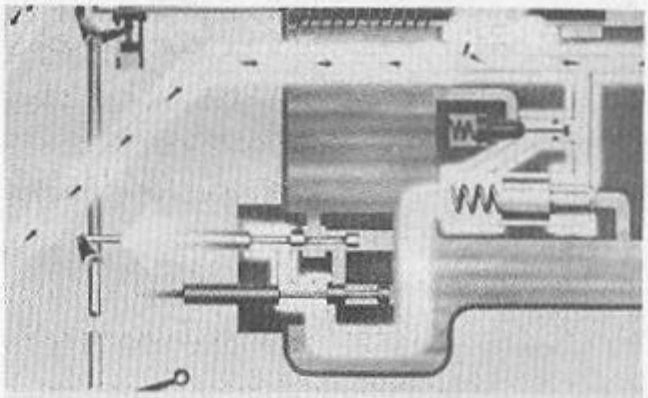


To start a manual retract stroke, first, press the interlock release lever to release the interlock. Then, while holding the interlock release lever in this position, raise the hand-control lever as far as it will go. Raising the hand-control lever does two things, . . .

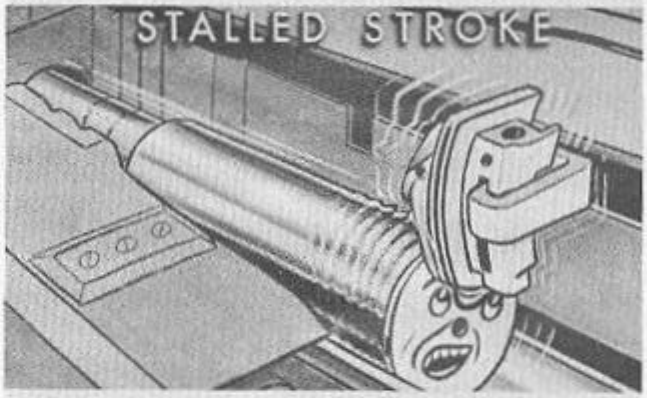


. . .(1) unlatches the main operating valve allowing its spring to move it to retract position; (2). . .

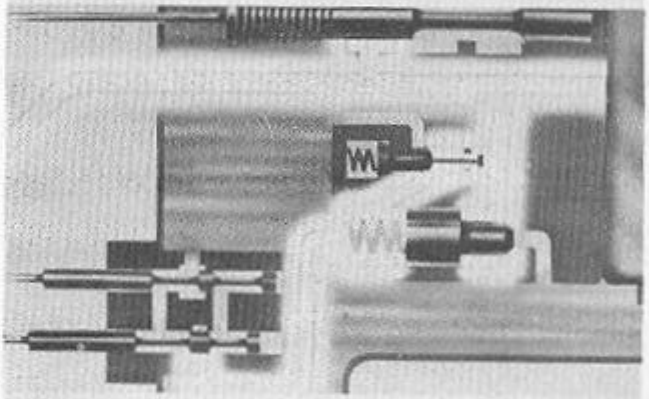
. . .moves the manual pilot valve to close the line through the pilot valve block. The unload valve closes, and the resulting pressure starts the manual retract stroke. The automatic mechanism operates to complete the stroke the same as it does when there is recoil.



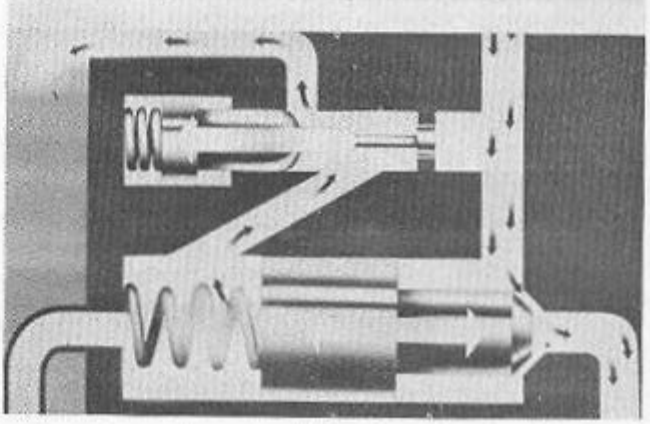
A stalled stroke, as in the case of a jam in a ram stroke, . . .

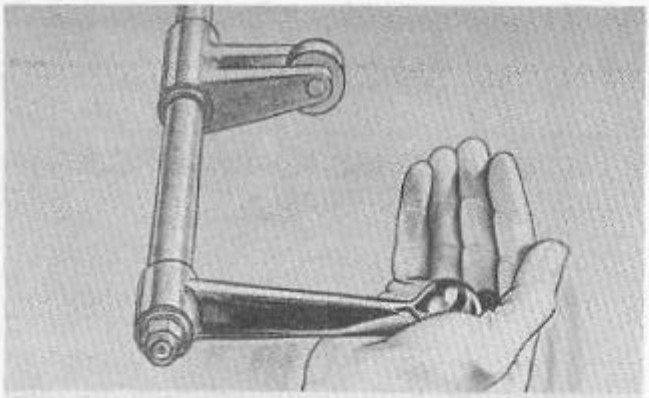


. . .immediately causes a pressure increase. In this, and in other conditions that could cause excess pressure, . . .

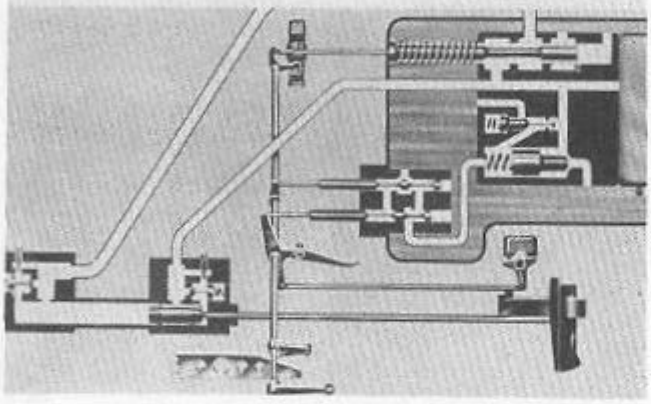


. . .the action of the relief valve pilot and the unload valve protects the system. In a stall, this action continues until the motor cuts out or, . . .



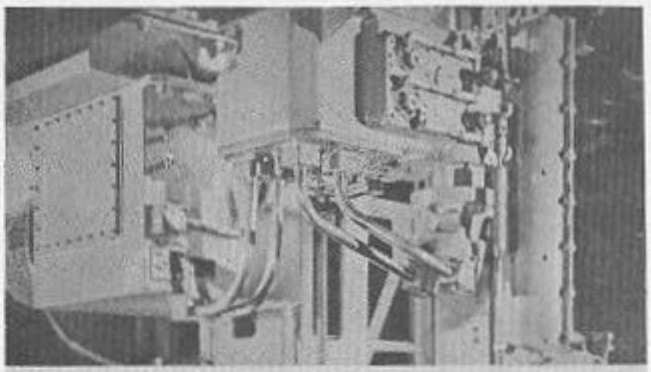


. . .until the hand-control lever is raised to retract the shell guard. Then the obstruction can be cleared.

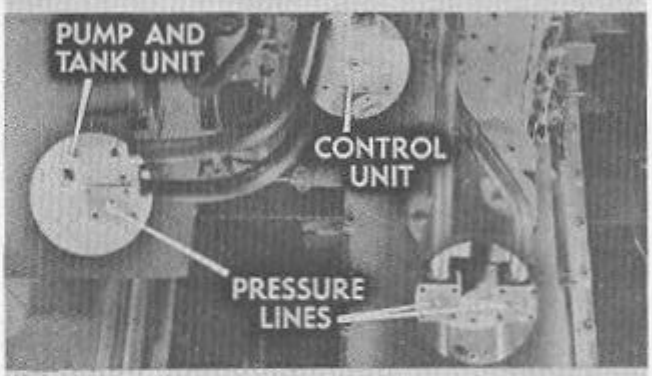


Here is our complete schematic drawing. On it you have seen all the basic operating parts, and how they work.

CHAPTER 22—VALVE BLOCK - REMOVAL AND DISASSEMBLY

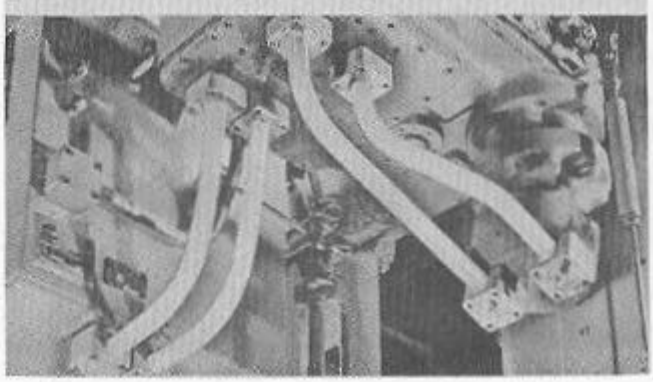


When it becomes necessary to remove and disassemble the valve block, there is a simple step by step procedure that can be followed. But first of all, the system must be drained of hydraulic fluid. . .

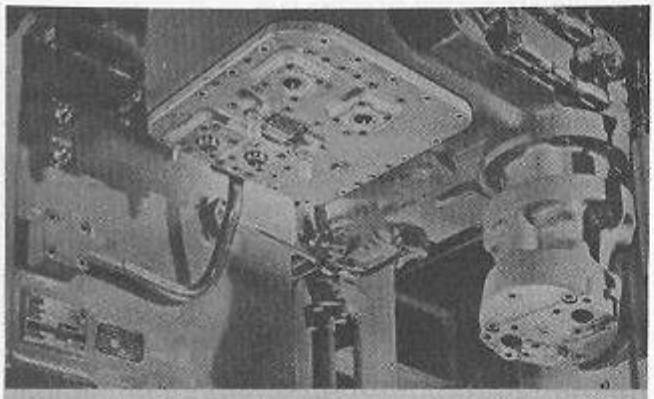


. . .from the pump and tank unit, the control unit, and the pressure lines. When the fluid has been drained we are ready for REMOVAL OF THE VALVE BLOCK. This includes four major operations. First, the preparatory steps; second, loosening the internal linkages; third, preparation of the valve block for removal from the control unit case; and fourth, lowering of the valve block to the deck. We will not describe the obvious steps, but each main step will be taken up in order, emphasizing the proper points. Ready?

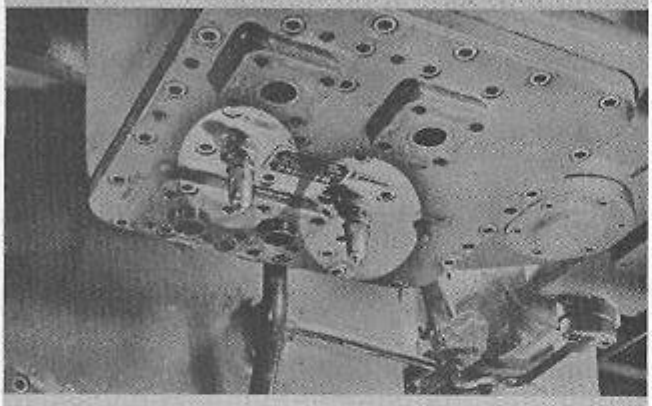
First, the PREPARATORY STEPS. This means removing all the indicated piping and disconnecting the external linkages.



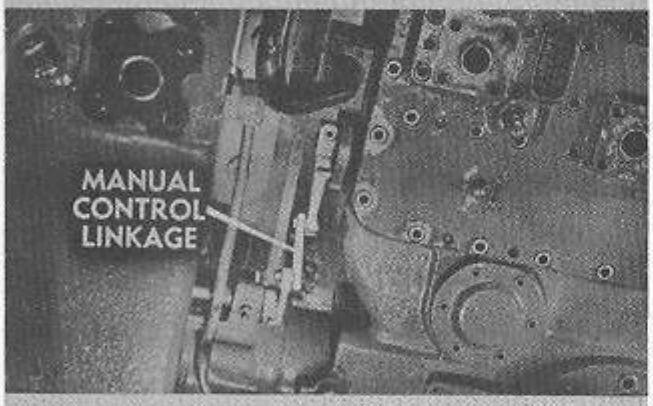
The piping from the tank to the control unit and from the control unit to the hydraulic motor is removed first.



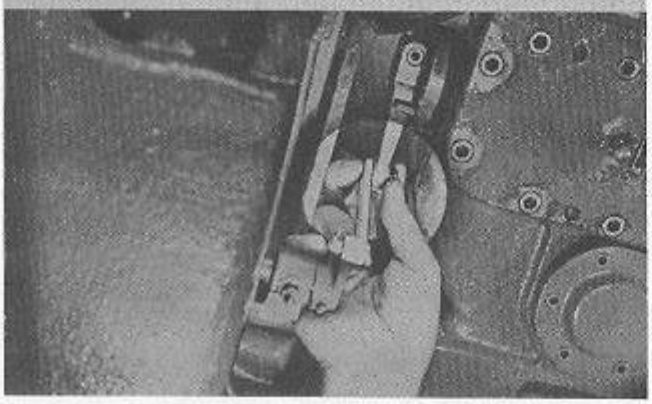
Now we have clear access to the bottom plate of the control unit.



See those needle valves? Make sure they remain undisturbed. Before removing the bottom plate, go around the side of the control unit.

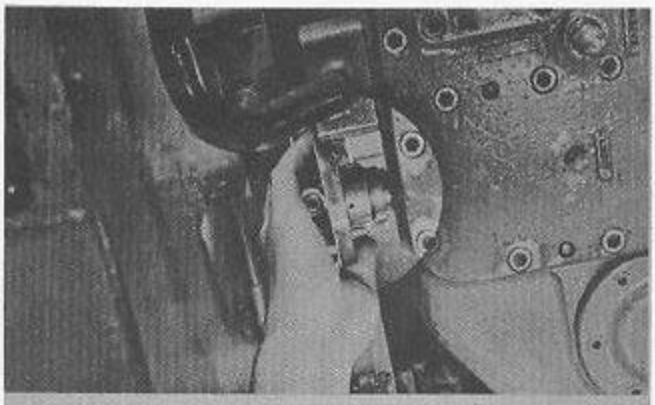


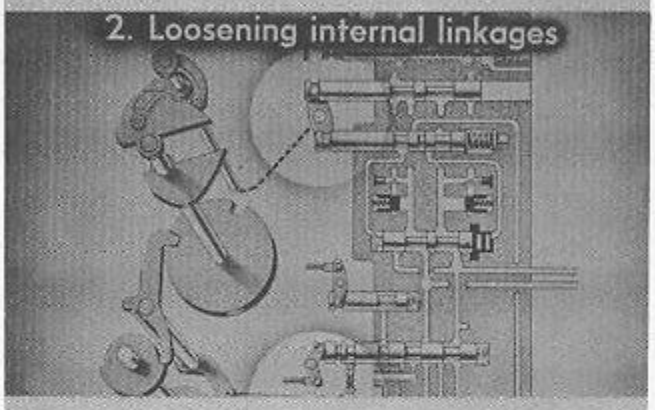
Here the manual control linkage is located.



Disconnect this linkage from the manual bypass valve crank. . .

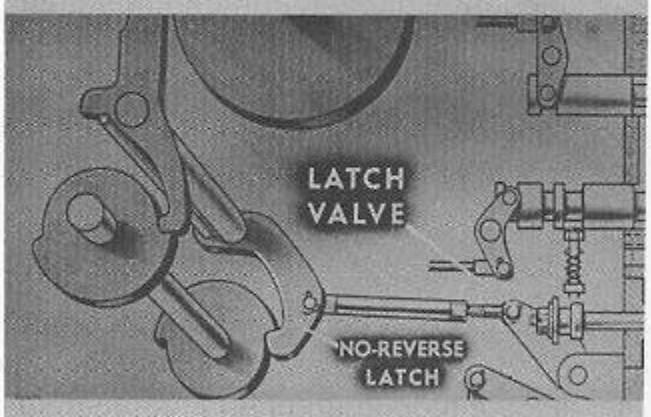
. . .and remove the crank arm assembly. That is all there is to the preparatory steps.



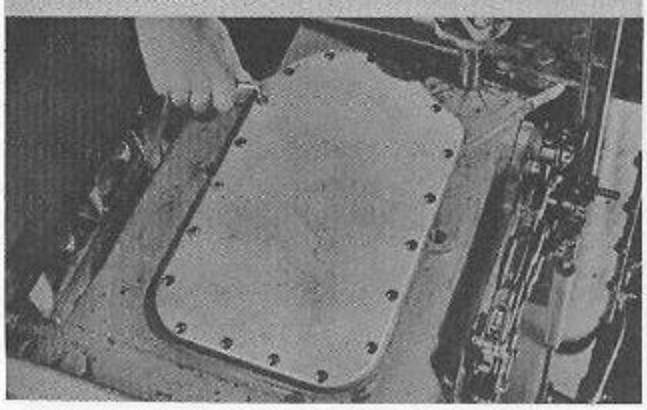


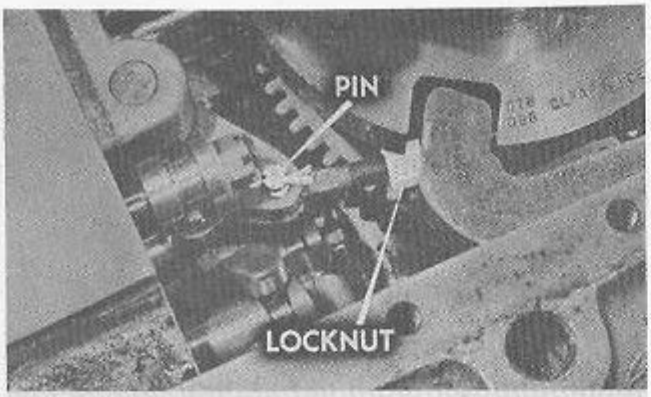
The second operation involves LOOSENING THE INTERNAL LINKAGES. From this schematic you will note that certain valves in the valve block are linked to certain mechanisms in the cam and latch assembly. These linkages will have to be disconnected at their valve block ends. Let's start with the bottom linkage. . .

. . .between the latch valve and the no-reverse latch. To disconnect this linkage, . . .

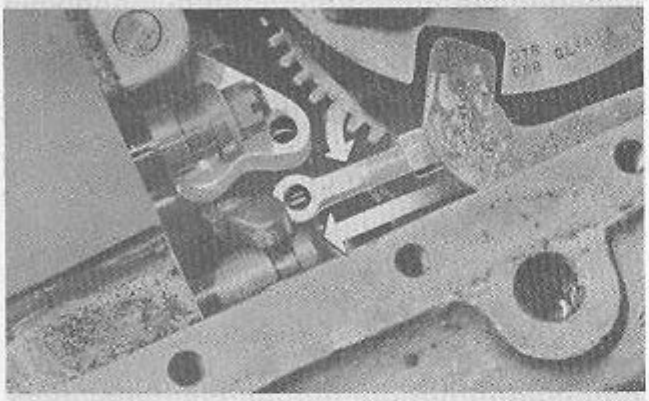


. . .remove the top cover of the control unit. Then, through the open top. . .

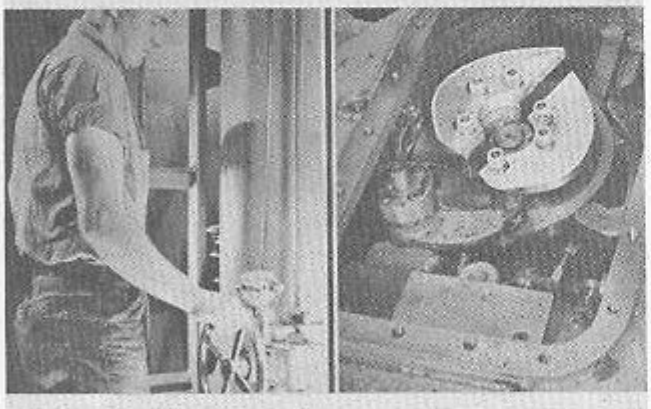




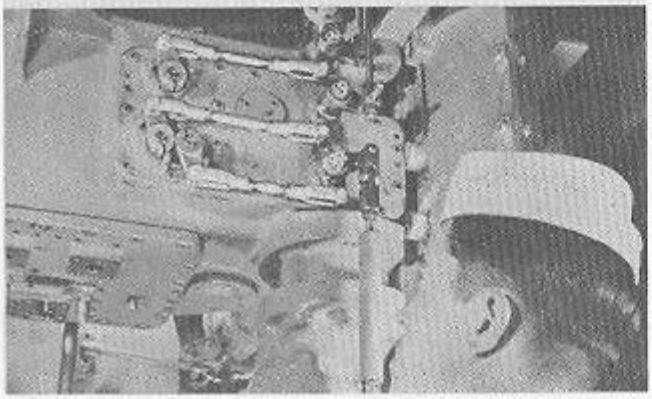
. . .remove the pin from the linkage at the latch valve, but don't loosen the locknut, because this would disturb the linkage adjustment. Incidentally, there is a little trick to removing that pin. First, you take out its cotter pin, then line up the flat surface of the pin head with the manual bypass valve, and then push down.



With the pin out, first, pivot the linkage clear of the latch valve. Second, pull the linkage, as shown by the straight arrow, and the no-reverse latch will be disengaged. Now, before further operations. . .

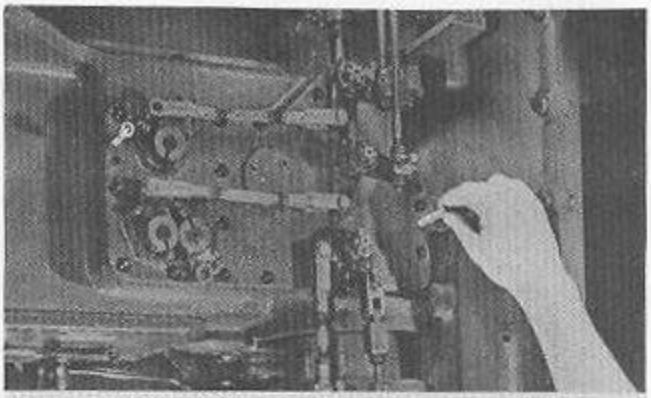


. . .the control unit must be placed in mid-cycle position as indicated by the deceleration cams, then. . .

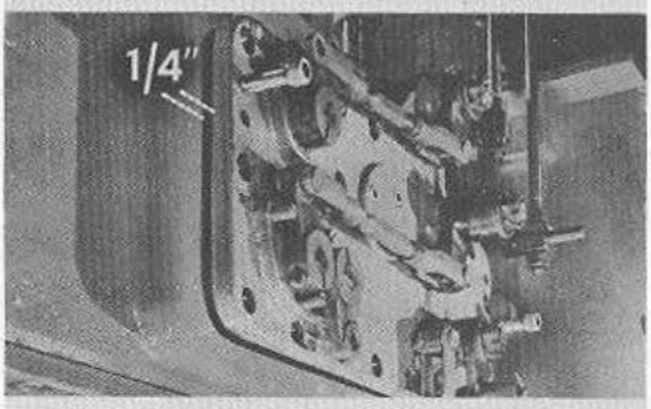


. . .the next job is to jack out the side plate, but don't touch the linkages. To loosen the side plate, . . .

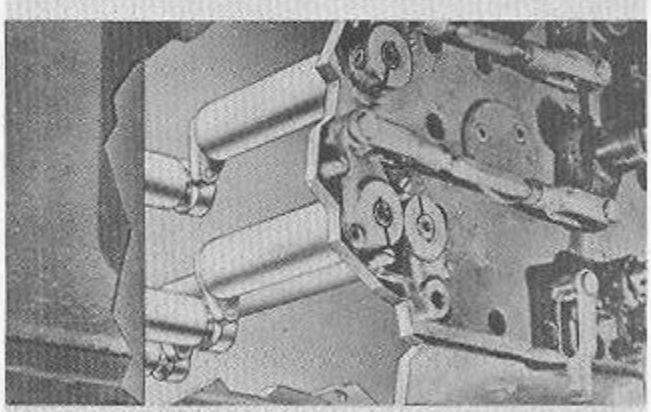
. . .back off on all the Allen bolts and insert a jackscrew in each of the two openings provided. Then, tighten up on the jackscrews. . .



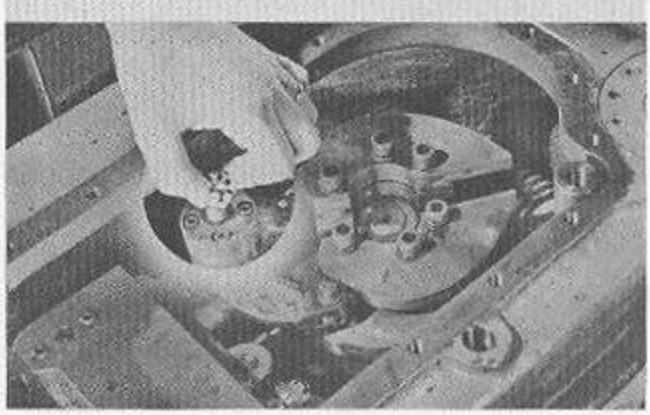
. . .until the plate is about 1/4 inch away from the case. The jackscrews will hold the plate in position. And. . .



. . .as the plate moves out the valve cranks will become disengaged from their respective notches.



Now, remove the large nut from the rocker arms, but don't disturb the four small Allen bolts which are for adjustments only.



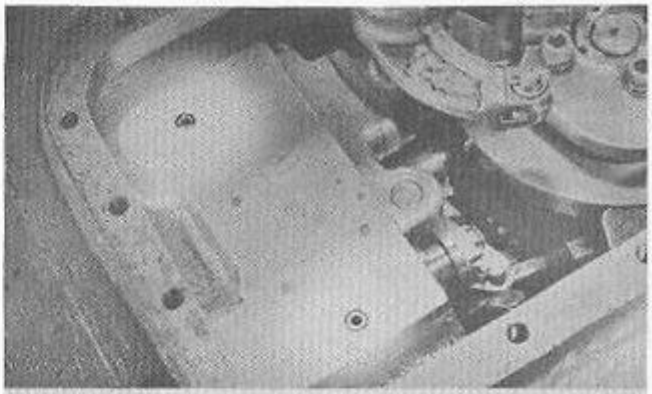
Now, lift the rocker arms off the T-shaft as far as they will come. The two arms are locked together and do not need to be separated. Because of the construction of the control unit case, . . .

. . .they will not lift completely off until the valve block has been lowered slightly. So, . . .

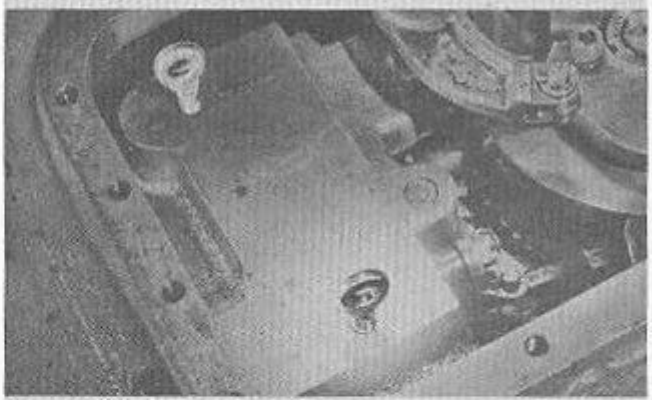
. . .the third operation is PREPARING THE VALVE BLOCK FOR REMOVAL. Now, of course, we must provide some way to keep the valve block from falling out when the Allen bolts are removed.

A block and tackle is used for this purpose. To attach the hooks to the valve block, . . .

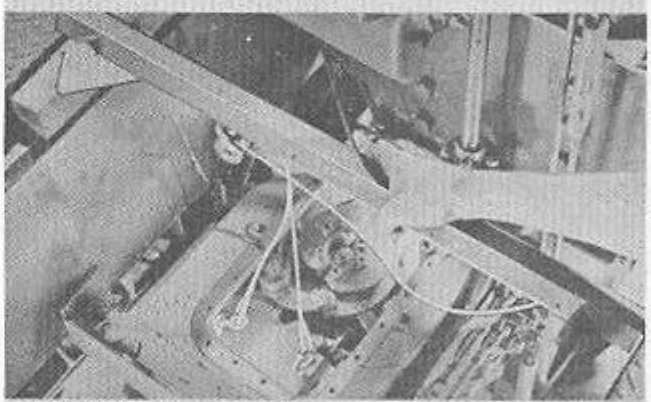
. . .remove these two Allen plugs, and then. . .



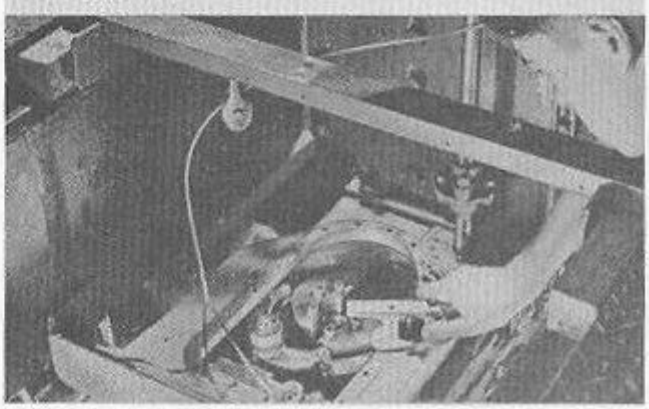
. . .insert a padeye in each of the two openings.

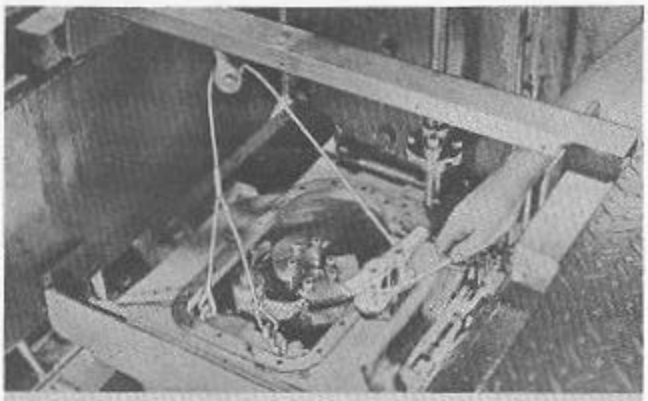


Then, rig the block and tackle to the valve block.

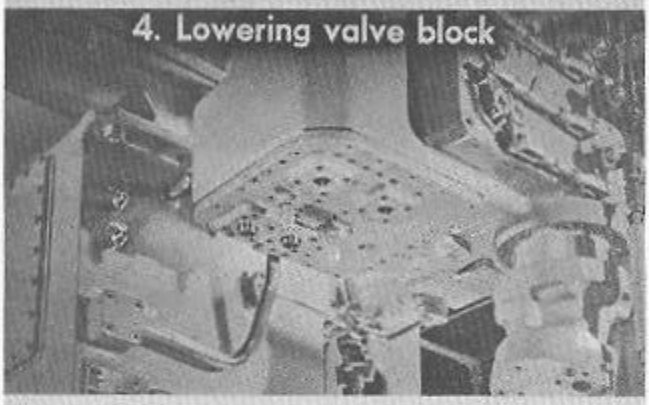


Attach a cleat to the control unit case in the opening provided. Then. . .

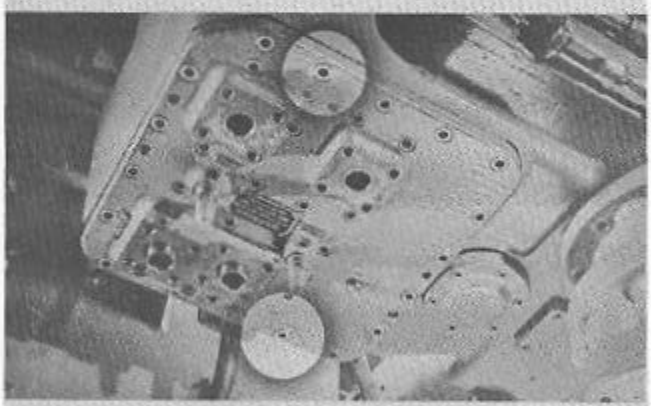




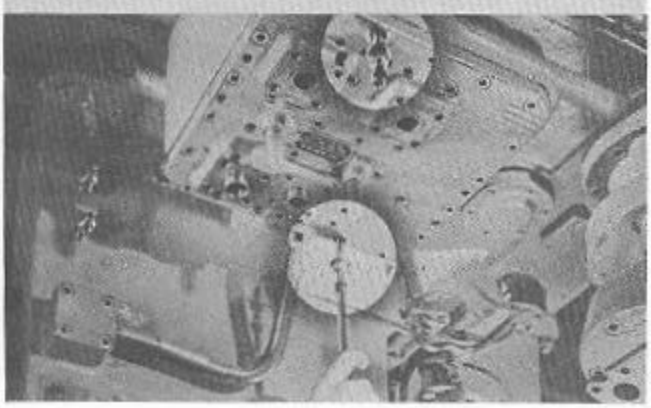
. . .secure the line to the cleat. This will keep the valve block from falling out when the bottom bolts are removed. This brings us to. . .



. . .operation 4, LOWERING THE VALVE BLOCK. In order to balance the block evenly while lowering it, . . .



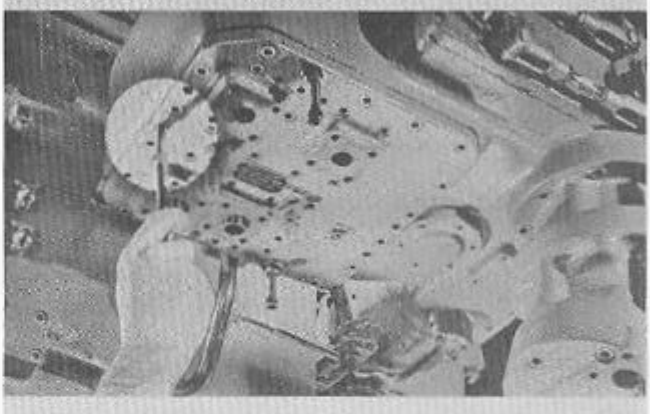
. . .remove the two Allen bolts, indicated here, . . .



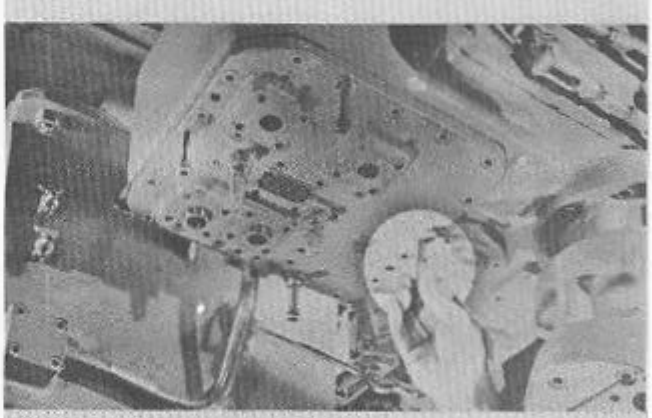
. . .and insert a lowering bolt in each of the two openings. Then to hold the bottom plate to the control unit case, . . .

. . .draw up tight on the locknuts of each lowering bolt.

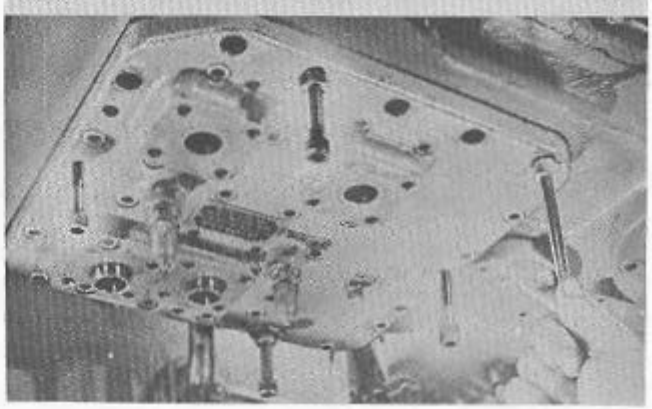
Insert a jackscrew in this empty hole in the bottom plate and draw this screw up tight.



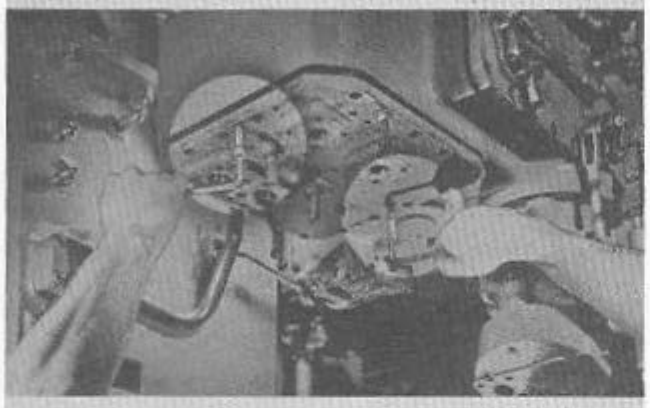
Do the same thing with a second jackscrew on the other end of the plate.



These jackscrews and lowering bolts will hold the valve block in position while you remove all the remaining Allen bolts from the outside row of the bottom plate. Now to lower the valve block. . .

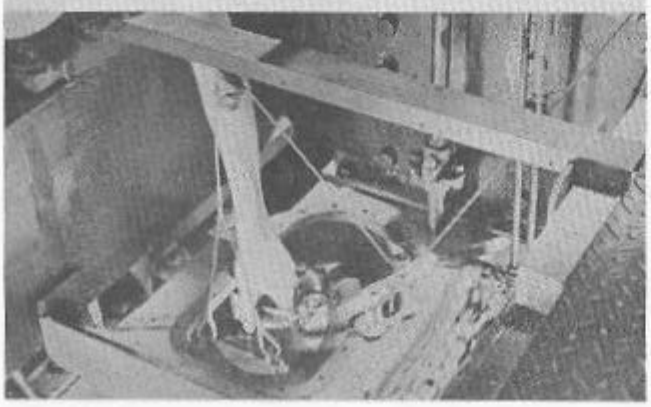


. . .back off slightly on both lowering bolt nuts at the same time.



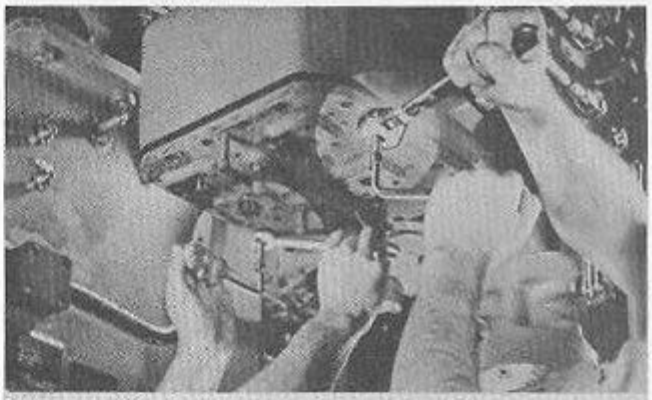
Then, draw up slightly on the two jackscrews. Repeat backing off on the lowering bolt nuts and drawing up on the screws, thus lowering the valve block evenly and slowly. Keep a sharp eye, at this point, for any obstructions. Continue to lower the valve block. . .

. . .until the bottom plate is about 1/2 inch below the control unit case. . .

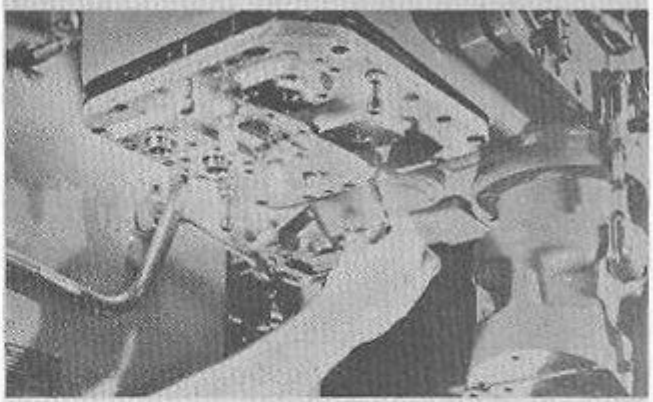


. . .and remove the rocker arms.

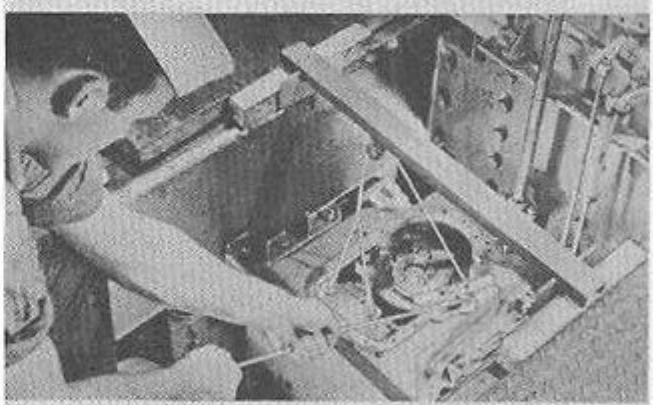
Now, continue backing off on the lowering bolt nuts until the bottom plate is clear of the dowel pins. The block and tackle, of course, will keep the valve block from falling. After the dowel pins have been cleared, . . .



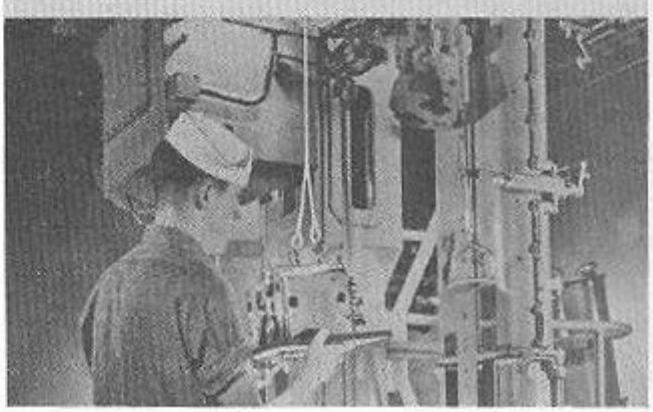
. . .remove the jackscrews and lowering bolts. Then, . . .

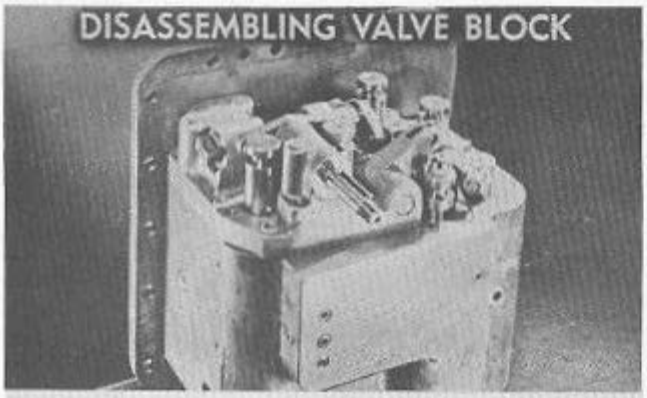


. . .slowly pay out on the lowering cable. . .

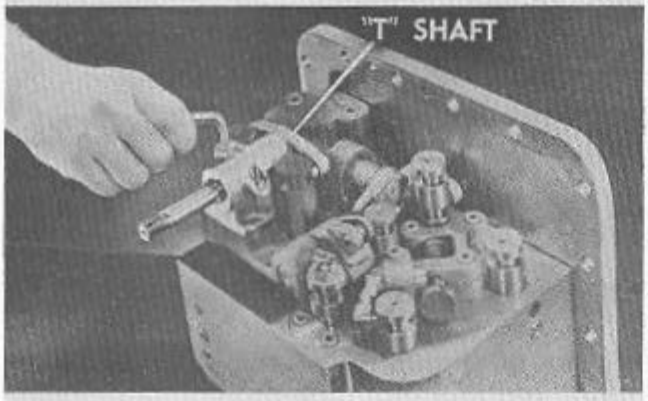


. . .and allow the valve block to be brought cautiously down to the deck. There, the valve block has been removed.

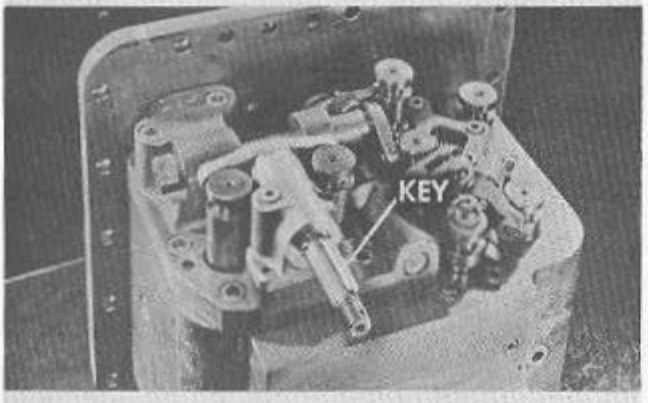




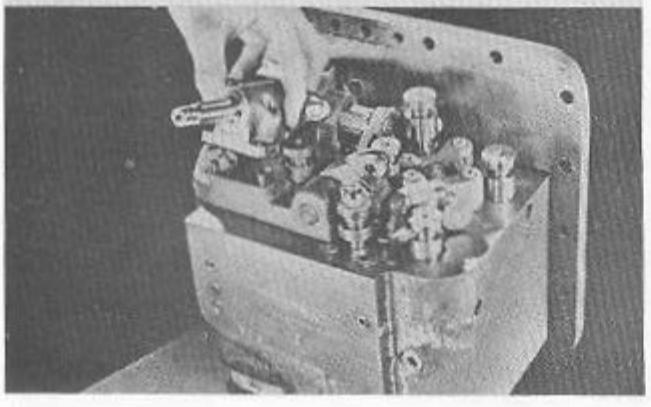
DISASSEMBLING THE VALVE BLOCK is next. To do this, . . .



. . .first, remove the T-shaft bracket and assembly. There is an important point to watch out for here. Before the T-shaft is taken off, . . .

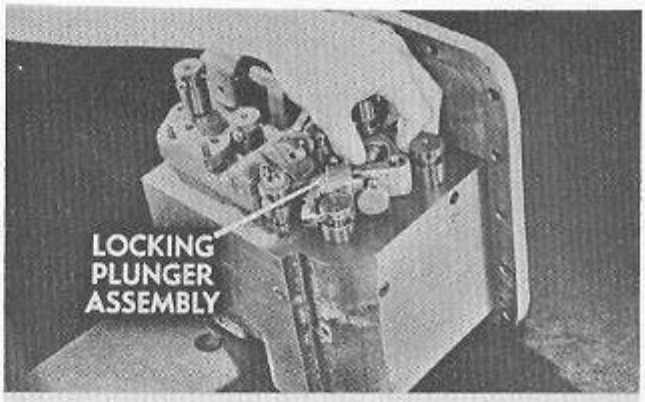


. . .note the key and the direction it faces. It always faces up. So when reassembling, the T-shaft must be replaced in the same up position, okay? Get the position of the key clearly in mind?

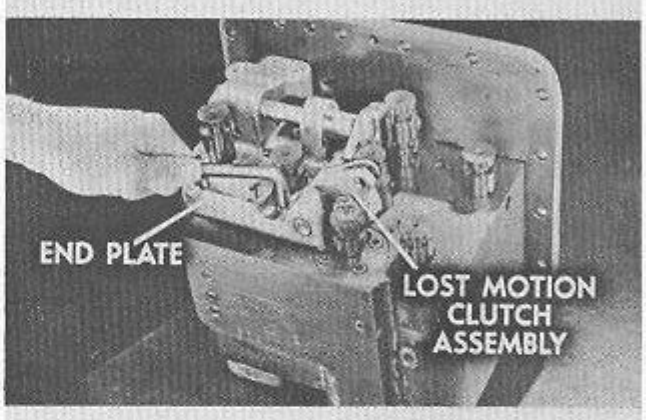


Then, lift the T-shaft off the valve block.

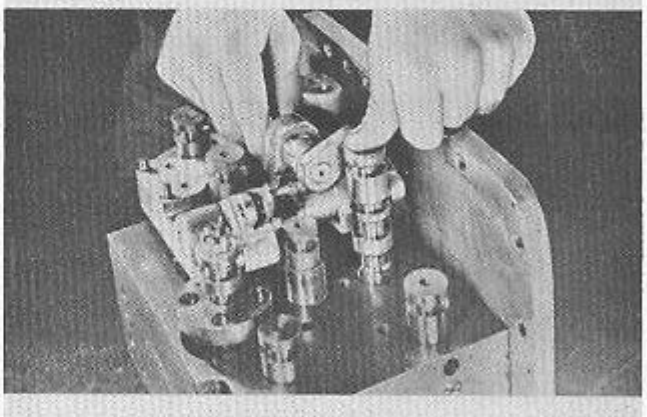
The locking plunger assembly is the second part to be removed. Remember, we are taking off these parts in order, and there are a lot of parts. Next, . . .



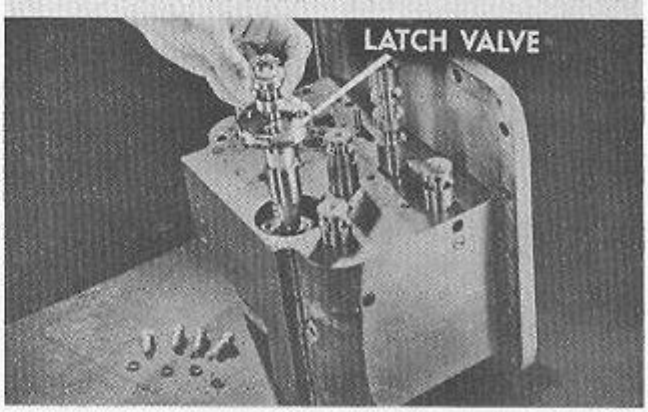
. . .remove the end plate that mounts the lost motion clutch assembly. First remove the Allen bolts. . .

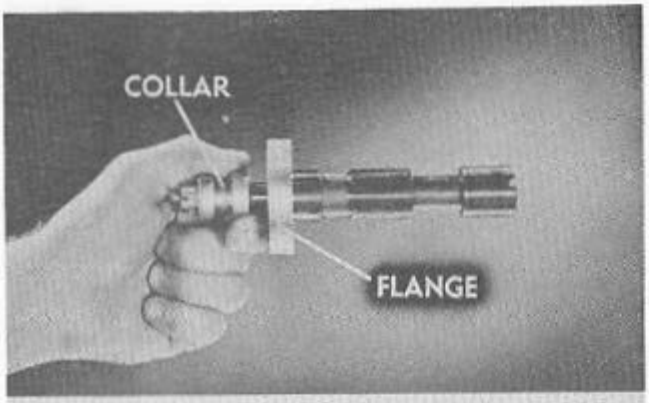


. . .then, hold down on the starting valve to prevent interference by the valve spring, and lift the end plate vertically—all the way off. Don't take this end plate assembly apart however, unless it is to be repaired.

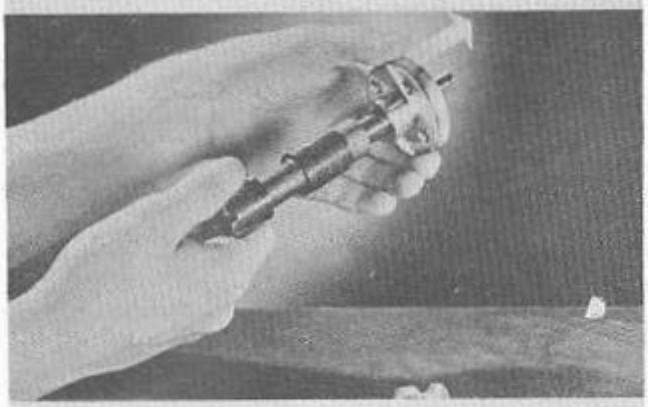


The latch valve flange is loosened next. There is a gasket beneath the flange. Don't tear it. Then, lift the latch valve out of the valve block. It is seldom necessary. . .

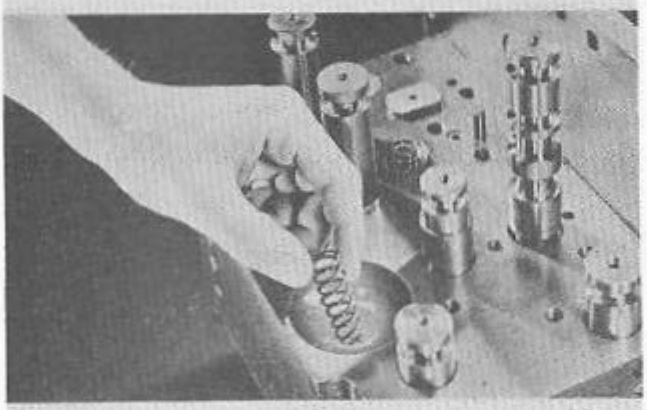




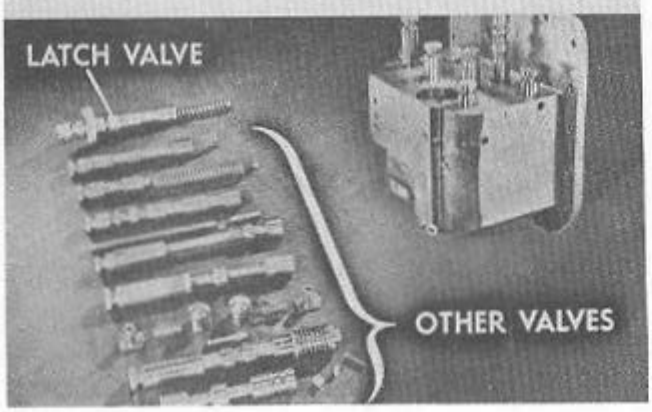
. . .to take the collar and flange off the latch valve. If corrosion should occur in these parts however. . .



. . .they may be easily disassembled. All right, the latch valve is out. . .

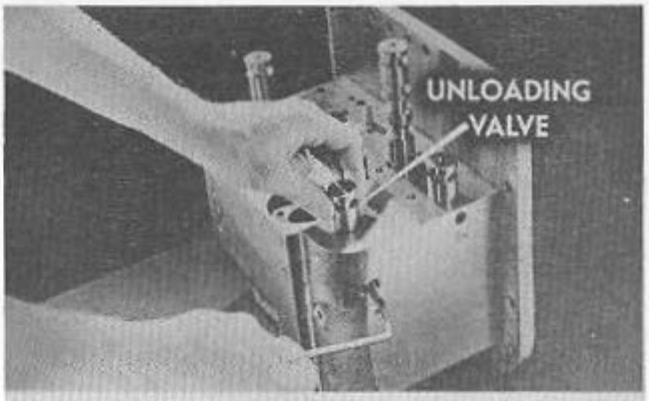


. . .and the spring is removed next.

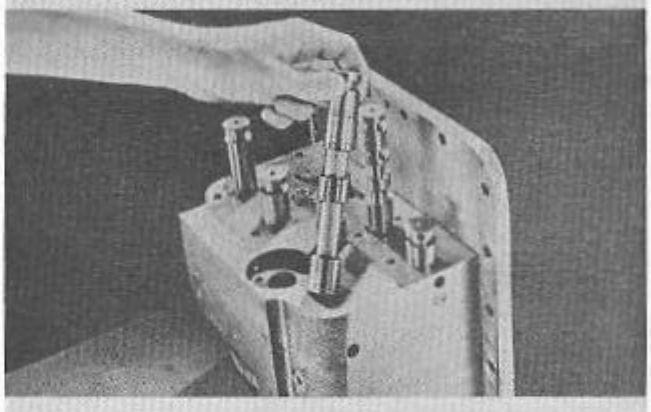


Place the latch valve and spring at the side of the valve block. As you remove the other valves, place them in order below the latch valve. This will help you remember the way in which they are to be replaced. All right, let's get after those other valves.

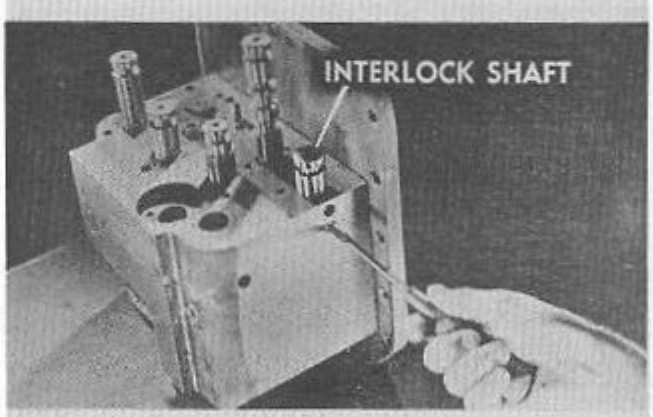
To take out the unloading valve it is necessary to remove its keeper screw in the valve block. With this screw out. . .



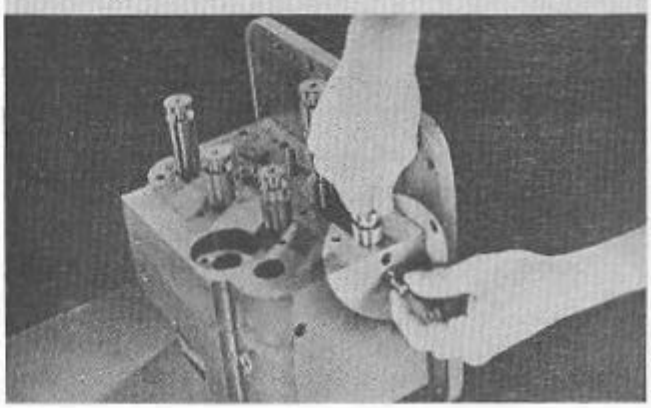
. . .the unloading valve may be removed.

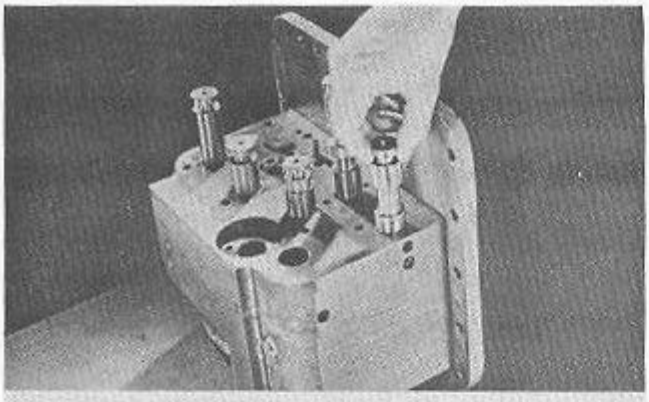


Removing the interlock shaft also calls for taking out a keeper screw. This interlock shaft is spring loaded. . .

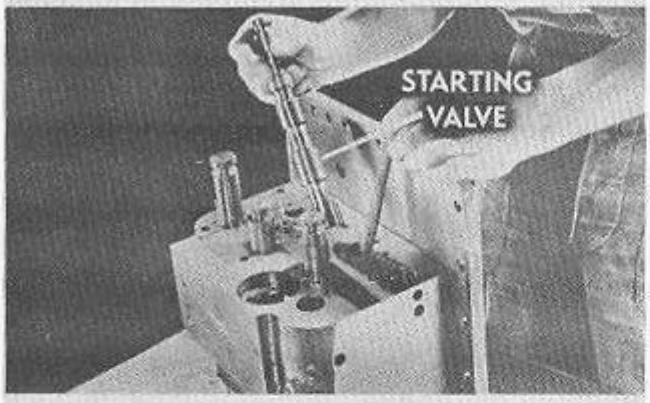


. . .so you have to hold it with one hand while you remove the screw. Then, ease up on the interlock shaft. . .



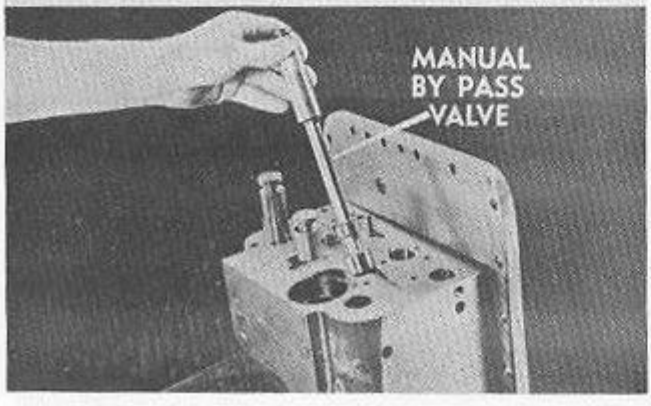


. . .and spring tension will push it out. Be sure you take out the spring, too. Next. . .



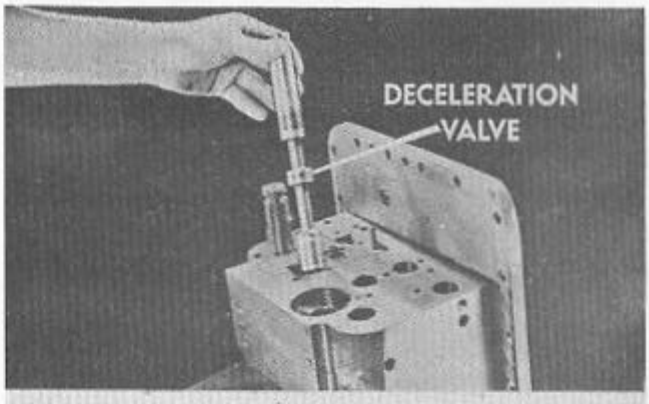
. . .the starting valve and spring is removed.

Then, the interlock plunger, . . .

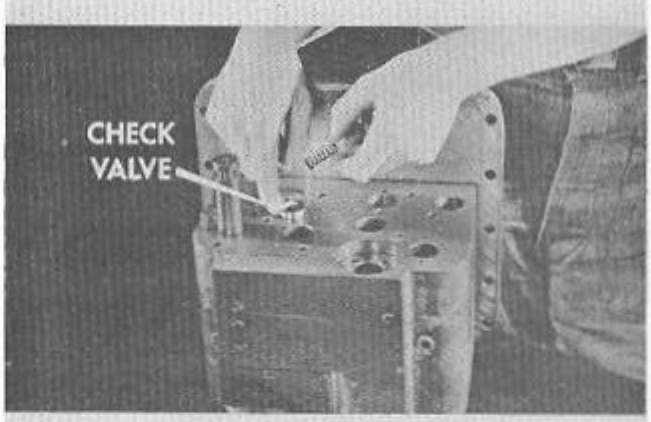


. . .the manual bypass valve, . . .

. . .and then the deceleration valve. But don't go away. We are not finished yet.

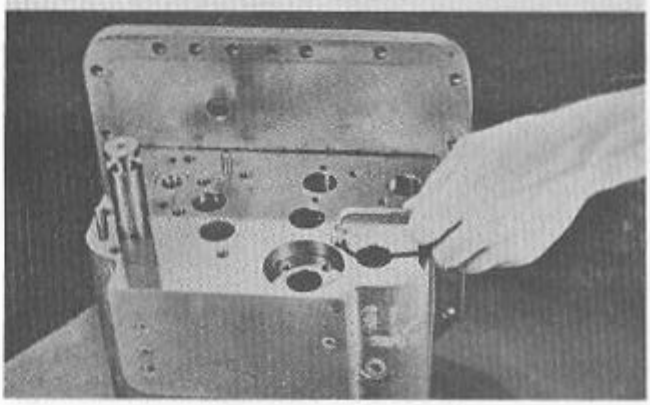


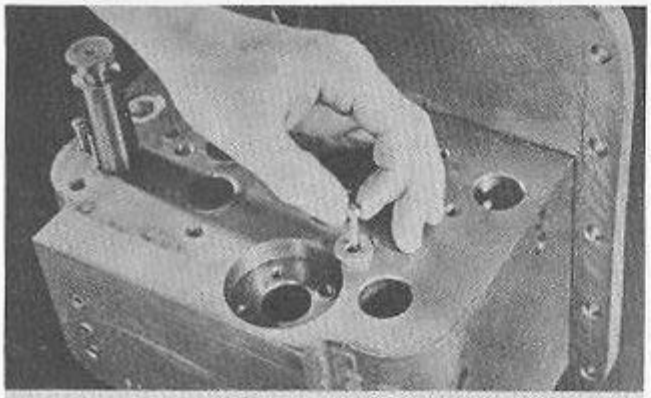
The check valve and its spring are next removed. Then, . . .



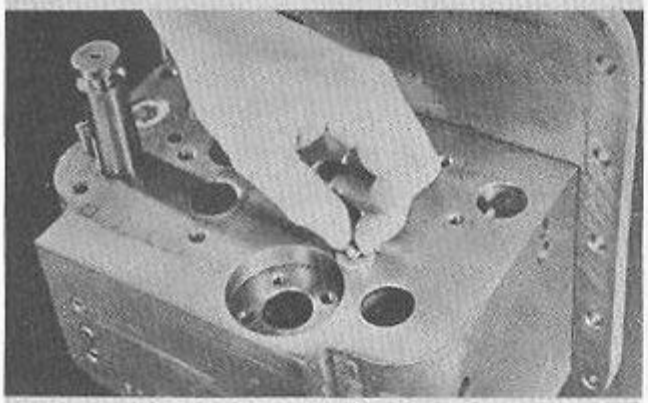
. . .the dash pot at this end of the directional valve may be taken out, although we are not yet able to remove the directional valve itself.

We've got a restriction plug to take out now, so first, remove the Allen bolt over the restriction plug and, in the opening, . . .

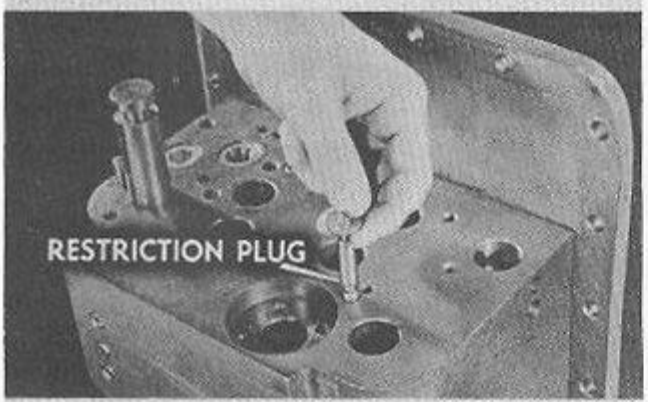




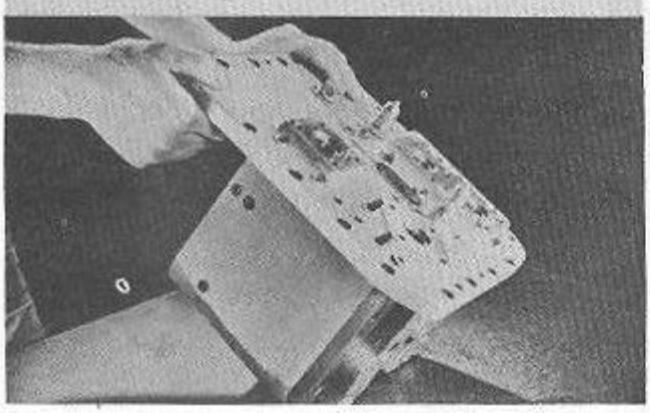
. . .insert a threaded machine screw fitted with several washers.



Turn the screw until it is handtight and it will engage the end of the restriction plug. Then, remove the screw. . .

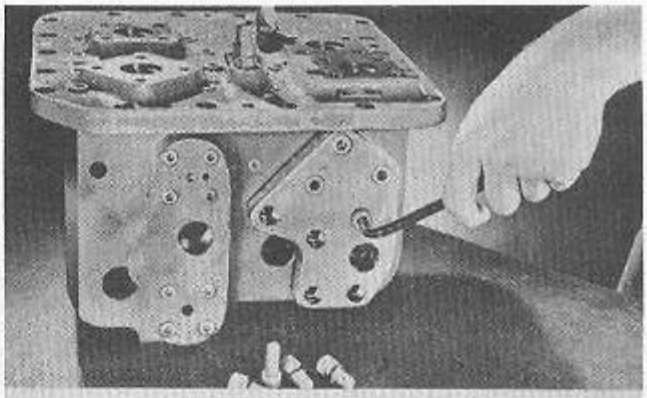


. . .and out comes the restriction plug.

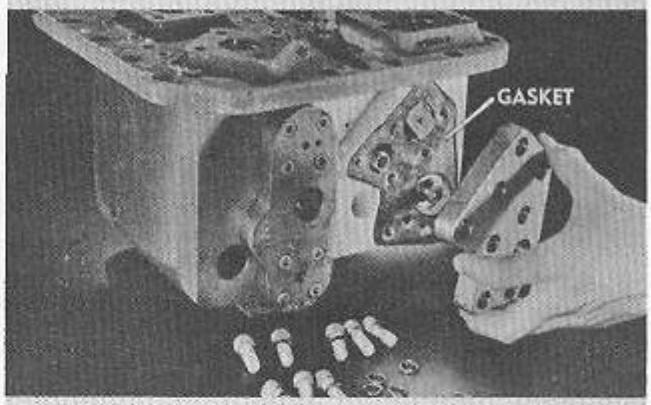


We've got to turn the valve block now so that the bottom plate faces up.

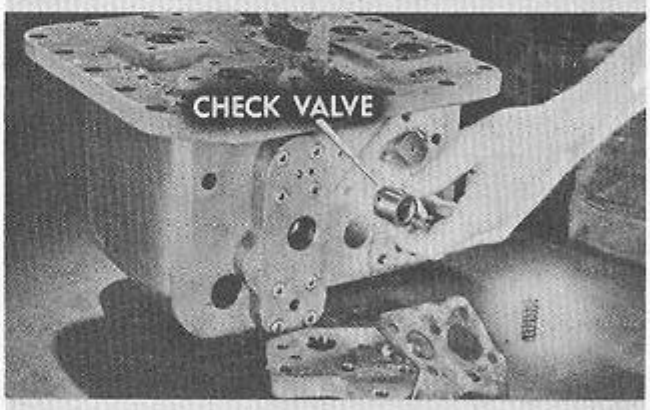
And, in this position we can remove the check valve cover plate.



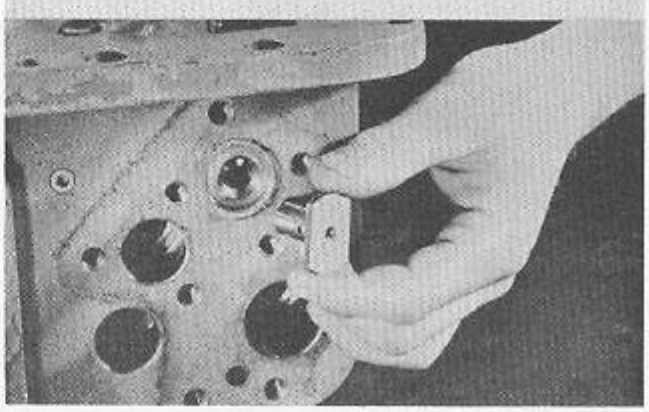
There is a gasket underneath. Don't tear it when you take off the plate.



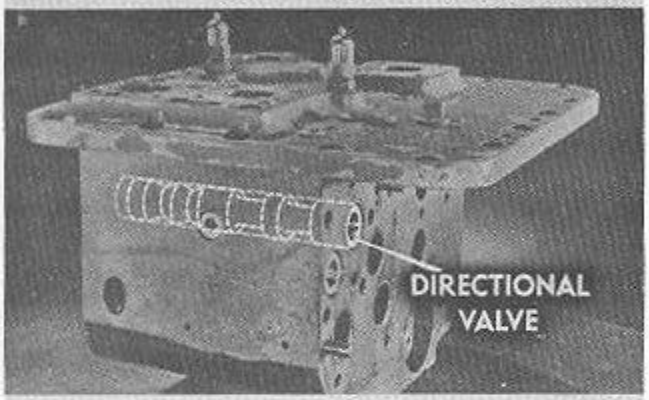
The second check valve and spring can now be removed. Also, . . .



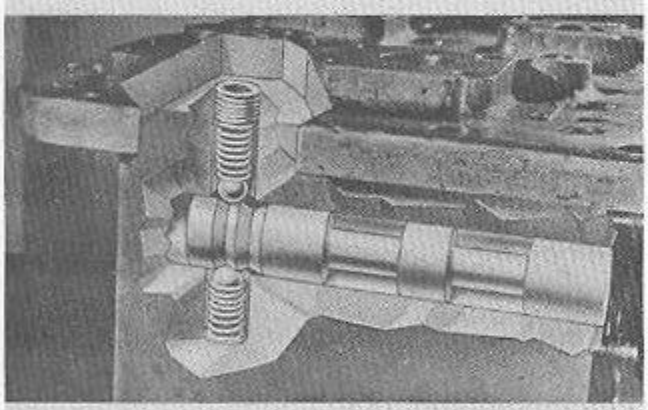
. . .the second dash pot from the directional valve. Now, from the same side. . .



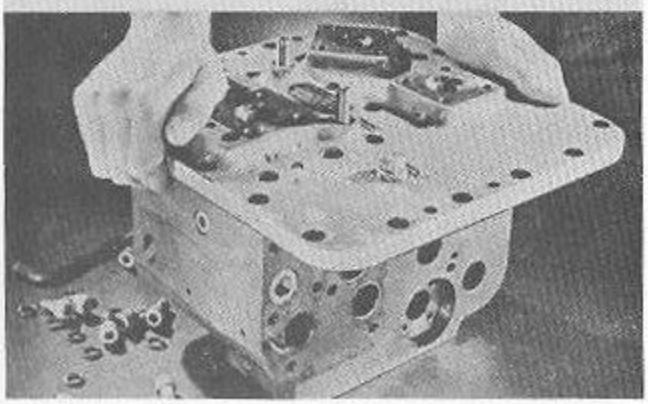
. . .take out the directional shifter valve. This valve can only be removed this way—from the rear of the valve block.



At last we're ready for the directional valve. Because the most recent design differs somewhat from the old design, let's consider each design separately.

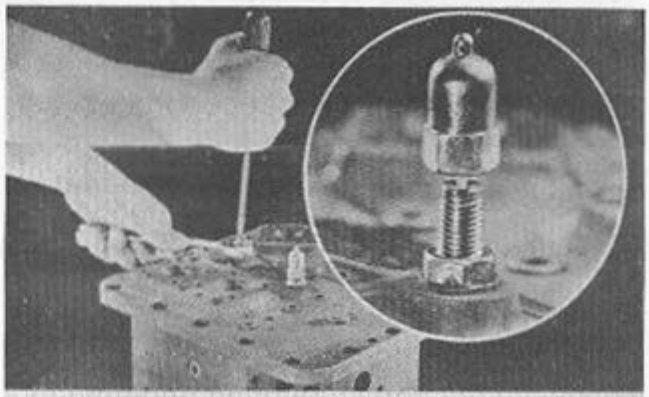


In the old design only the upper spring detent is held in place by an Allen bolt. And, care must be taken that the springs and detents do not fall into the valve block. With the old design, therefore, . . .

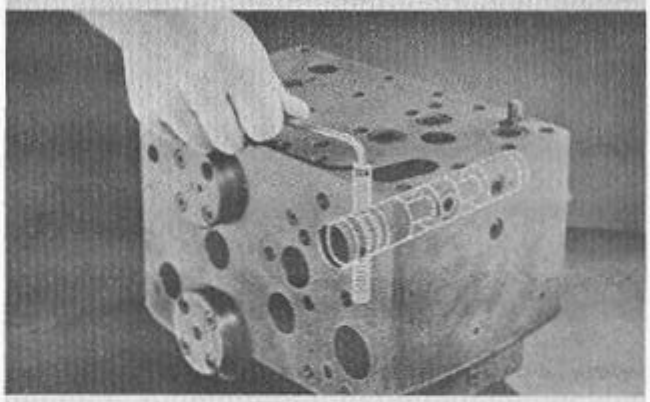


. . .the bottom plate has to be taken off before the springs and detents can be removed. To get it off. . .

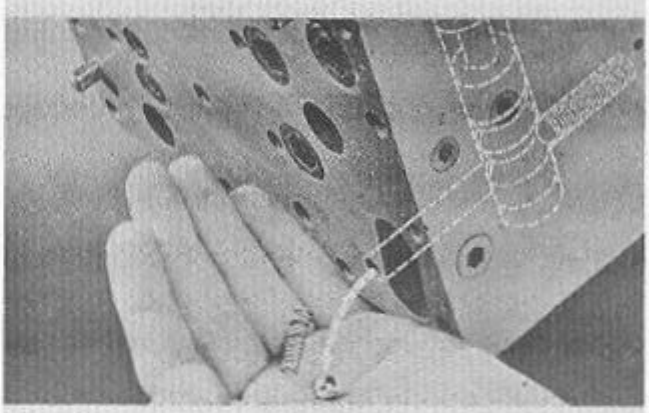
. . .the needle valve covers and locknuts must be removed. This may disturb the needle valve adjustments. And they will have to be readjusted after reassembly. With the bottom plate off. . .



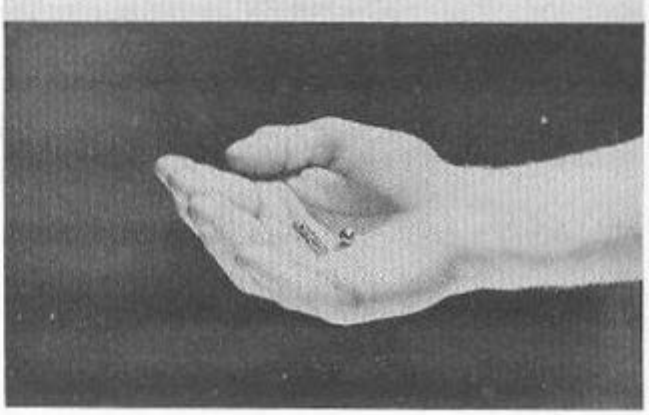
. . .remove the Allen bolt that holds the upper spring and detent in place. Tilt the valve block, . . .



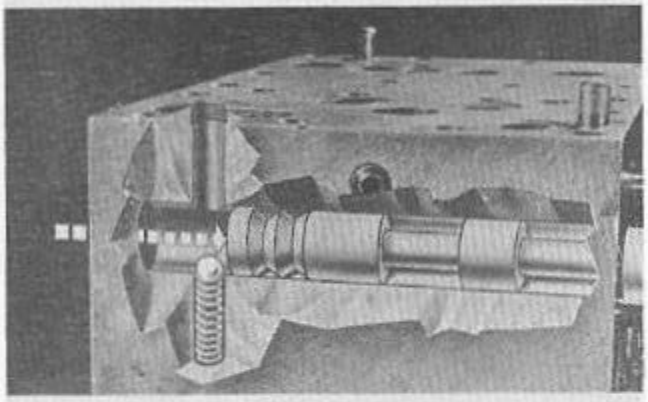
. . .and catch the spring and detent as they fall out.



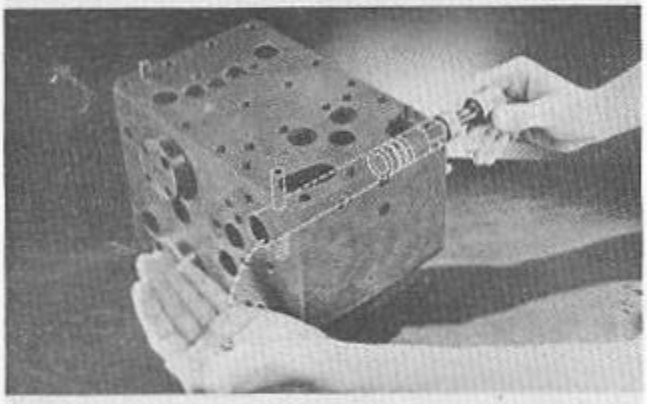
Look at this detent. In the old design it is the ball bearing type.



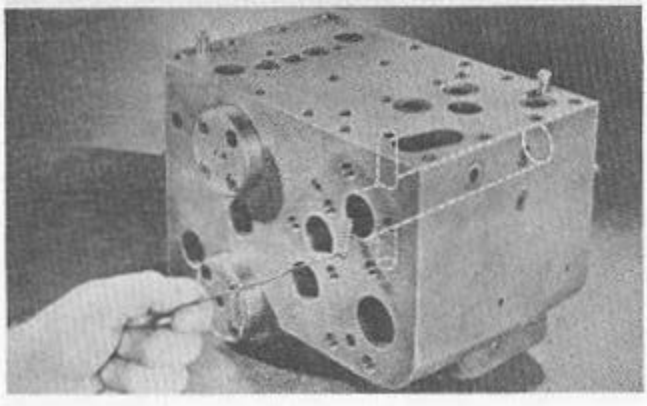
Now for the directional valve itself. There is only one correct way to remove the old design directional valve. And that's the same way most of the other valves have been removed—through the face of the valve block. It's the only way which prevents the lower detent and spring from falling into the valve block.



Don't push the directional valve all the way out at first. Push it just far enough to remove the lower detent and spring. In this position it acts as a barrier to keep the detent and spring from falling into the block.

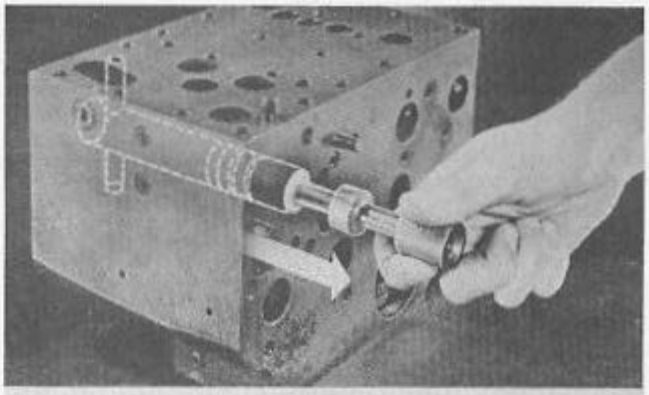


Then, tilt the block far enough for the detent to fall out the directional valve port. The spring is still inside.

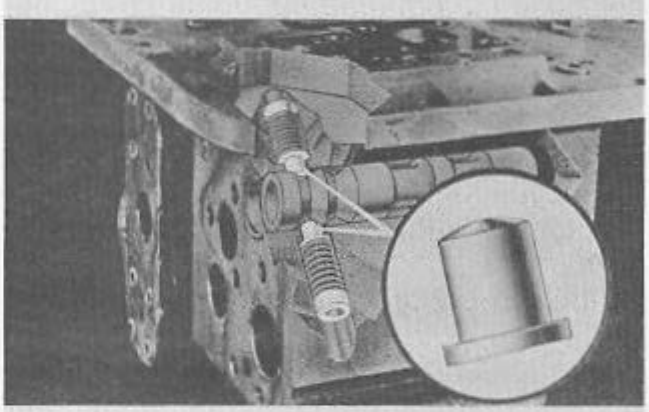


So, use a wire to lift it out of the detent recess.

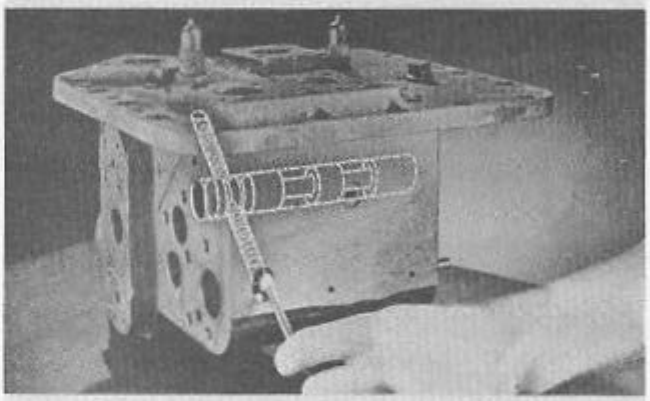
All you have to do with the old design now is pull the directional valve all the way out through the face of the block.



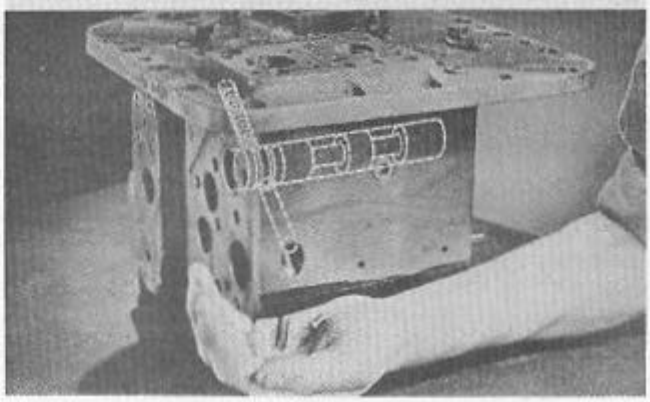
The new design is somewhat different. First of all, the detents are of the rivet type and there's an Allen plug for each detent.

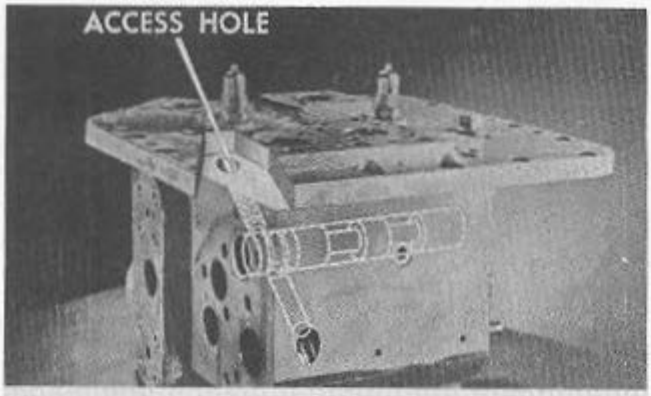


Remove the lower Allen plug first. . .

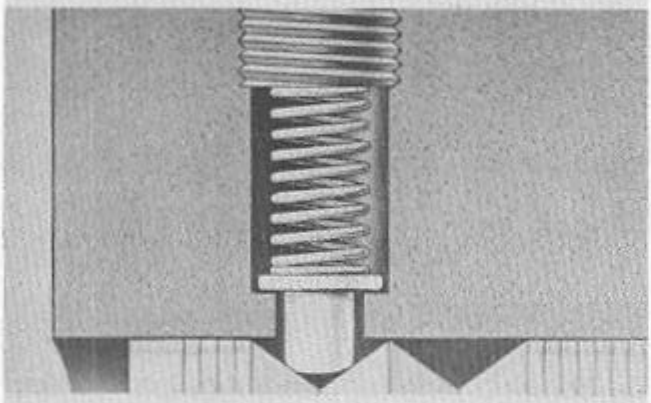


. . .and catch its spring and detent.

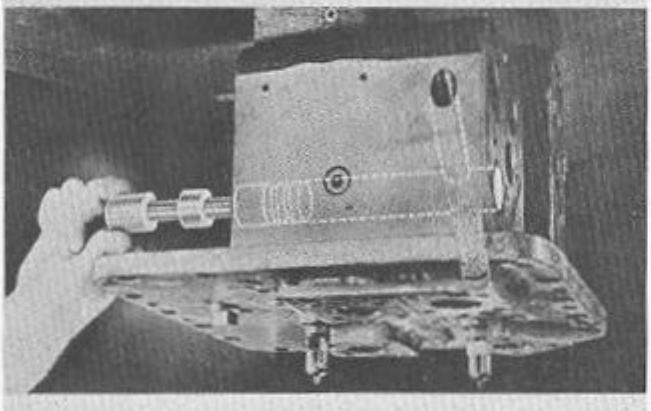




The access hole for the upper detent and spring is located underneath the bottom plate, the same as in the old design, but, . . .



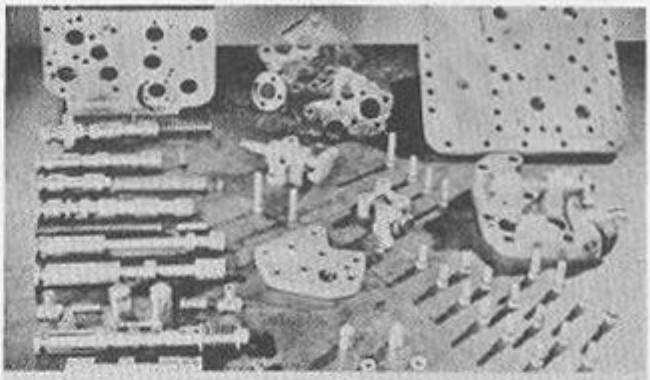
. . .the new rivet type is so constructed that it will not fall out when the directional valve is removed.



In the new design, then, the directional valve can be taken out without removing the bottom plate. And the needle valves will remain undisturbed.

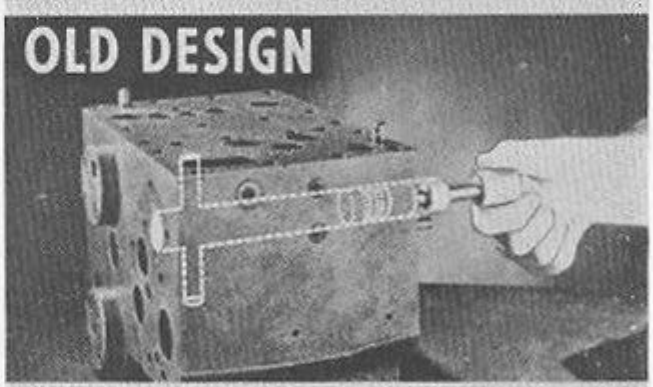
The directional valve is the last one out. So it goes at the bottom of your lineup. And the job is complete. The valve block has been disassembled and you can take a breather until we reassemble it in the next chapter.

Here is the valve block disassembled. Now we'll reassemble it in the same orderly, step-by-step way we took it apart. Reassembly and replacement of the valve block may be divided into four major operations. First, replacement of the valves in the valve block; second, replacement and connection of the T-shaft assembly; third, replacing the valve block into the control unit case; and fourth, connecting the internal and external linkages.



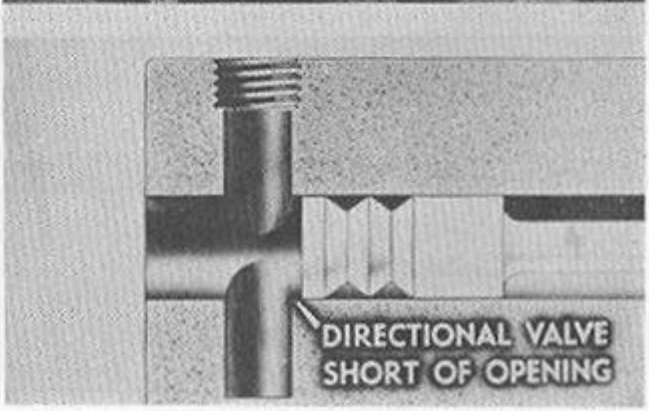
STEP 1

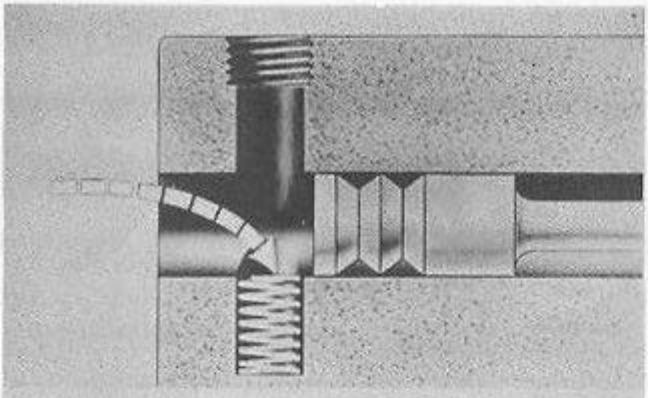
First, we'll take up replacement of the valves, starting with the directional valve—the one that was removed last. Remember there are two designs of directional valves.



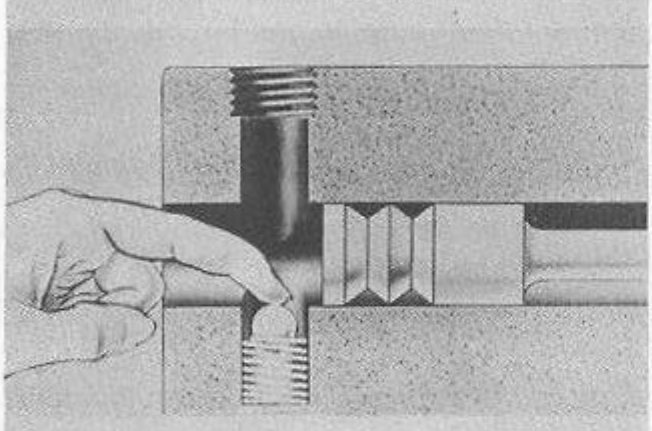
With the old design, first, insert the directional valve from the same side of the valve block through which it was removed. Then, . . .

. . .slide the directional valve into a point just short of the detent spring opening.

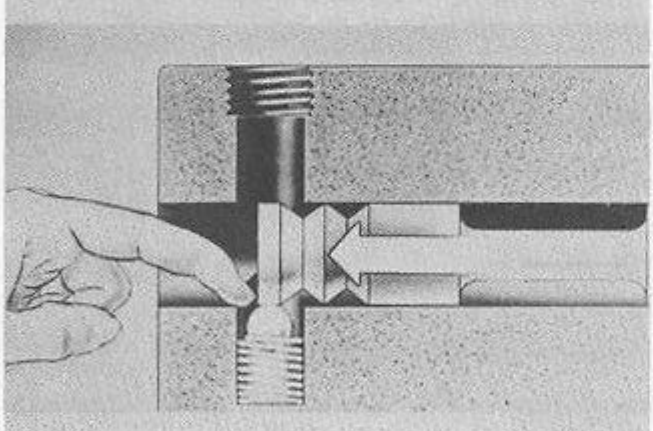




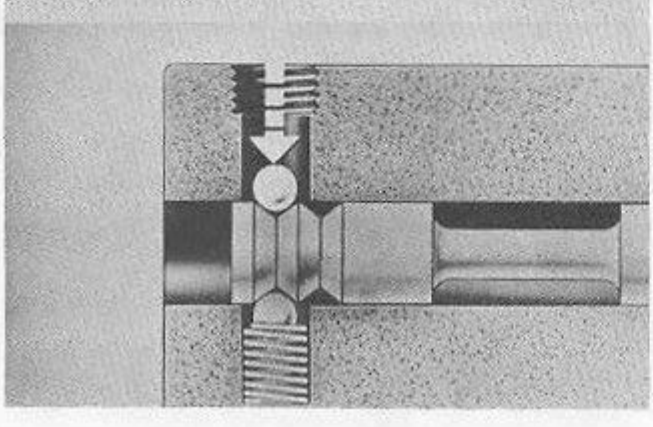
Drop the detent spring into this opening.



Place a ball detent on the spring and press it down. . .

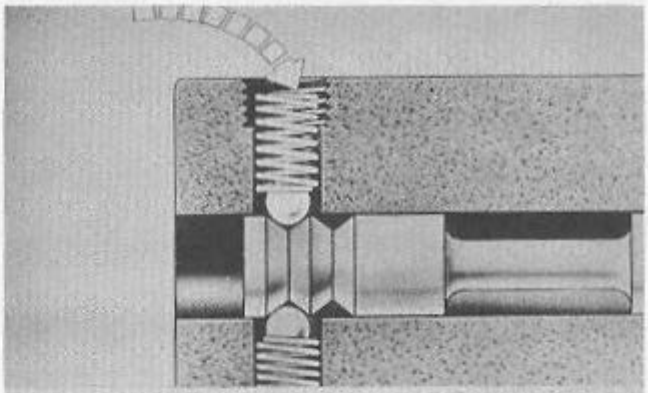


. . .as you move the directional valve into position.

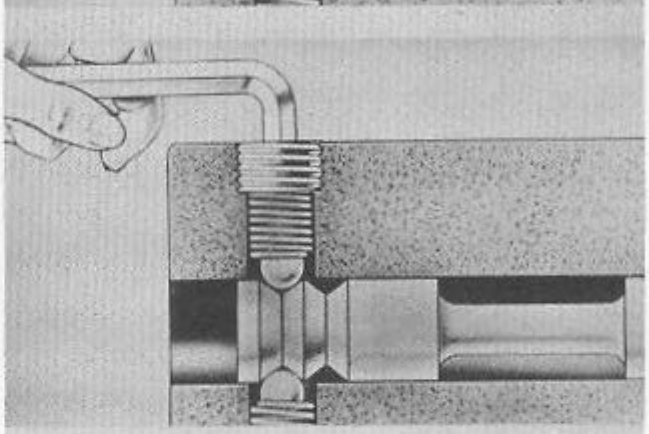


Then, drop in the second detent. . .

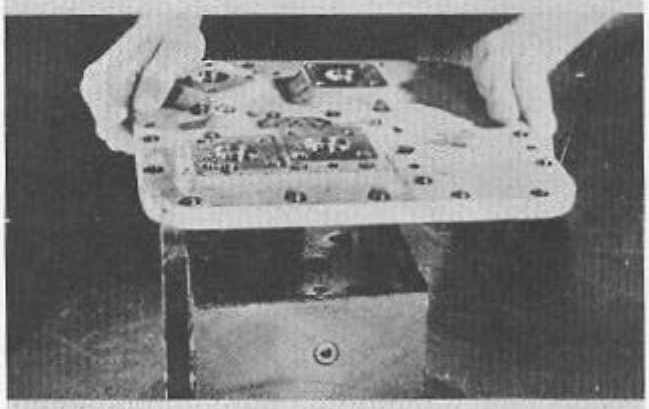
. . .and its spring. . .



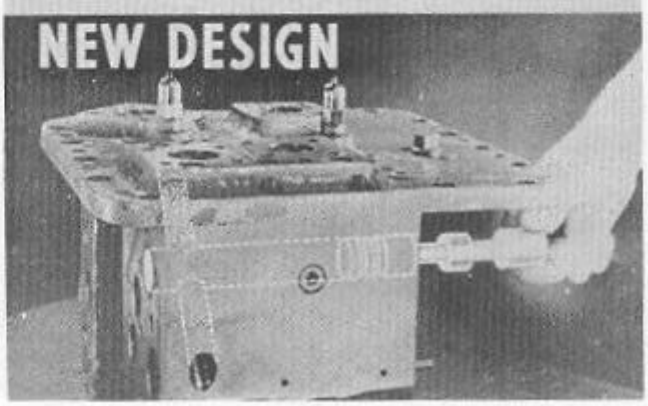
. . .and screw in the Allen plug. Now, . .

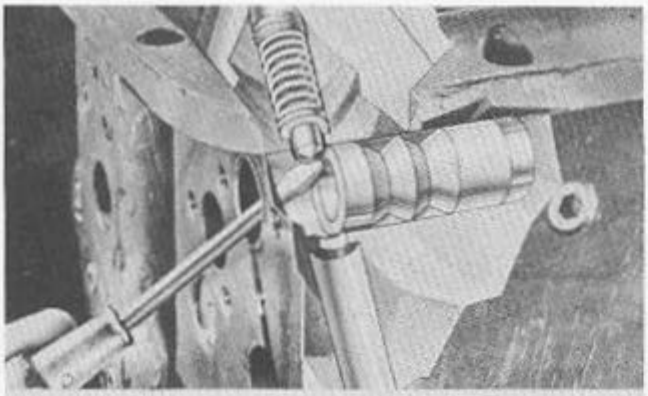


. . .replace the bottom plate. So much for the old design.



For the new design, also insert the directional valve through the same side from which it was removed.

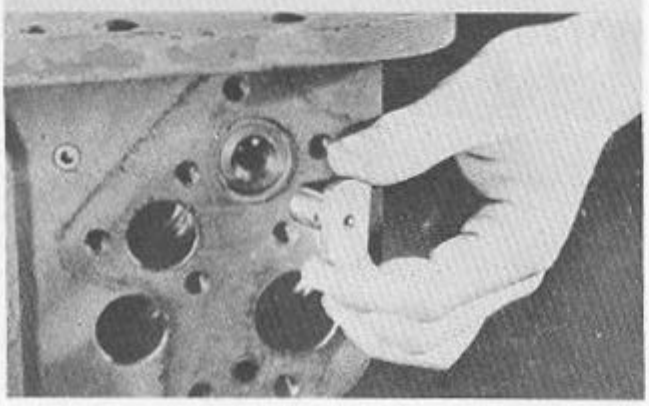




Then push back the upper detent and slide the directional valve into place.

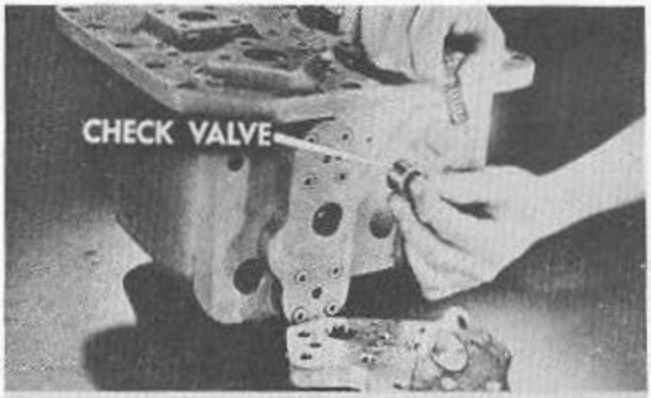
Replace the lower detent, spring, and Allen plug and you are all set with the new design. So much for the directional valve.

The directional shifter valve is next. Slide it in through the same side from which it was removed.

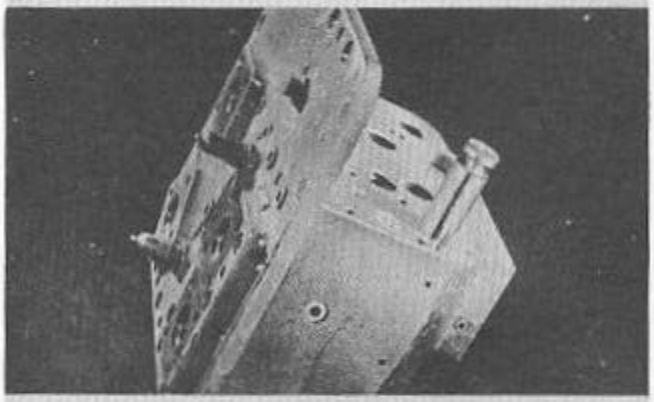


Then, replace the dashpot in the detent end of the directional valve.

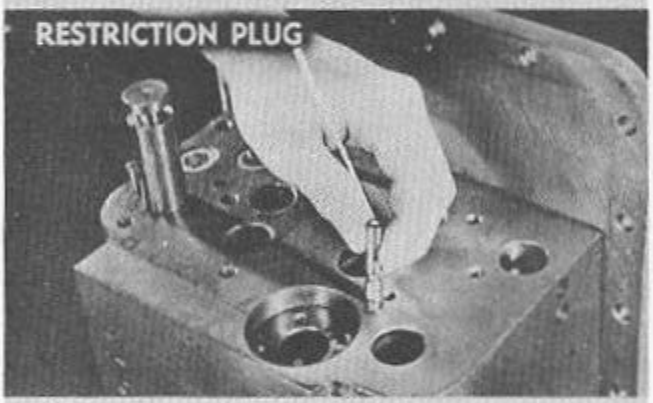
The check valve, its spring, gasket, and the end plate are replaced next. The remaining parts of the valve block belong on the opposite side. So, . . .



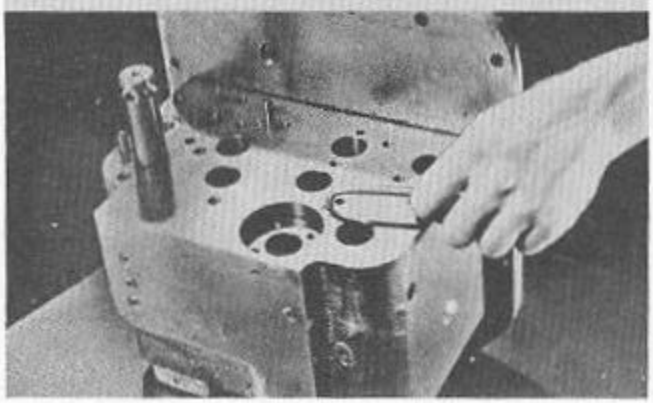
. . .bring the valve block to this position.

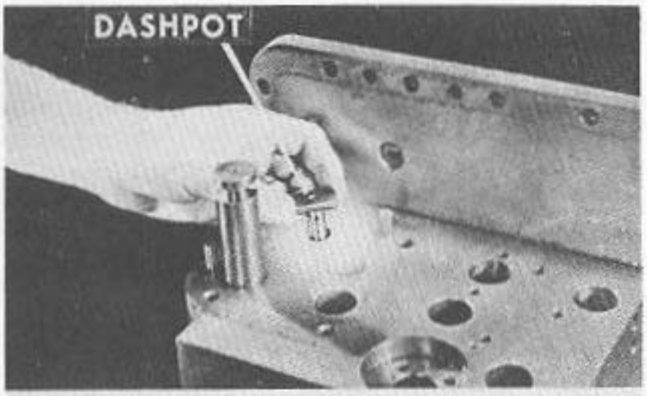


Now, insert the restriction plug in its port with the threaded hole up.

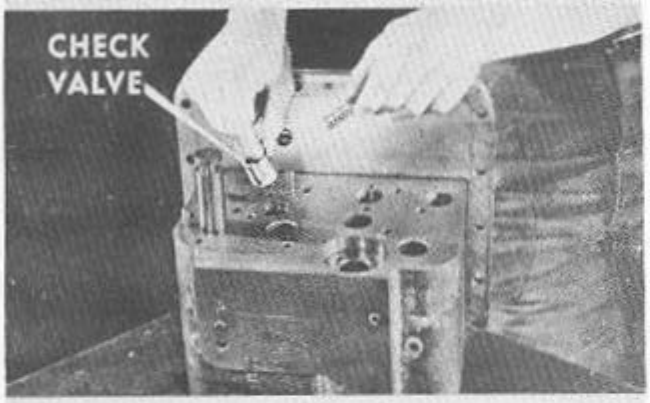


And tighten it, of course.

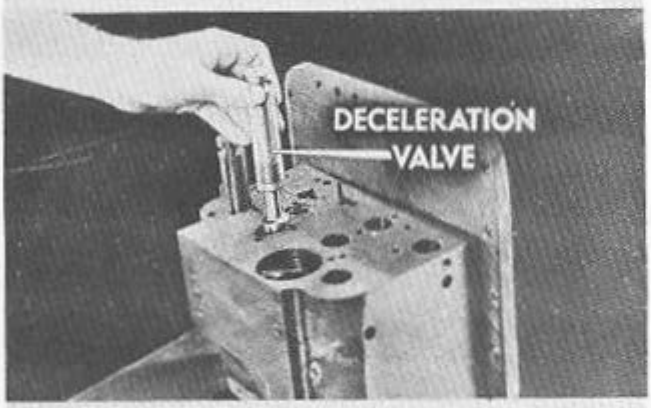




Replace the second dashpot at the end of the directional valve.



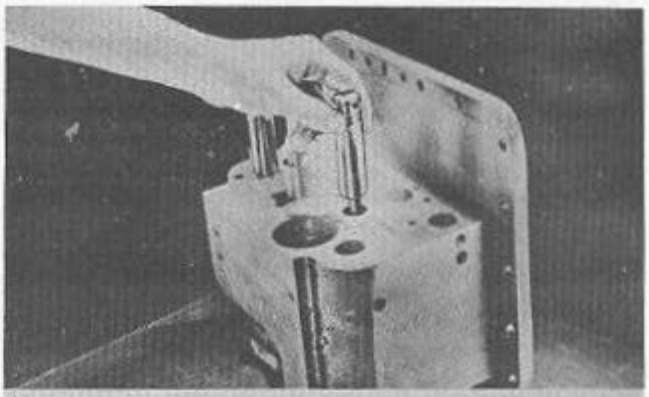
Put the second check valve in place and follow it with the check valve spring.



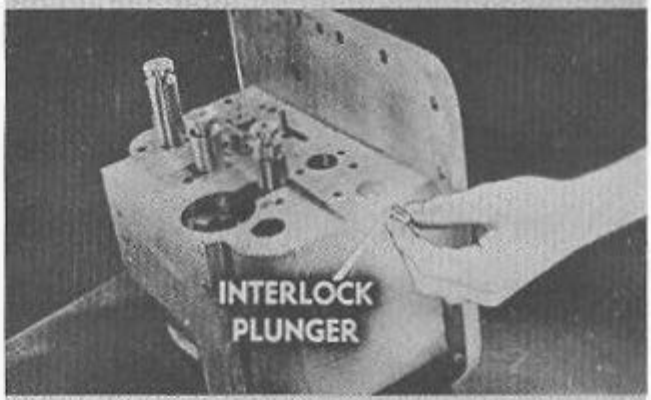
Slide the deceleration valve into its correct port.

Next, the manual bypass valve. . .

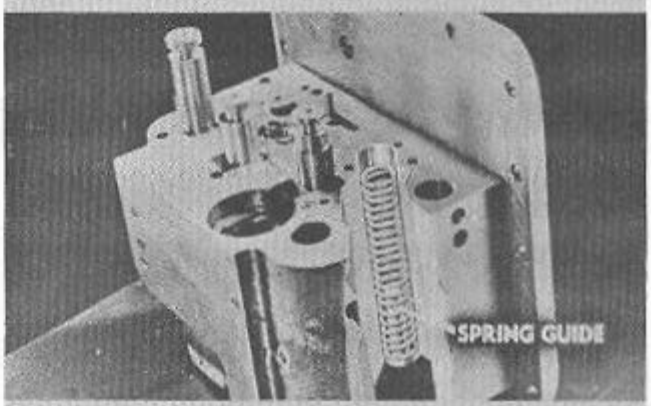
. . .which, also, is returned to its proper port.



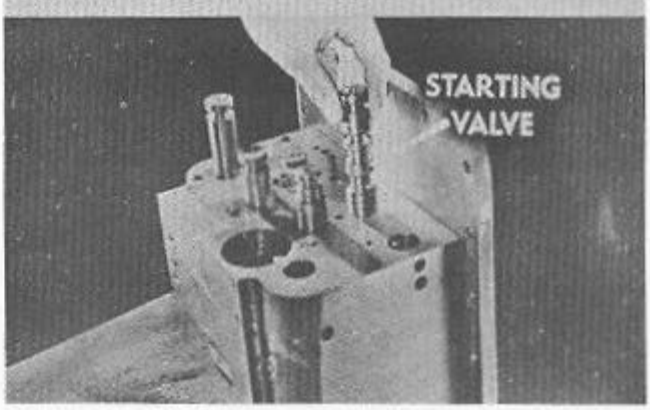
Then, the interlock plunger which goes back in the slot at the side of the interlock shaft opening. The starting valve will be next. . .

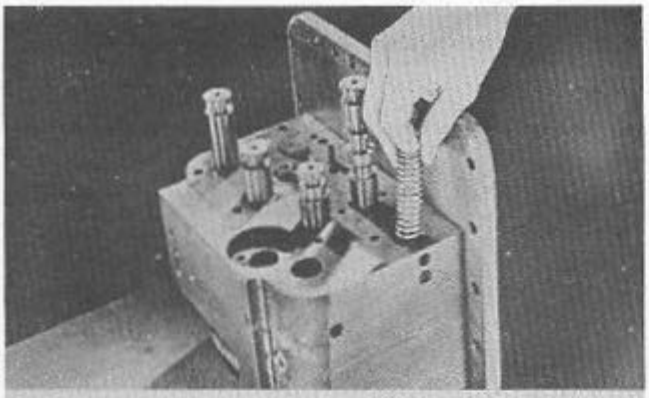


. . .but first, over the spring guide, center the starting valve spring.

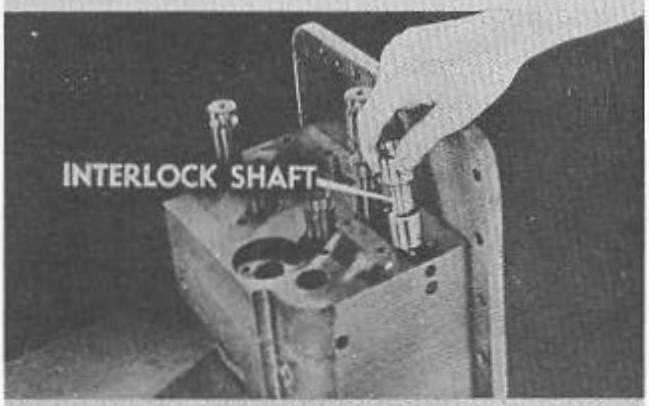


Then replace the starting valve itself.

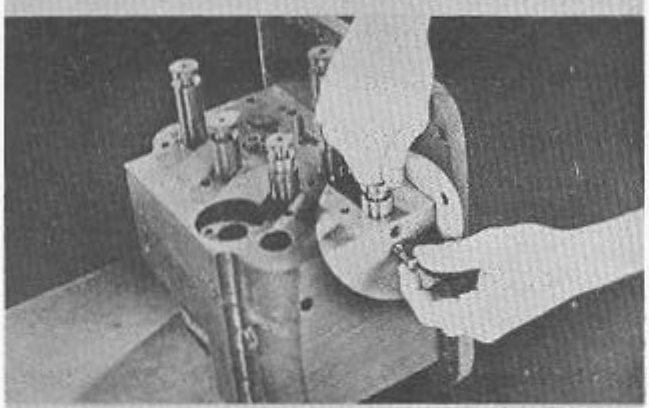




Here is the interlock shaft spring. Know where it goes? Right, in the interlock shaft spring opening. . .



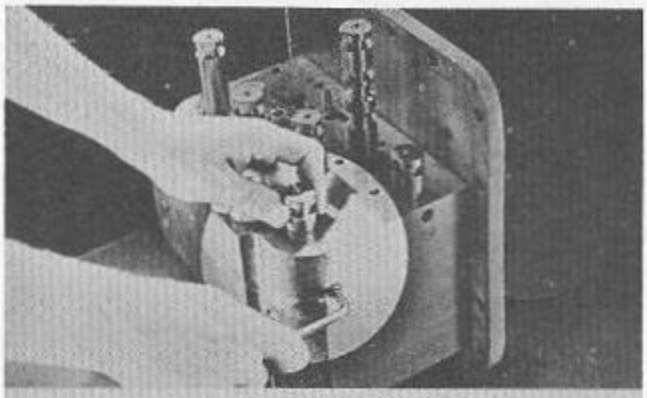
. . .followed by the interlock shaft.



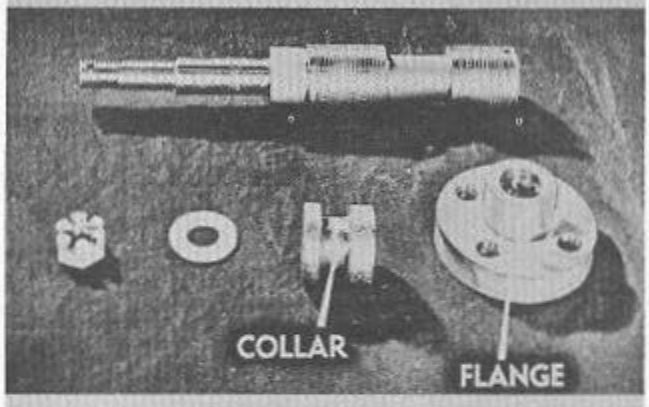
Hold the shaft down against the spring while you replace and tighten the keeper screw and its locknut.

Insert the unloading valve next. . .

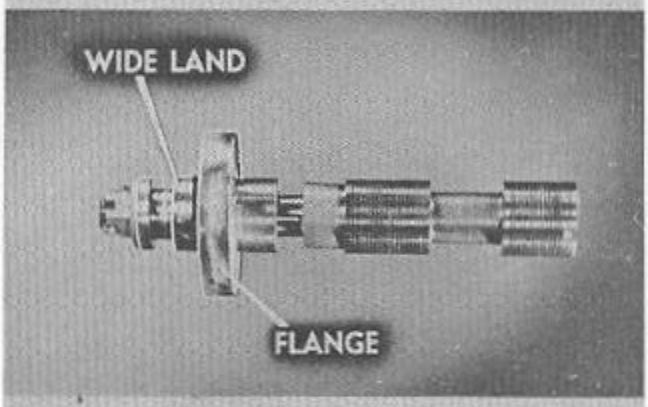
. . .and hold it in place while tightening its keeper screw.



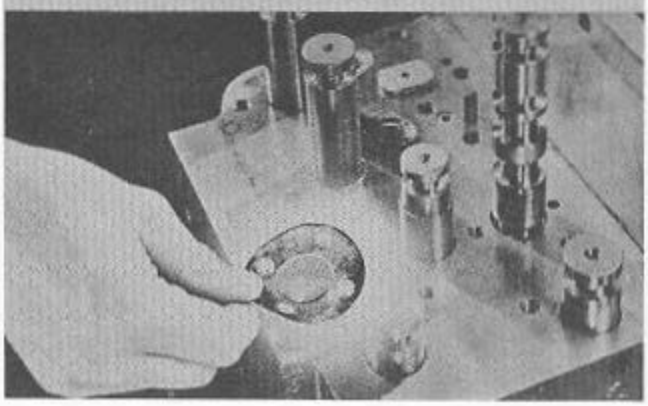
Now for the latch valve. If the collar and flange had to be removed they must be replaced. Remember. . .

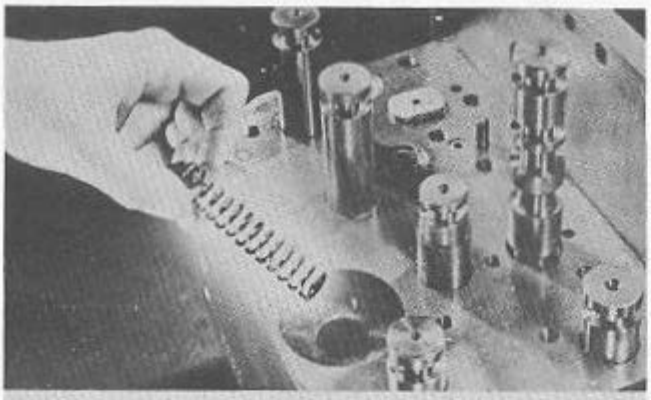


. . .the wide land of the collar must always be replaced next to the flange or the valve will not function properly. Before the latch valve can go back into the block. . .

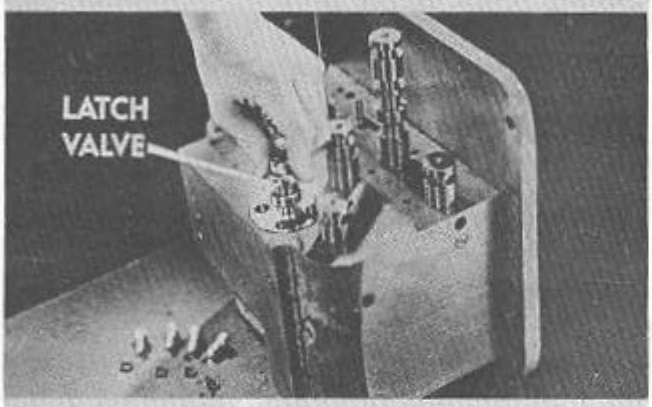


. . .the gasket must be replaced. Be careful or it might tear.

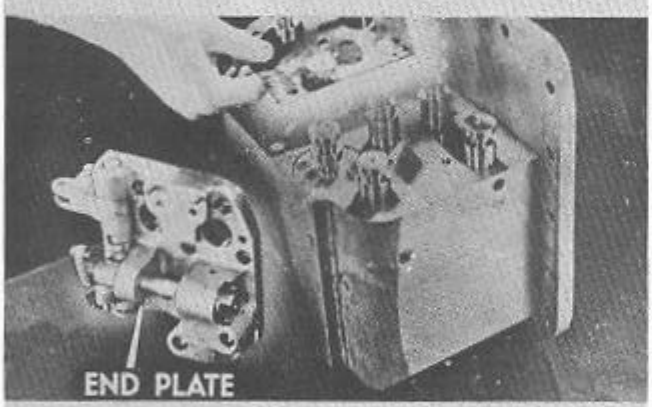




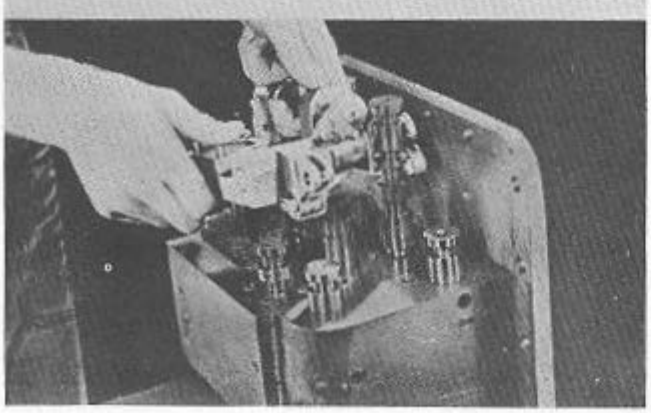
Then, put back the spring. . .



. . .and the latch valve may now be slid in. Make sure the scribe mark on the flange lines up with the one on the valve block. Then, secure the flange to the valve block with Allen bolts.

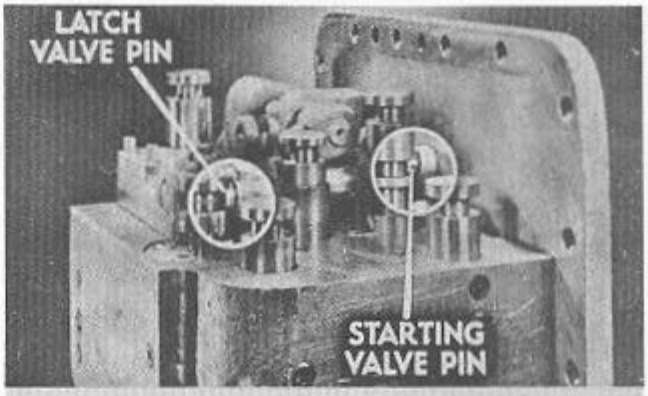


Next, is the end plate to which is mounted the lost motion clutch. First, set the gasket in place carefully.

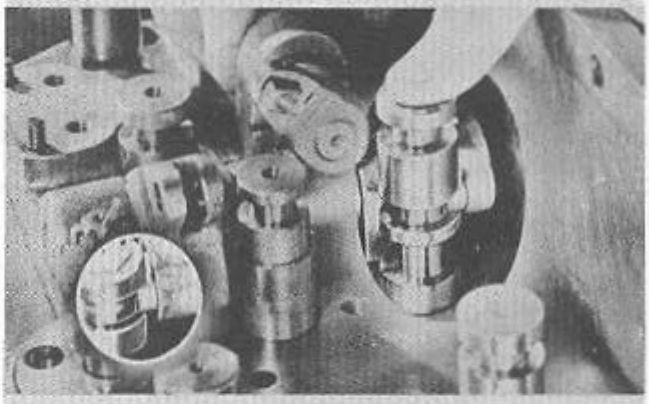


Then, set the end plate down on the gasket.

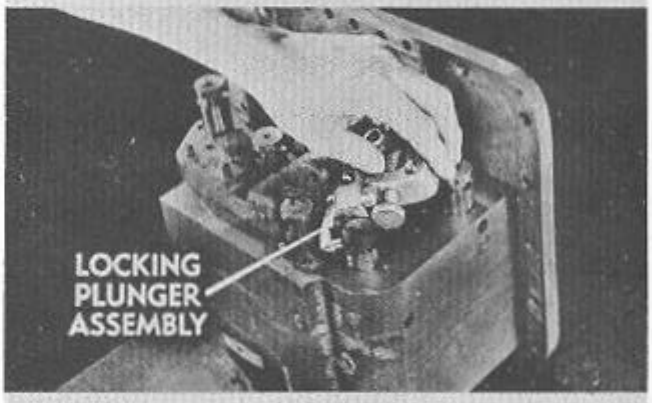
There are two pins in the lost motion clutch—the latch valve pin and the starting valve pin. Push down on the starting valve. . .



. . .until the starting valve pin goes in the middle groove. The latch valve pin can then be engaged. Finally, . . .

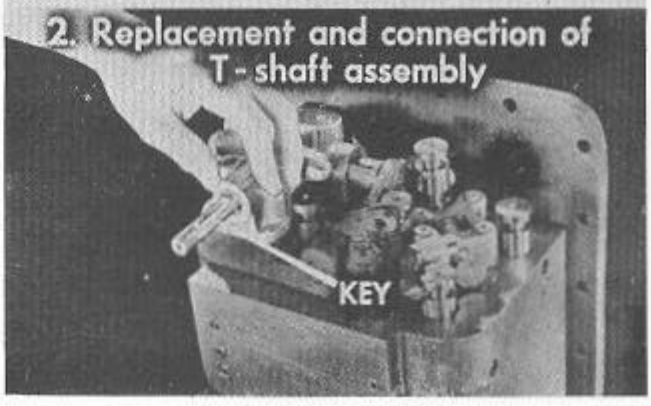


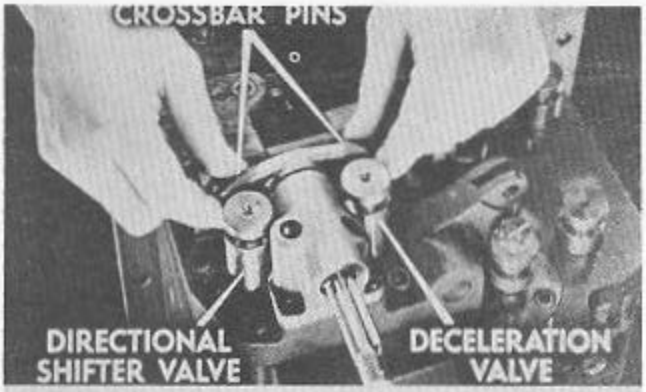
. . .set the locking plunger assembly in place and make it fast with Allen bolts. Well, that completes operation number 1—replacing the valves—and it brings us to. . .



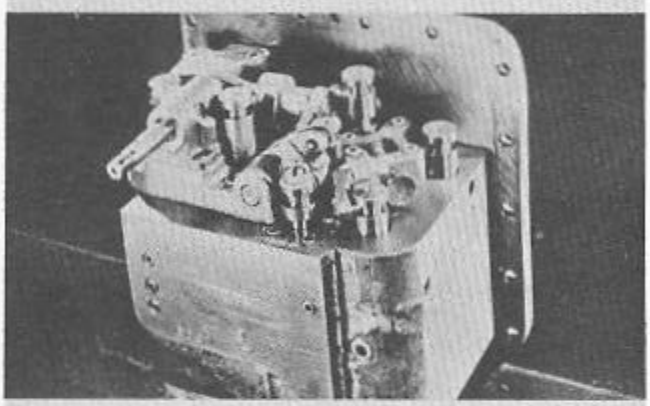
STEP 2

. . .number 2—replacement and connection of the T-shaft assembly. And, with this second operation, there are two things to remember. First, make sure the key faces the same direction as when removed, that is, facing up.

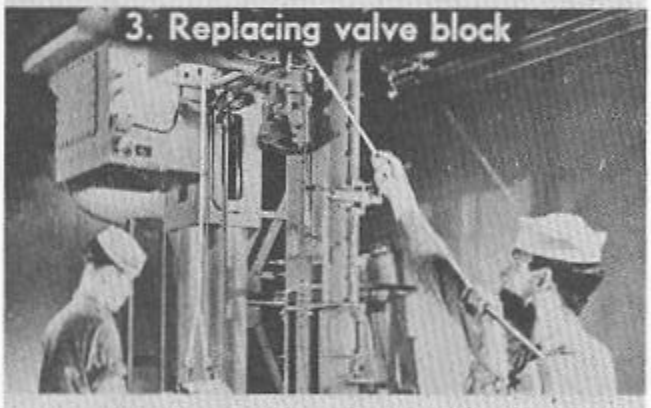




Second, there are two crossbar pins on the T-shaft. You cannot see them here. They are right behind the directional shifter valve and the deceleration valve. But these pins will fit into the grooves on the two valves. When they do, secure the T-shaft assembly.

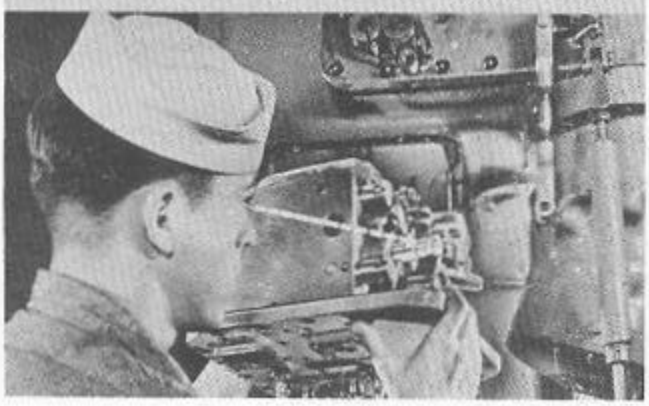


Well, there it is. The valve is not completely reassembled. But it still has to be replaced on the hoist. And that's next.



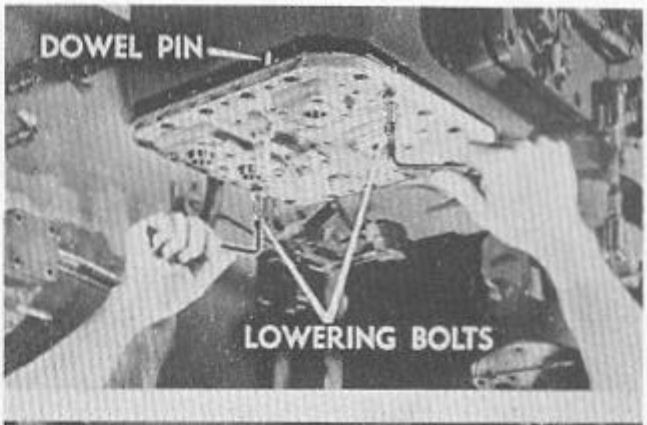
STEP 3

Operation number 3—replacing the valve block. Start right in by attaching a hoist cable and raising the valve block up to the control unit.



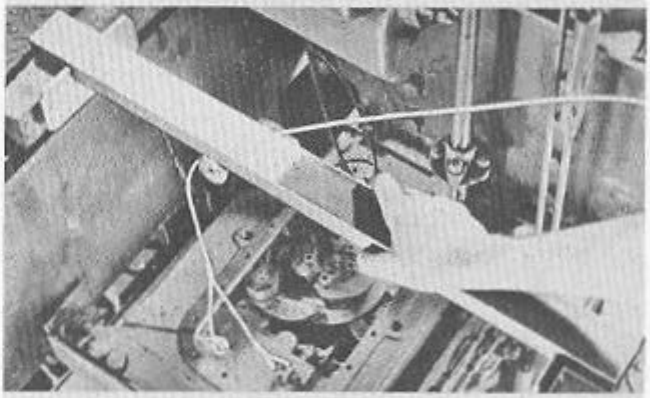
As the valve block goes in, watch that manual bypass valve. Make sure it doesn't become disengaged from its operating crank.

The dowel pin on each side is your guide for replacement. Using these pins, move the bottom plate up just far enough for the lowering bolts to take hold. Tighten up evenly on the two lowering bolt nuts. . .

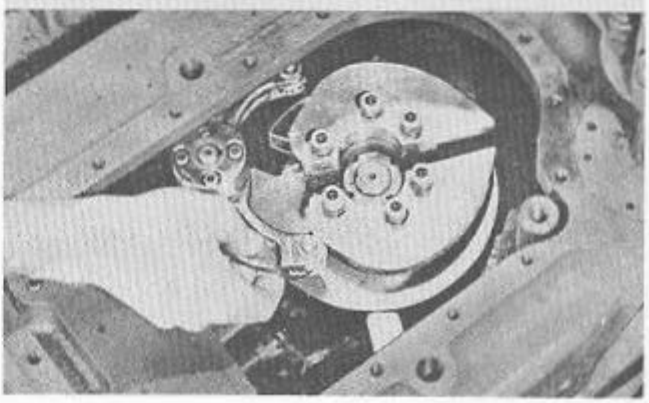


. . .until there is about 3/4 inch space left between the bottom plate and the control unit case. Don't pull the bolts tight or you won't be able to get the rocker arms in place.

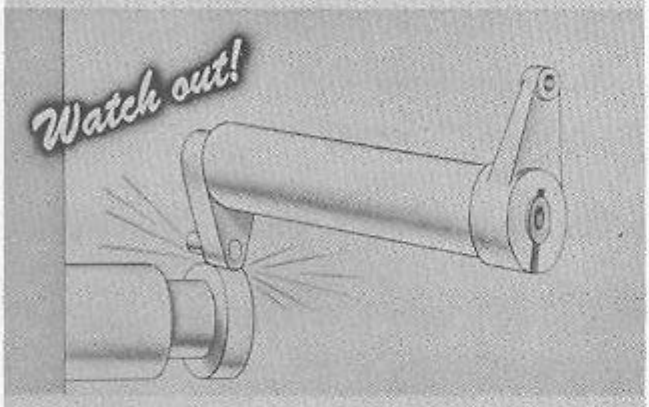
That hoisting gear has served its purpose. So, remove it now. . .



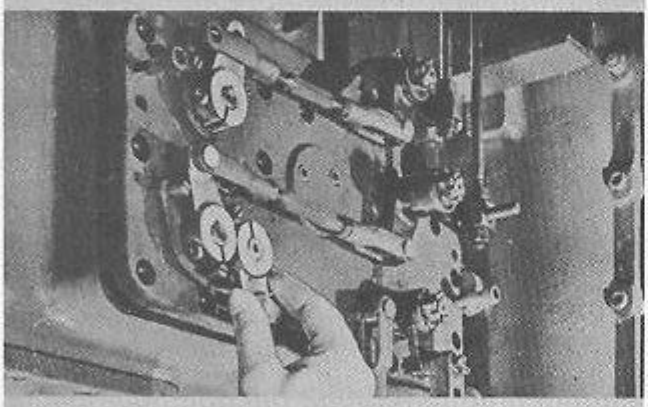
. . .and then replace the rocker arms. Make sure the cams and latches are in midcycle position, as shown here. Then, . . .



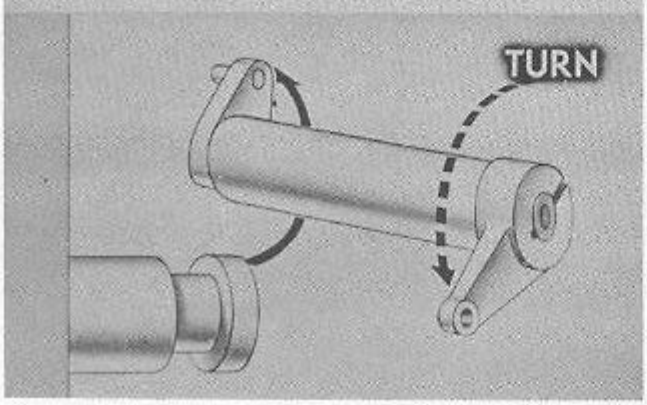
. . .at the lower end, tighten up again on the lowering bolts nuts. While the valve block is being drawn into its final position. . .



. . .watch out or this might happen. A valve head may get hung up on one of the inside linkages. If this occurs. . .

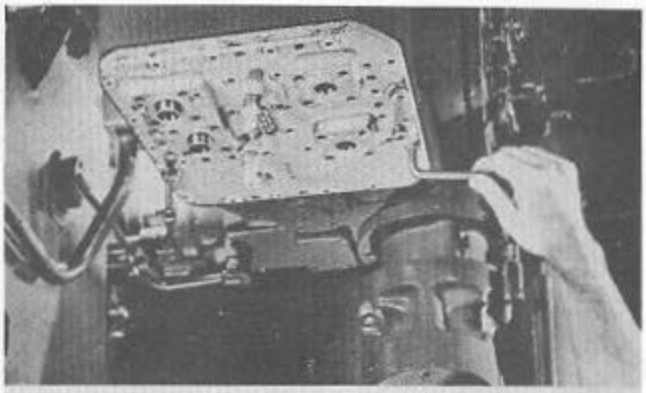


. . .turn each valve crank on the side plate.



As you turn the crank the linkages will be cleared.

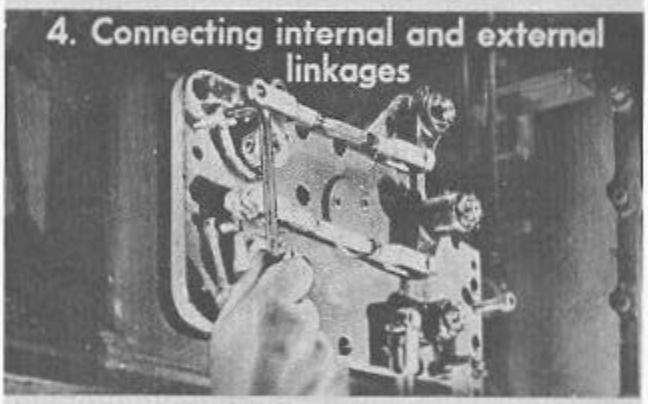
All right, the valve block is in final position and we're now tightening the last Allen bolt in the bottom plate.



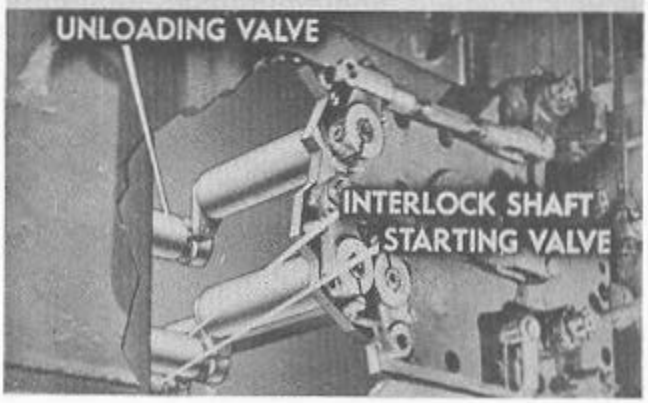
The lowering bolts have served their usefulness, so remove them now and replace with Allen bolts. This secures the valve block. . .

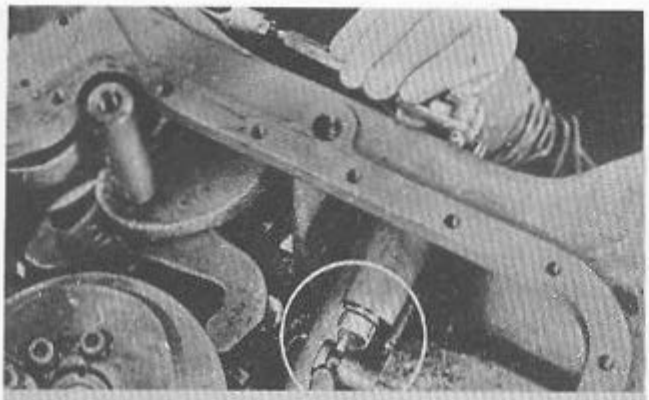
STEP 4

. . .and brings us to step 4—connecting the internal and external linkages. First of all, remove the two jackscrews that have been holding the side plate away from the control unit case. Then, . . .

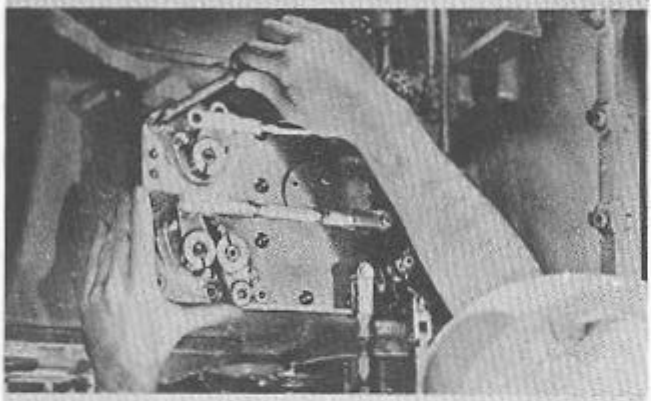


. . .engage the cranks in the heads of the unloading valve, the interlock shaft and the starting valve. You'll have to check this. . .

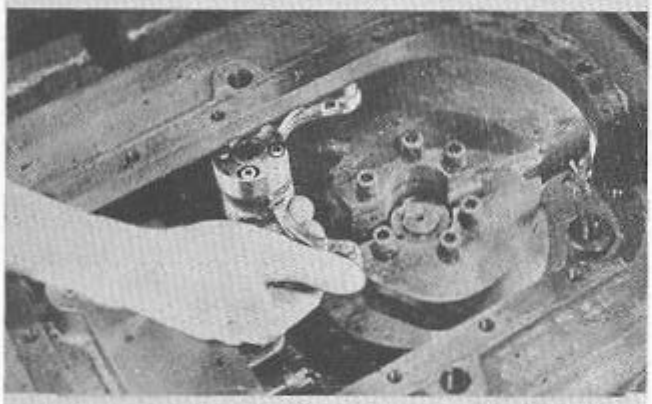




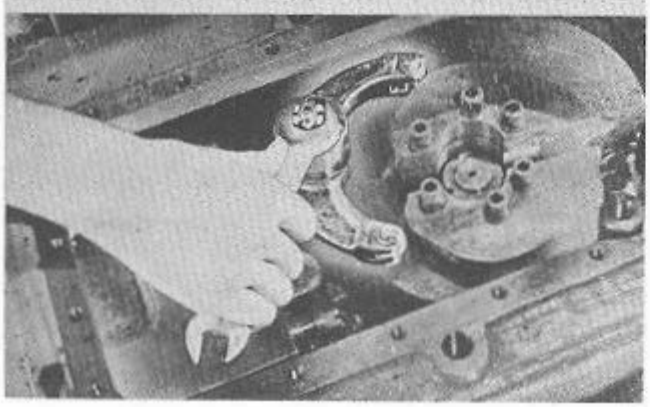
. . .from the top of the control unit. The next step. . .



. . .is to move the side plate into place and tighten up on all the Allen bolts.

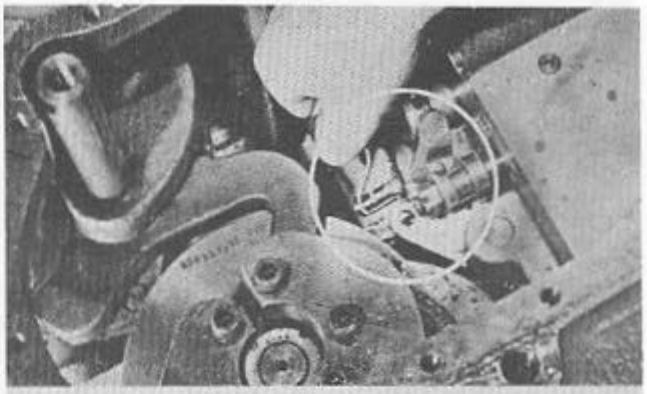


Now, set the rocker arms in their final position on the T-shaft. If the shaft has been correctly replaced, the rocker arms will go on this way.

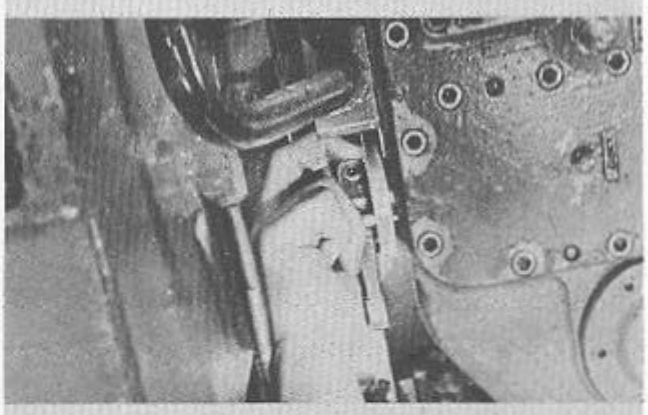


Secure the arms by tightening the locknut making sure the T-shaft crossbar is engaged with the directional shifter valve and the deceleration valve underneath. Then, run the unit to the end of the cycle position and. . .

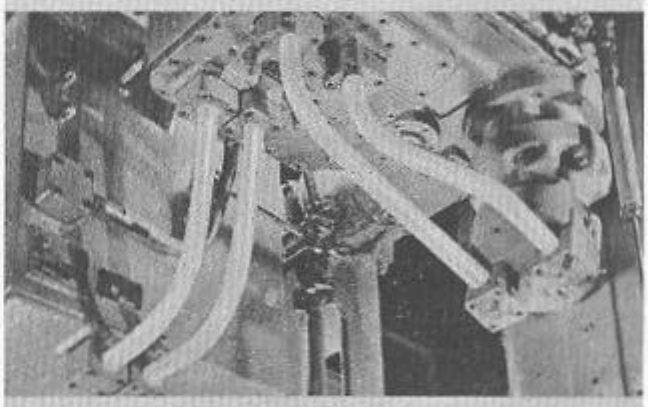
. . .through the upper end of the control unit replace the pin in the linkage that connects the no-reverse latch to the latch valve.



At the lower left side of the control unit, replace the crank arm assembly of the manual bypass valve and reconnect the linkage. Finally, . . .



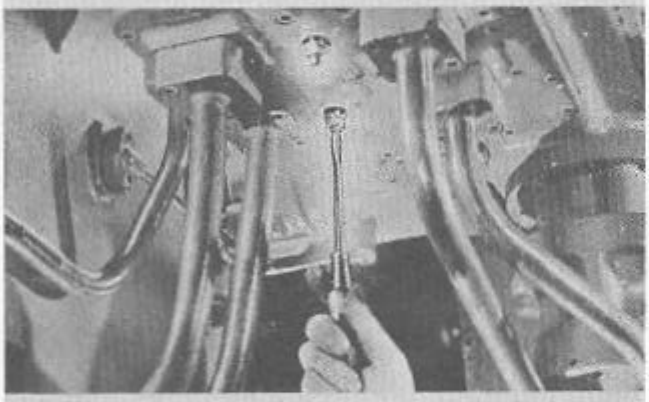
. . .replace all the transmission piping to the bottom of the control unit. The system is empty, of course, . . .



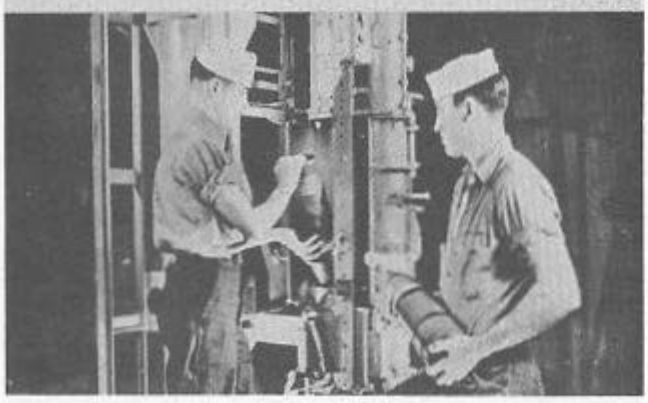
. . .so we must refill it with hydraulic fluid, using a fine mesh screen to filter out foreign matter.

Fill the tank to the lower petcock level. This will take about 20 gallons. Then, . . .

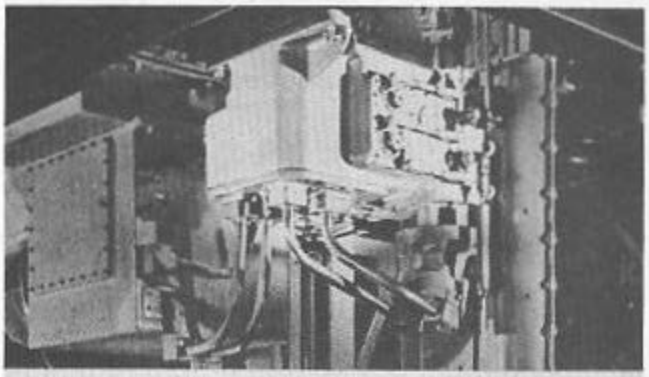
. . .pour 2 gallons more into the control unit case before replacing the cover plate.



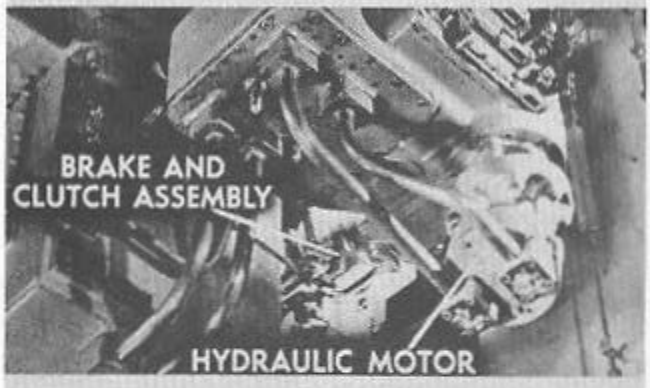
If the needle valve adjustment has been disturbed, each valve must be adjusted until the flights come to a slow, easy stop at the end of a cycle during power operation. Well, that's all there is for the valve block. It's not a hard job and it may be done any number of times. . .



. . .without affecting the operation of the hoist, providing the disassembly and re-assembly procedures are properly carried out.



In this chapter we will see how the entire control unit can be removed from the hoist and completely disassembled. Two of its parts—. . .



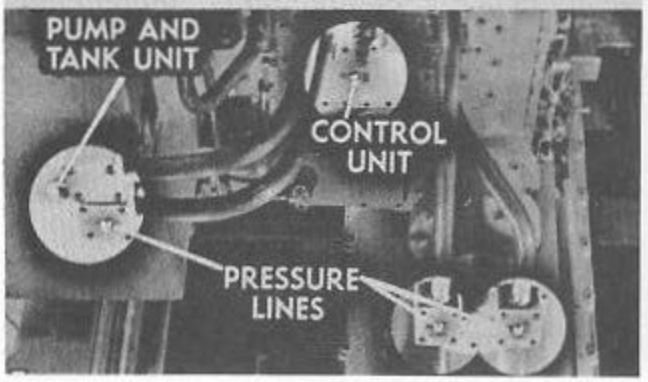
. . .the brake and clutch assembly, and the hydraulic motor will remain attached to the control unit until after it has been lowered from the hoist.

REMOVAL

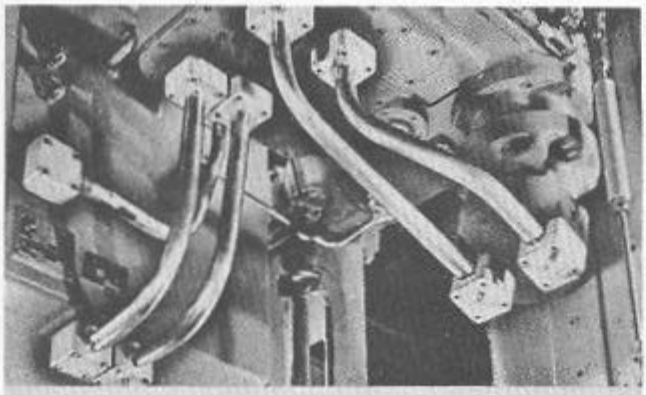
Removal of the control unit is divided into 3 main operations; first, the preparatory steps; second, disconnecting the external linkages; and third, lowering the control unit.

REMOVAL STEP 1

First, the preparatory steps. This consists of draining the hydraulic fluid from three parts of the system—. . .



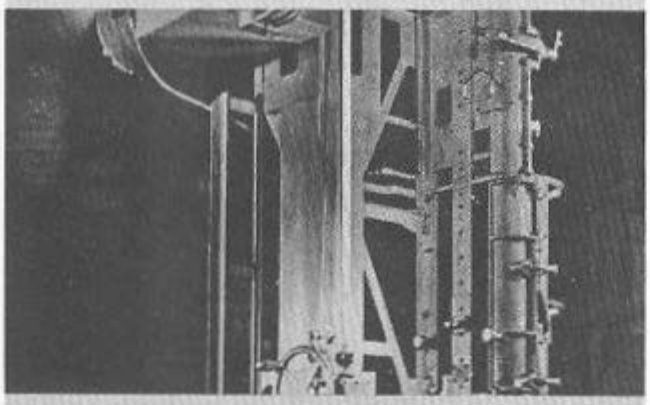
. . .the pump and tank unit, the control unit, and the pressure lines. After draining. . .



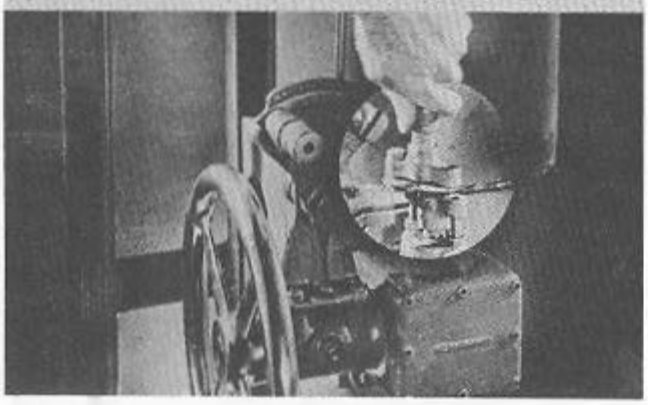
. . .remove all the tubing for the hydraulic fluid. That's all there is to the preparatory steps. Now we are ready. . .

REMOVAL STEP 2

. . .for number 2—disconnecting the external linkages, that is, the manual drive shaft and, above it, the linkages on the side of the control unit.

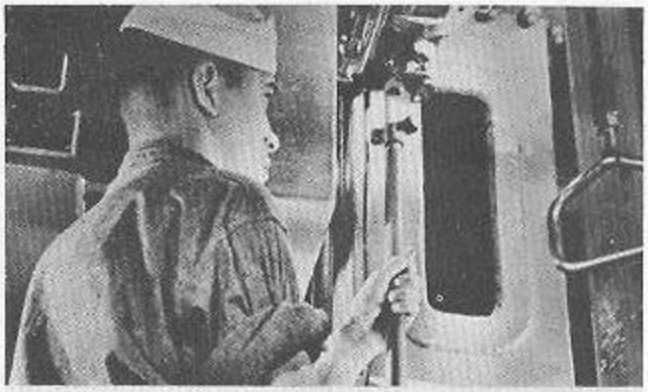


To remove the manual drive shaft, which connects the handwheel to the brake and clutch assembly. . .

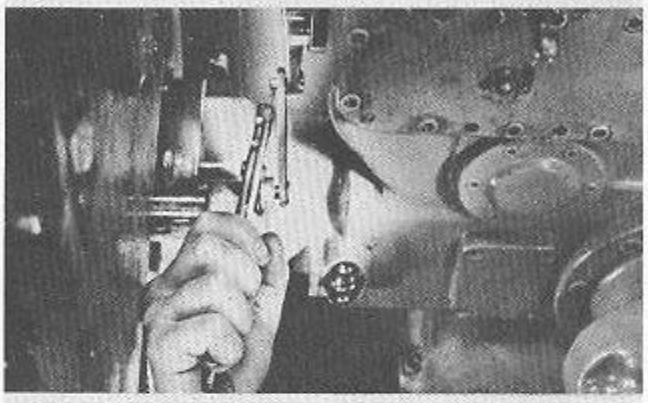


. . .disconnect the coupling at the lower end. . .

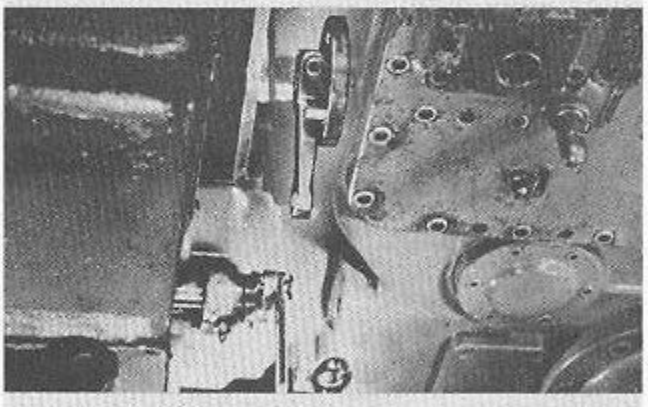
. . .and also disconnect the coupling at the upper end. The shaft will now be entirely free.



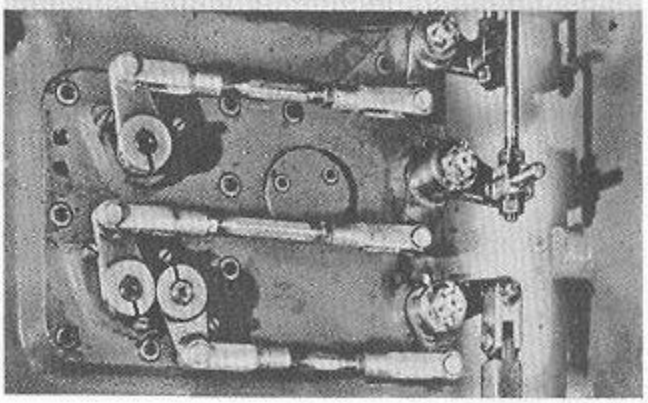
Next, disconnect the linkage for the manual bypass valve. . .

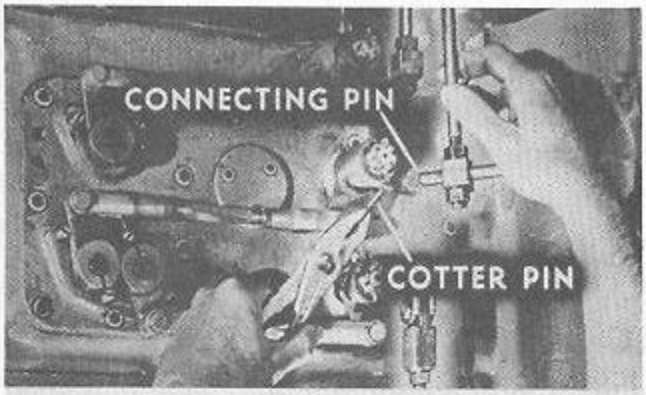


. . .and let this linkage hang loose.

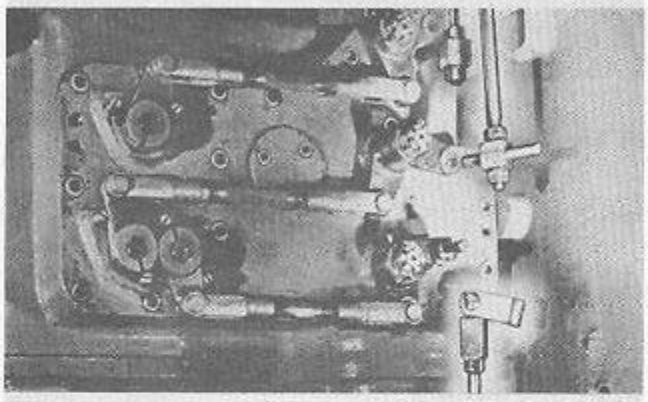


Now, disconnect the three linkages at the opposite side of the control unit. Each linkage. . .





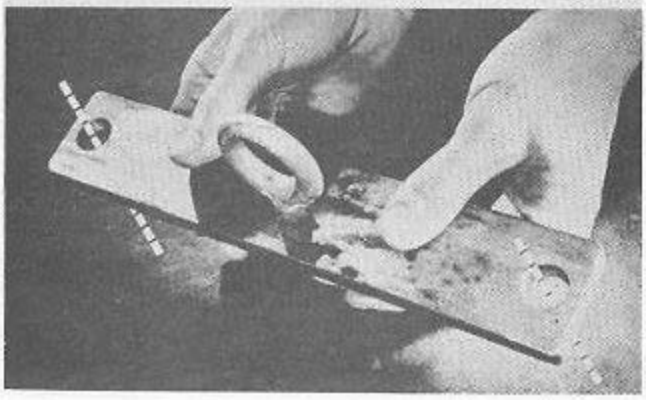
. . .has a connecting pin which is held in place by a cotter pin. When the cotter pins are removed. . .



. . .the linkages will hang free. This takes care of the external linkages.

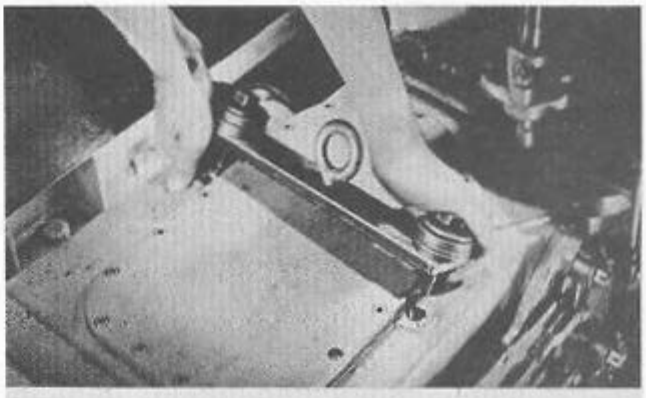
REMOVAL STEP 3

Third action is—lowering the control unit. To do this. . .

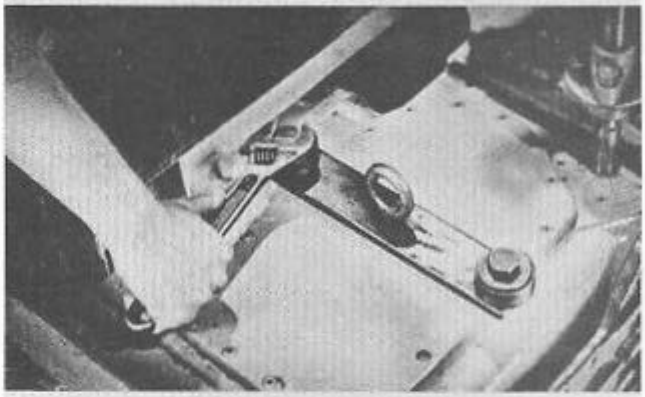


. . .we need a ready-made bar and pad eye. If such a bar is not obtainable, a strap may be used similar to the one employed in lowering the valve block.

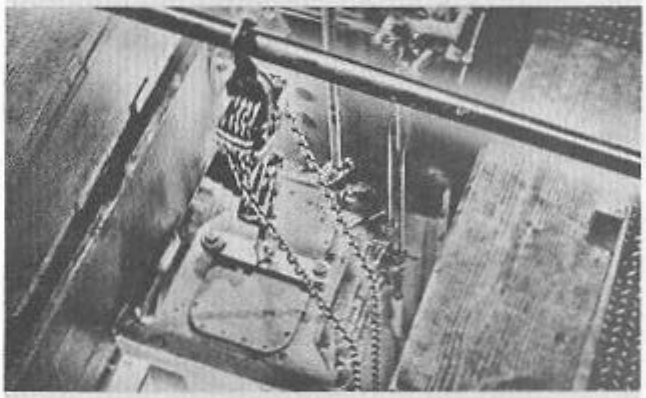
All right, now insert bolts in the bar. . .



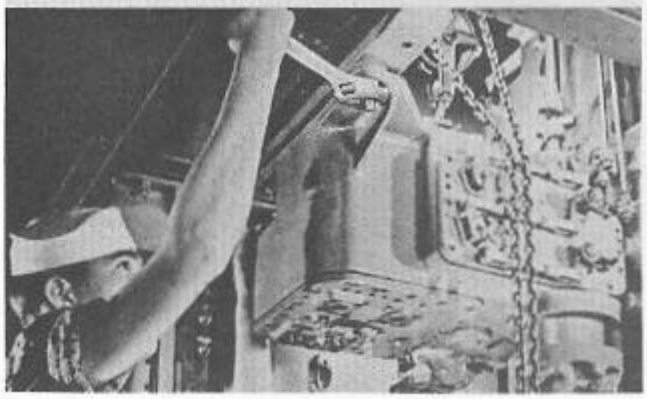
. . .and make it fast to the control unit.

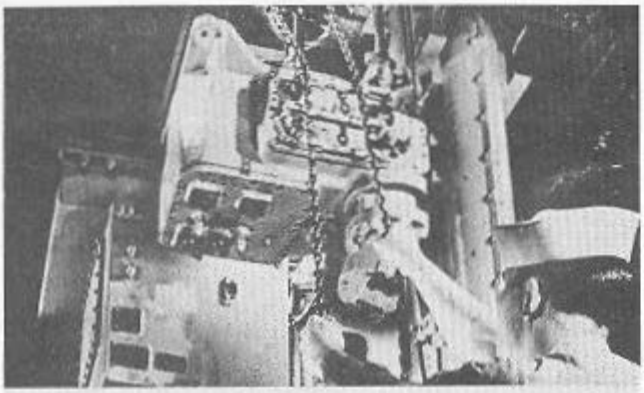


Then, rig up a chain fall or a block and tackle. Take the slack out of the line and secure it so that the control unit will not drop. . .

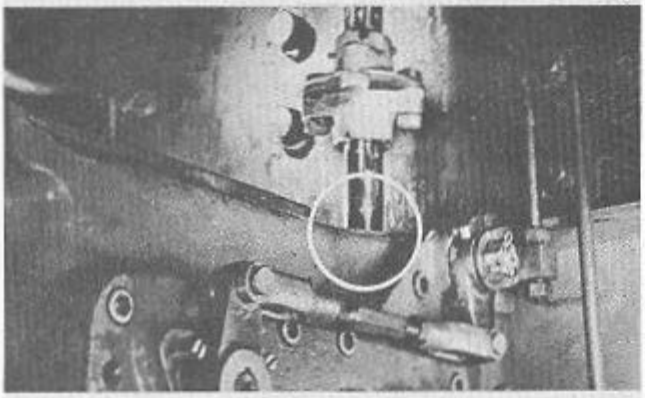


. . .when the four bolts that hold the unit are removed.

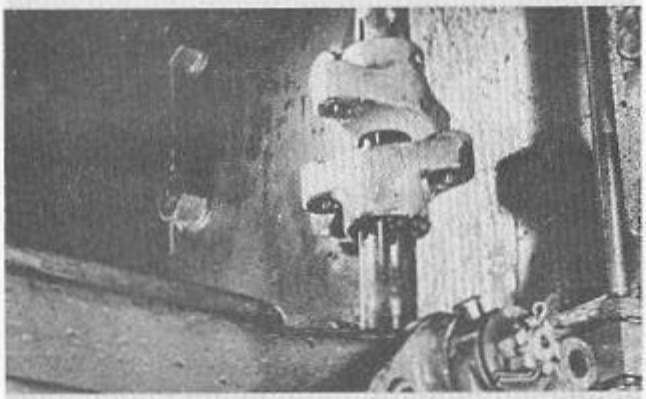




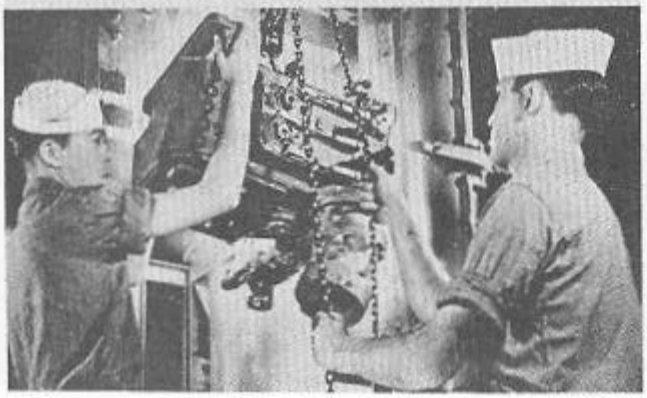
Then, ease off carefully, and lower away.



Make sure the power drive shaft slides out. If it does not. . .



. . .disconnect the self-aligning coupling.



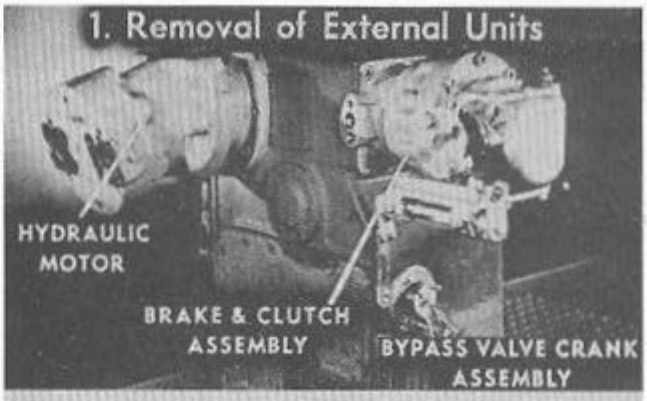
The control unit can now be lowered to the deck. And the job of removal is complete.

DISASSEMBLY

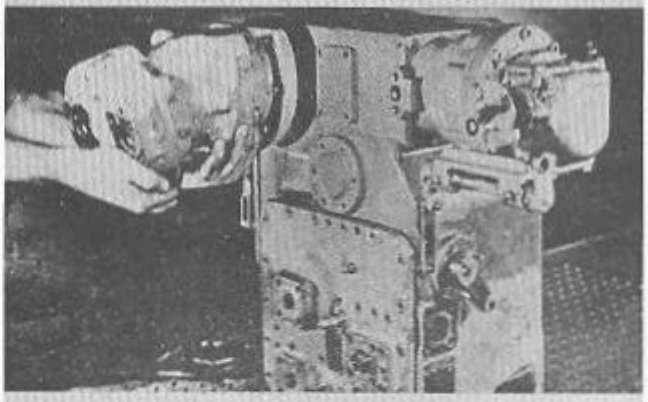
Disassembly of the control unit includes five major operations; first, removal of the external units; second, disconnecting the internal linkages between the valve block and the cam and latch assembly; third, removal of the valve block; fourth, removal of the worm shaft, worm, and output shaft assembly; and fifth, removal of the timing cam assembly and shaft.

DISASSEMBLY STEP 1

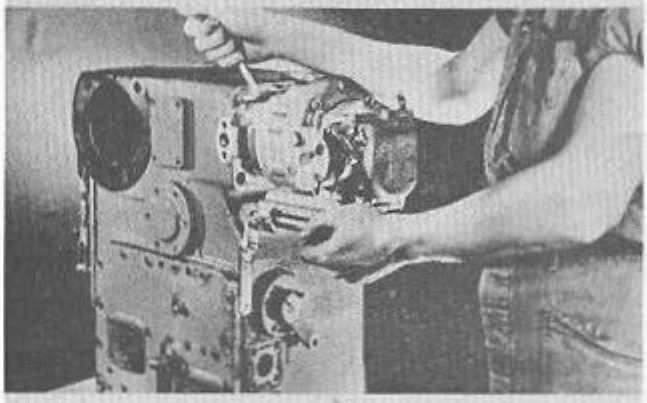
First we start with removal of the external units. These are the hydraulic motor, the brake and clutch assembly, and the bypass valve crank assembly.



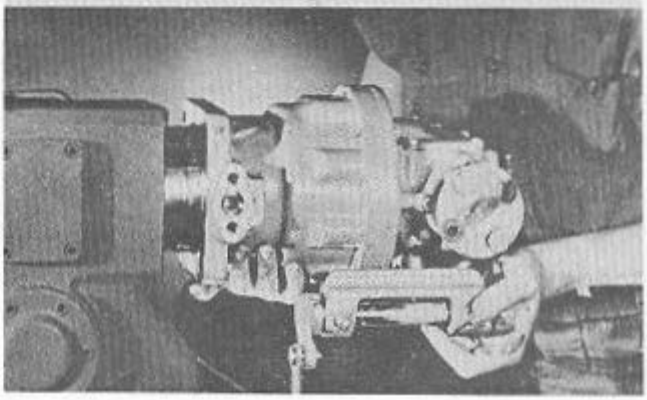
The hydraulic motor is removed first. The drive shaft has a splined connection and should come out freely.

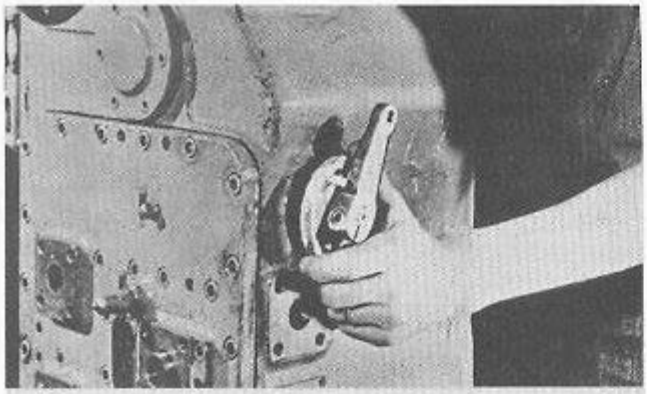


The brake and clutch assembly can be pulled out after removing the four Allen bolts from the mounting flange. But this assembly. . .

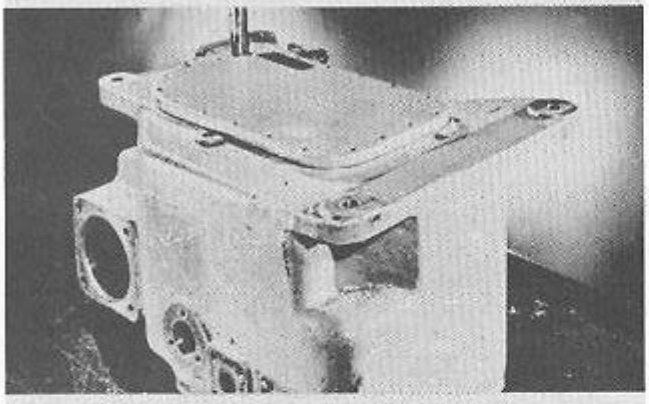


. . .must be pulled out straight, because of the closely fitted, splined construction of the drive shaft.

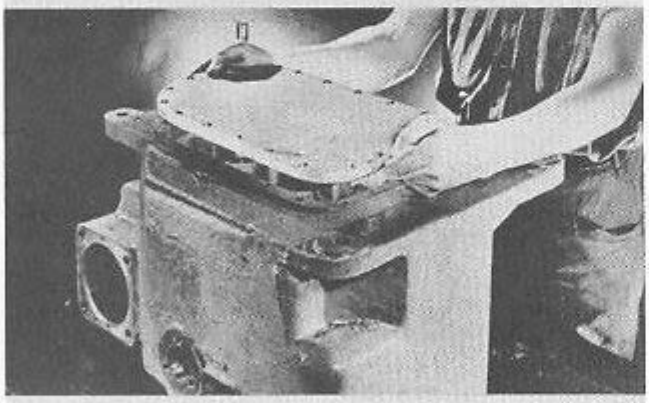




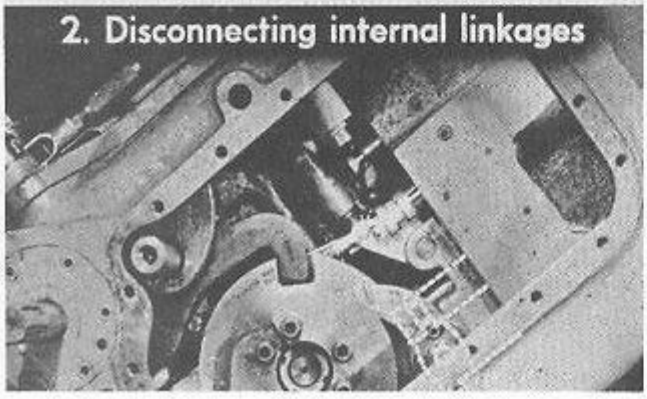
Then, remove the manual bypass valve crank assembly.



Position the control unit now so that the top cover plate faces up, like this.



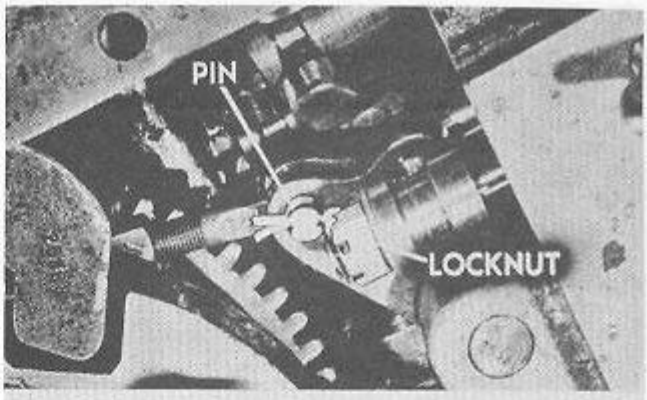
After removing the plate we are now ready. . .



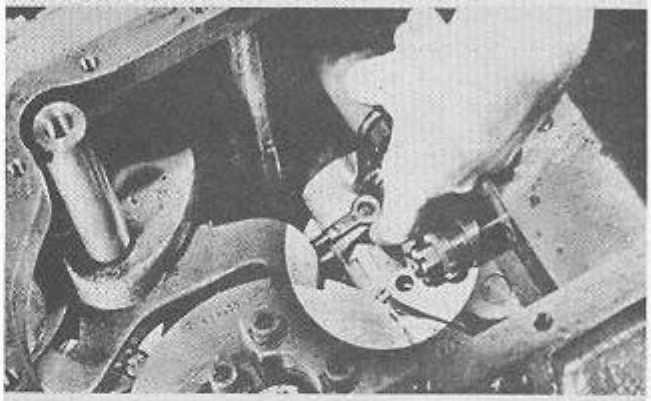
DISASSEMBLY STEP 2

. . .for operation 2—disconnecting the internal linkages. One linkage is clearly visible here. The second is indicated by dotted lines. The visible linkage is disconnected first. To do this. . .

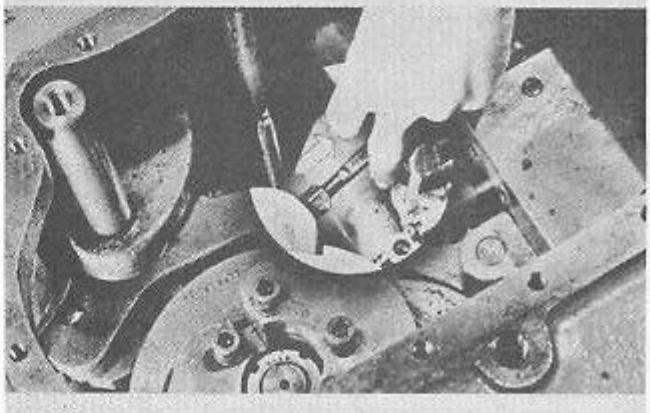
. . .remove the pin from the no-reverse latch linkage at the latch valve. Notice the locknut, but don't loosen it. Then, with the pin out, . . .



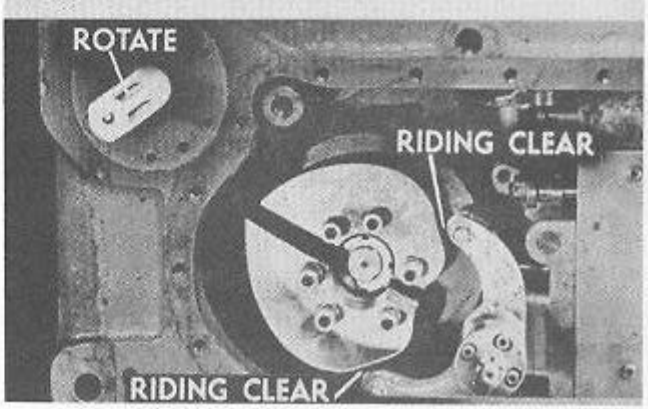
. . .the linkage will pivot clear of the latch valve as indicated by this arrow. We can now start to remove the rocker arms.

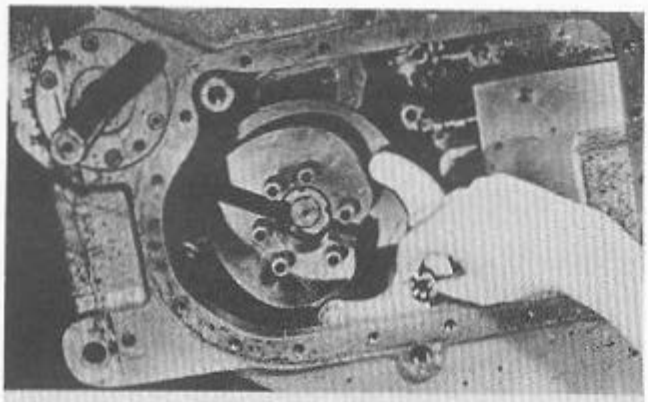


Pull the no-reverse latch linkage in the direction indicated. This is to disengage the no-reverse latch from the notch in the no-reverse cam. Now, . . .

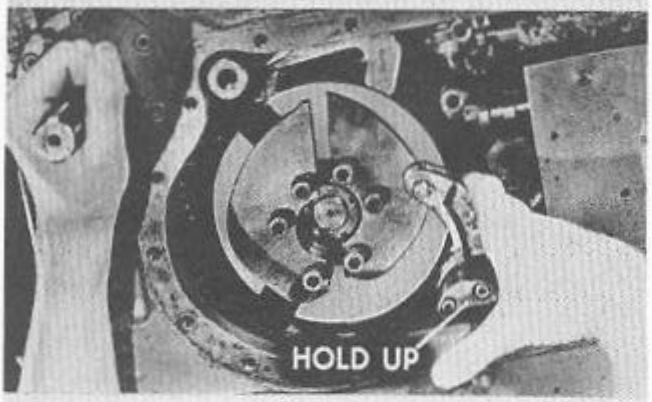


. . .rotate the output shaft to the midcycle position. Note that the rocker arms are riding clear of the deceleration cams.

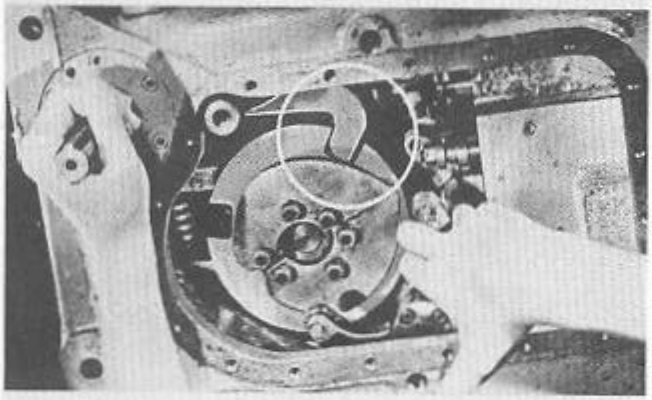




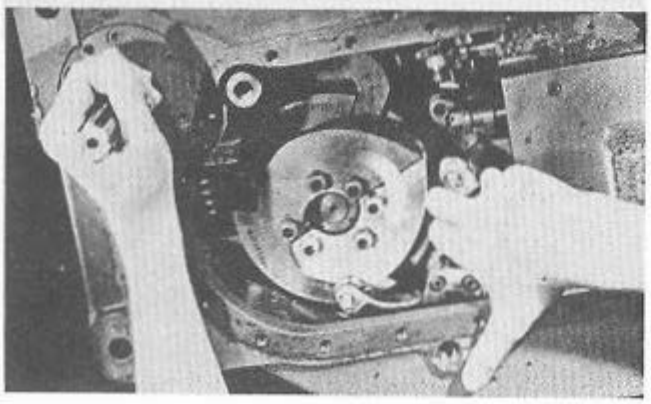
Remove the large nut and lockwasher holding the rocker arms.



Hold up the rocker arms as far as they'll go and rotate the output shaft. . .

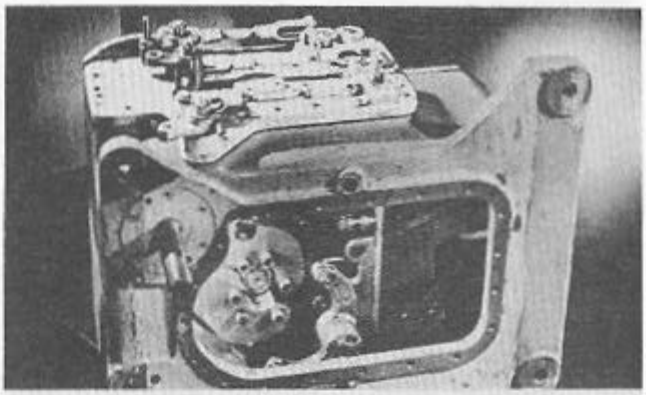


. . .until the timing plunger drops into the notch in the timing cam. Be sure the output shaft is rotated. . .

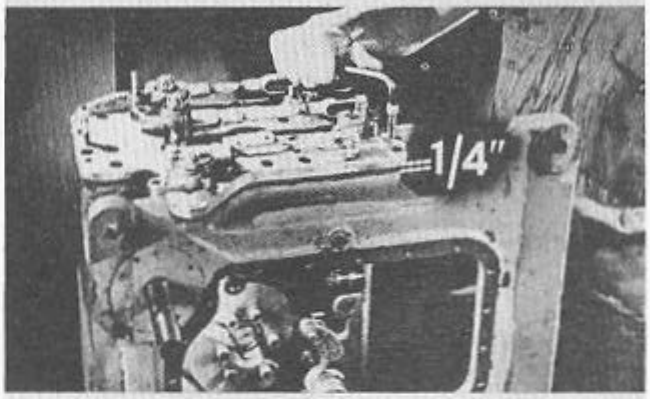


. . .so that the under cam moves in the direction of this arrow, that is, toward its rocker arm. In this way the cam and the rocker arm will not bind. Leave the rocker arms in this position temporarily.

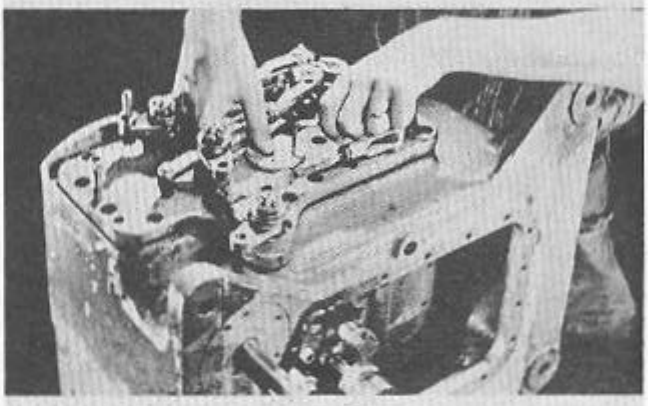
Now, position the control unit so the side plate faces up. Then, . . .



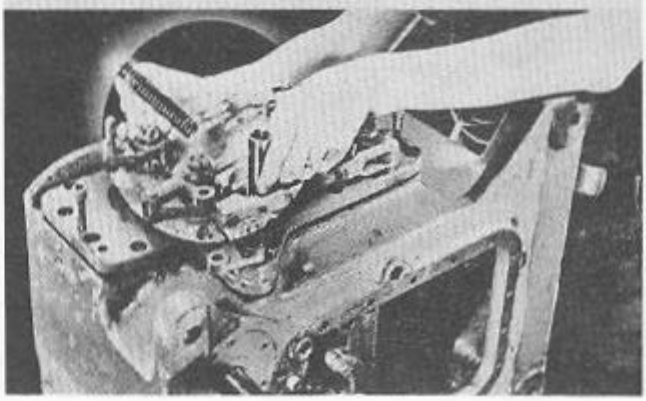
. . .by means of the jackscrews, raise the plate approximately one-fourth inch. This will cause the valve cranks underneath the plate to disengage as the plate is raised.

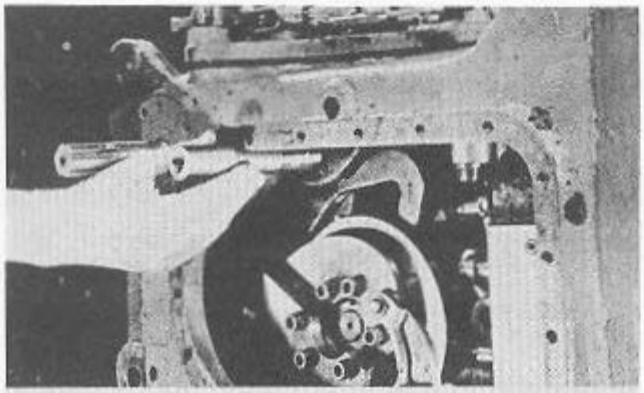


Now, press down on the small cover while removing the Allen bolts. Take off this cover. . .

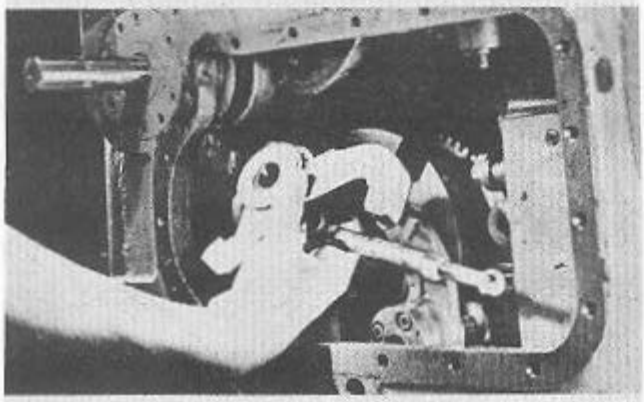


. . .and remove the stop latch spring and plunger that are mounted beneath it.

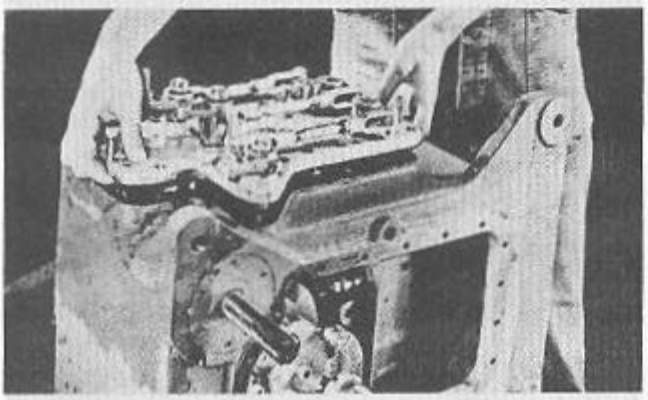




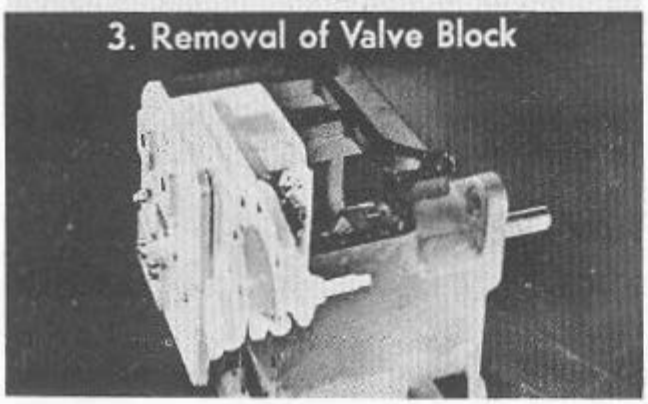
Pull out the pivot shaft holding the stop latch and the no-reverse latch.



And remove the latches and the spacers that separate them. There are two latches and three spacers.



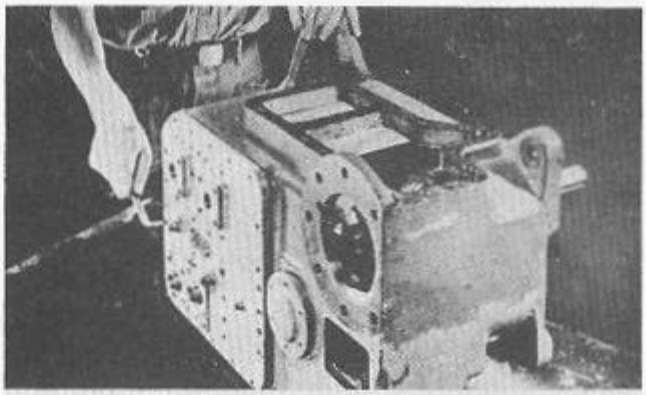
Now you can lift the large side plate assembly entirely clear.



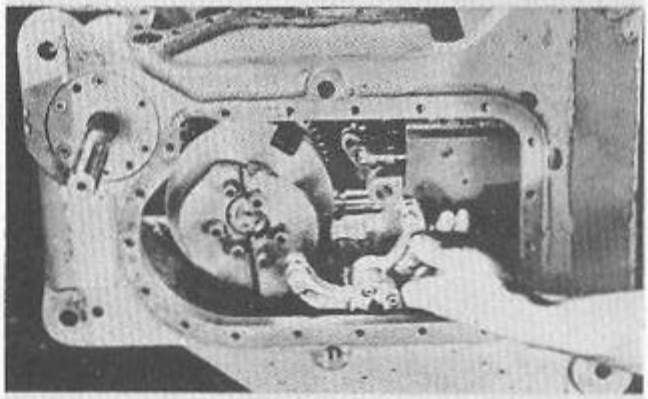
DISASSEMBLY STEP 3

Step number 3 is—removal of the valve block. Let's begin. . .

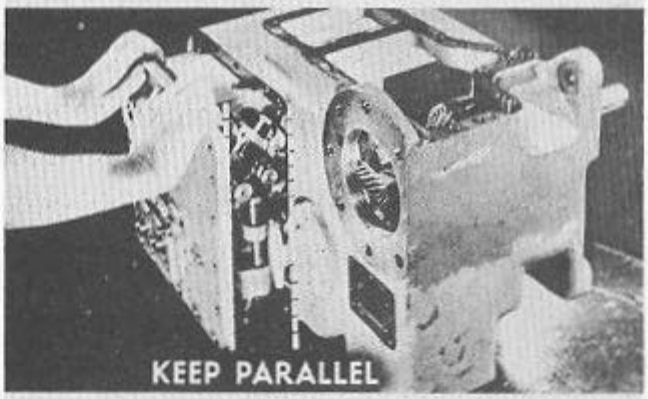
. . .by removing the outermost row of Allen bolts. Don't touch the others. The bottom plate and the valve block are then moved out a short distance. And, on the opposite side of the unit, . . .



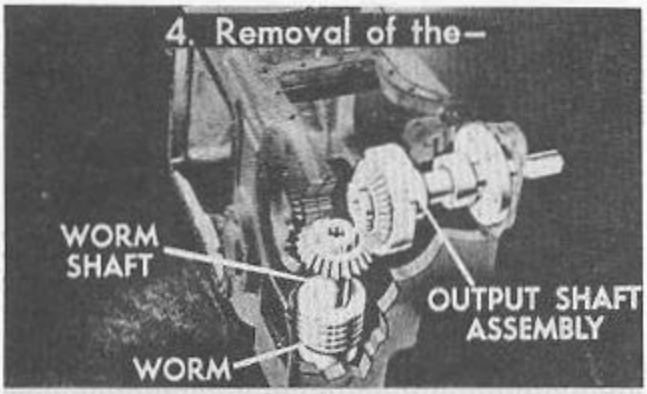
. . .the rocker arms are removed all the way. Back again on the other side. . .



. . .we can now take out the valve block. If you keep the face of the valve block parallel to the face of the control unit, you won't have any trouble with the crossbar of the T-shaft binding with the teeth of the worm wheel. As you get the valve block out, . . .

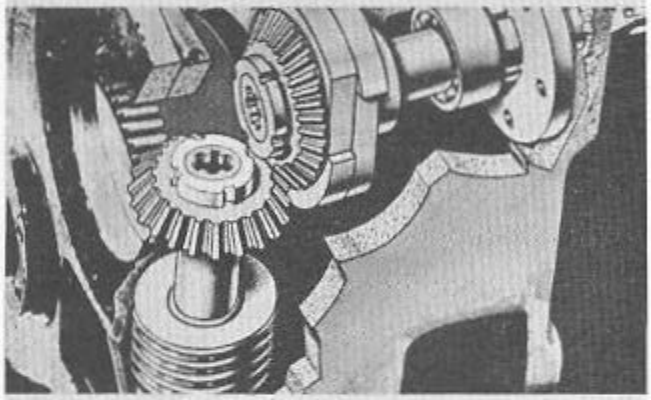


. . .use care not to rest it, or let it fall, on the T-shaft, or the shaft will be damaged.

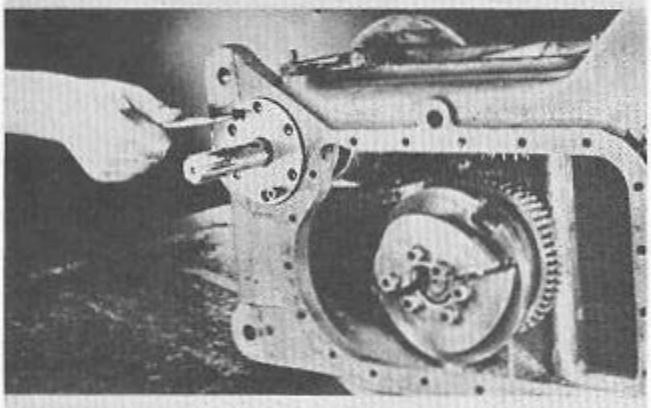


DISASSEMBLY STEP 4

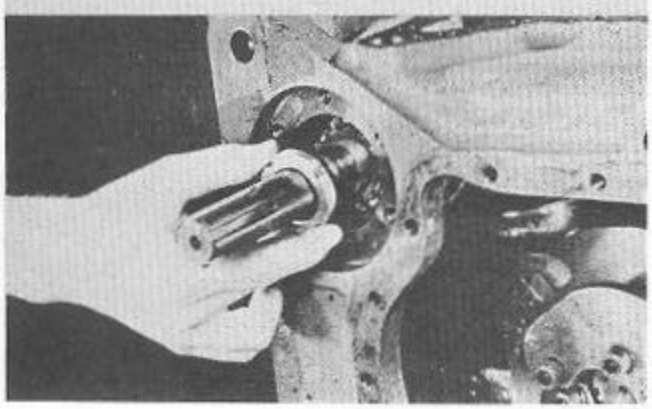
We are now ready for number 4—removal of the worm shaft, worm, and output shaft assembly. Unlock the star washer first. . .



. . .and remove the locknut on the worm shaft. The worm shaft and worm may now be removed.

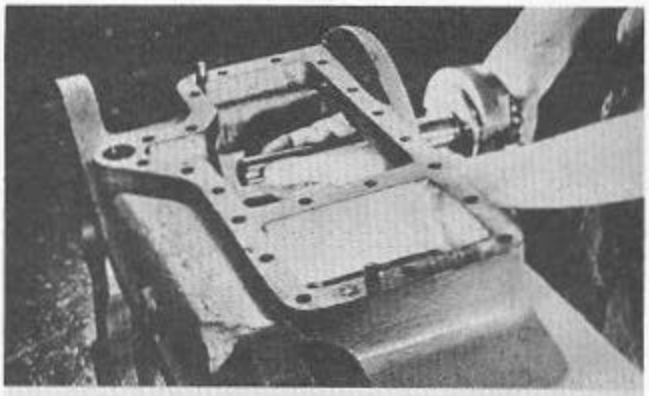


The output shaft assembly is removed next through the opposite side of the control unit. First, take off the packing cover with the aid of jackscrews. And. . .

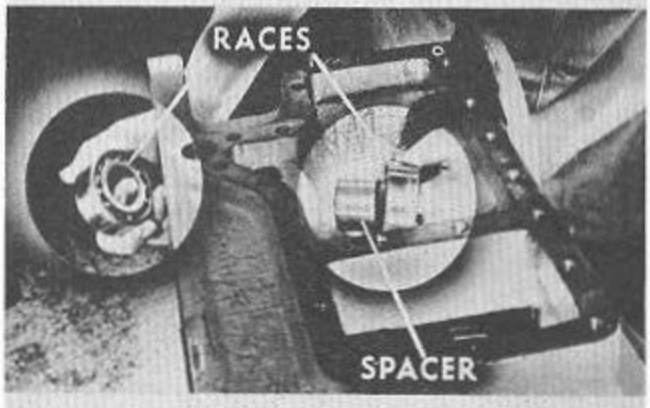


. . .with the cover off, unlock the star washer and remove the locknut found below the cover.

Then, pull out the output shaft assembly. Finally, . . .



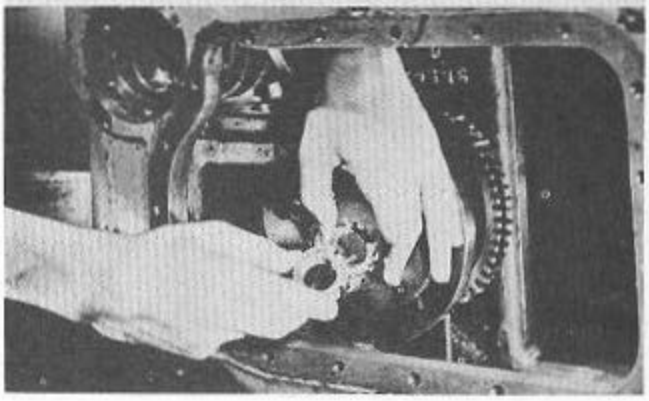
. . .remove the ball bearing races for the output shaft and be careful not to lose the spacer.

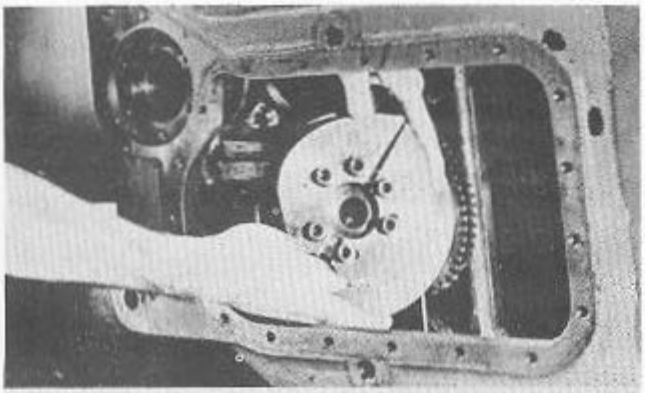


DISASSEMBLY STEP 5

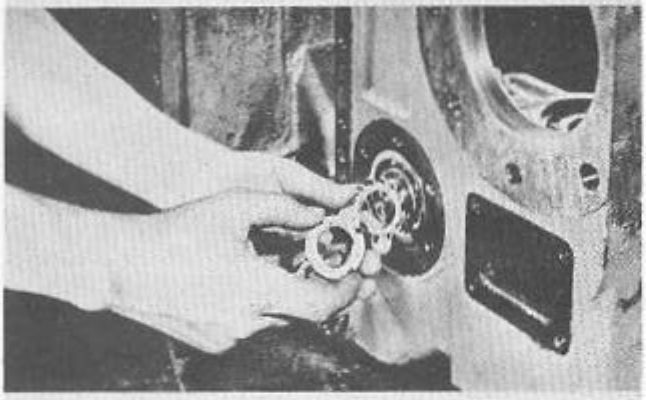
Fifth and final step is—removal of the timing cam assembly and shaft. Here again. . .

. . .unlock the star washer and remove the locknut that holds the timing cam assembly.

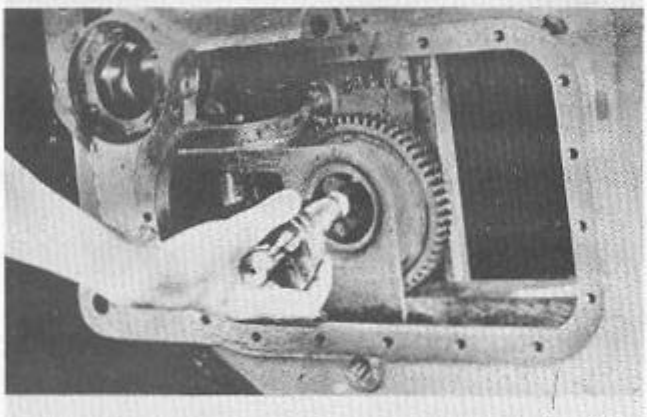




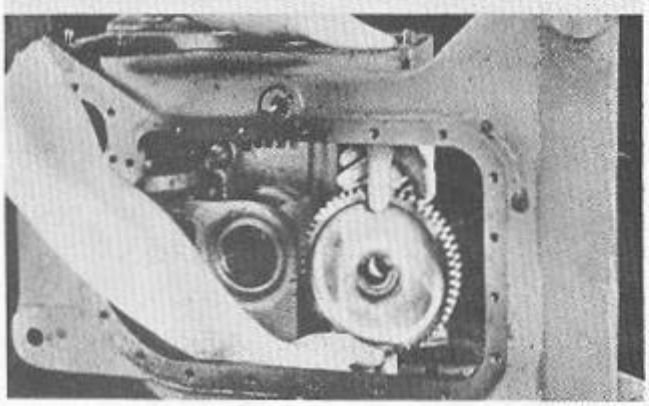
Then, lift the timing cam assembly clear of the control unit. And, around on the opposite side. . .



. . .unlock the star washer and remove the locknut which holds the timing shaft. Back again on the first side. . .

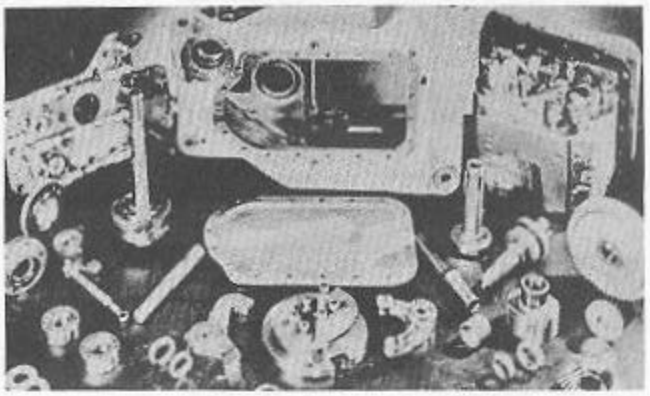


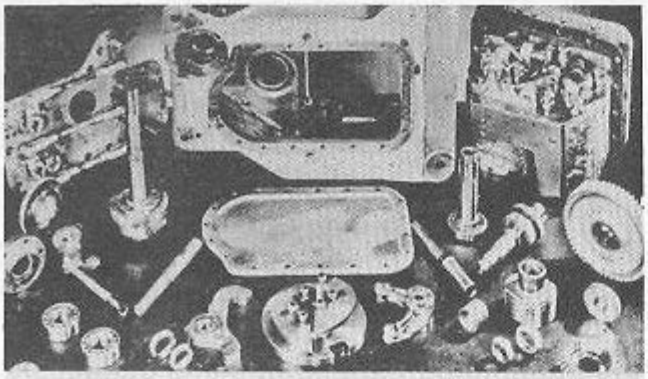
. . .the timing cam shaft is now removed, and don't lose its spacer. Be sure, also, that the worm wheel does not bind or cant during removal of the timing shaft. With this timing shaft out. . .



. . .the worm wheel may now be removed. And, the job of disassembly is complete.

Well, there it is. Disassembling the control unit requires patience, skill, and accuracy. And all steps must be carried out in the exact order given in this chapter.



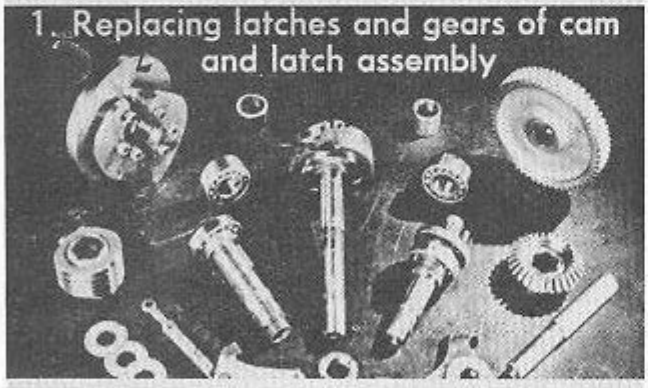


Well, we got it apart. Now let's put the control unit back together and replace it on the hoist. And let's carry out each step in the proper order, because one mistake might make it necessary to go back and do the whole job over again. First of all, let's reassemble it.

REASSEMBLY

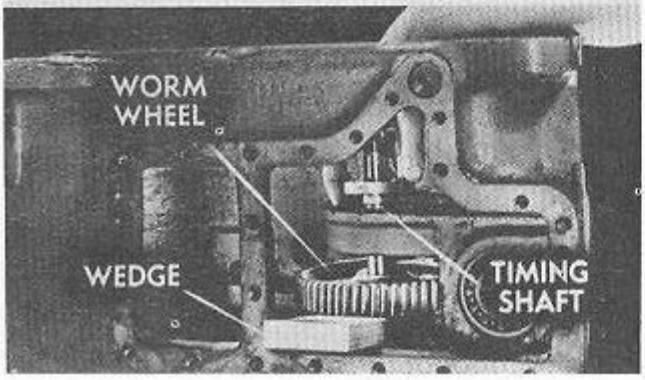
Reassembly of the control unit involves five operations; first, replacing the latches and gears of the cam and latch assembly; second, checking the unit for correct timing; third, replacing the valve block in the control unit case; fourth, adjusting the deceleration cams, rocker arms, and no-reverse latch linkage; and fifth, replacing the external units. In each case we'll concentrate on the main steps, not the obvious ones, such as tightening bolts. . .

. . .or replacing covers—OOPS, wrong cover.



REASSEMBLY STEP 1

First action then is replacing the latches and gears of the cam and latch assembly.

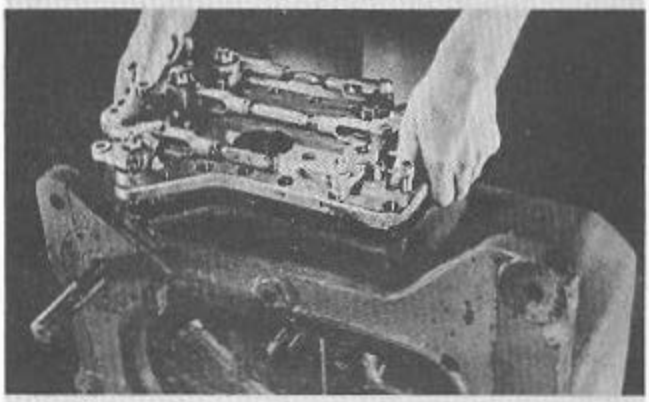


The worm wheel goes back first. Use a wooden wedge to keep the wheel from canting when the timing shaft is inserted and be sure the spacer on the timing shaft is mounted correctly. Then, . . .

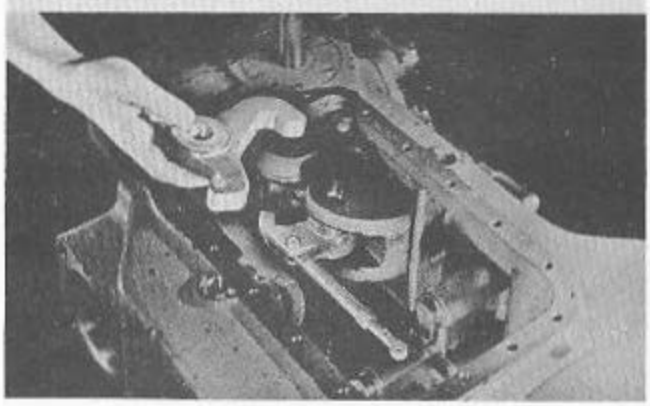
. . .turn the control unit on its side and slide the output shaft assembly into place. Replace the star washer and locknut, . . .

. . .but don't tighten the nut too much or the shaft might bind.

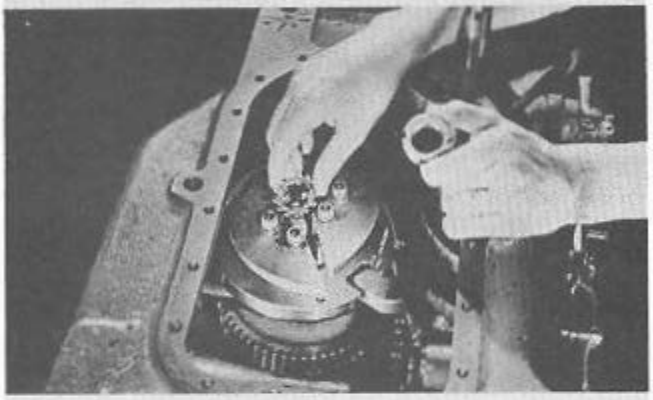
Then, replace the packing cover and mount the side plate assembly. Use several Allen bolts to hold the side plate in place.



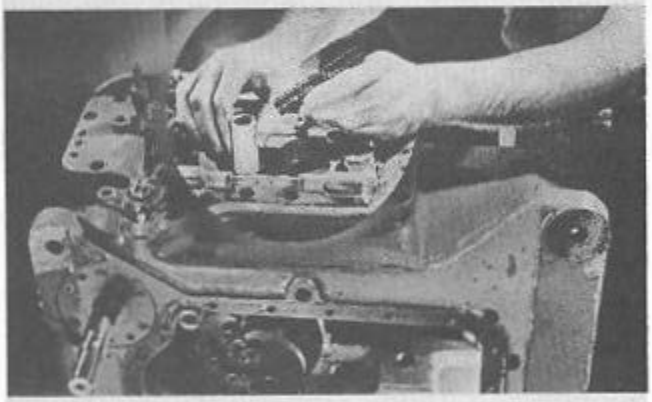
Set the stop latch in place after the no-reverse latch has been put back. A word of caution here—the arrows indicate the correct location of the three spacers. Be sure they are put back this way.



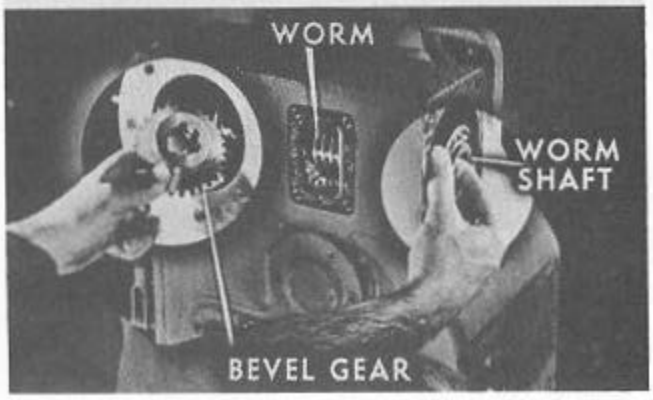
Now put in the pivot shaft that holds the latches and spacers in place.



Replace the timing cam and deceleration cam assembly together with star washer and locknut. Be sure the dowel pin on the under side of the timing cam drops into place. Next, . . .

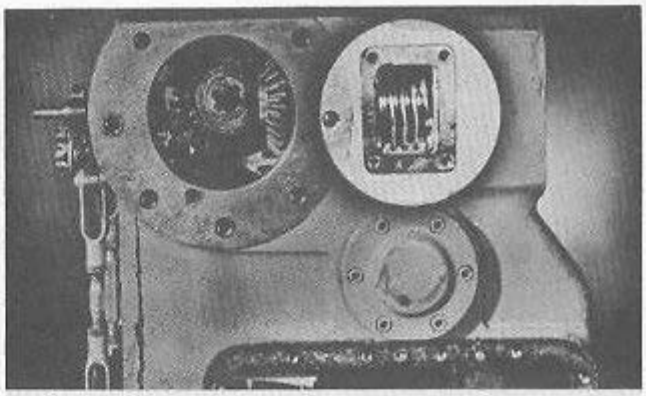


. . .replace the stop latch plunger and spring through the opening in the side plate. And then, replace the plunger cover. You are now ready to turn the control unit on its side so that the bottom faces you. . .

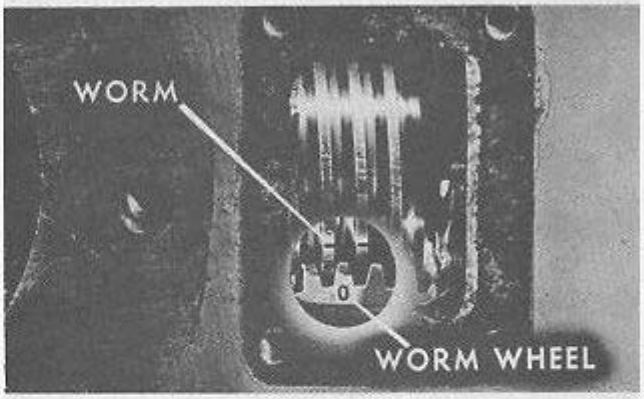


. . .and in this position replace the worm, worm shaft, and bevel gear. Be sure to match the assembly marks. These marks may be seen. . .

. . .by looking through the inspection opening in the control unit case. Let's look closer.

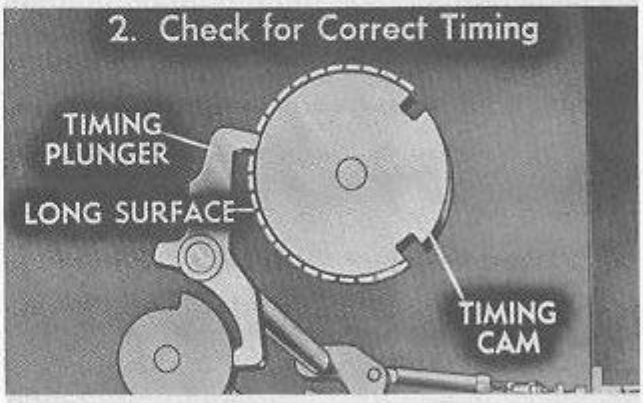


Here they are—two marks on the worm and one on a tooth on the worm wheel. The marked tooth on the worm wheel must fall between the two marks on the worm.

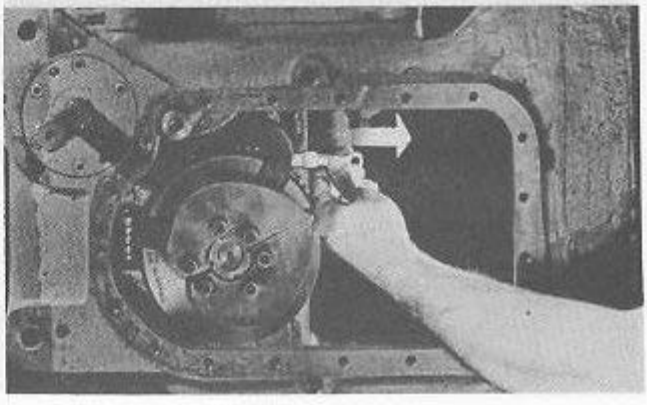


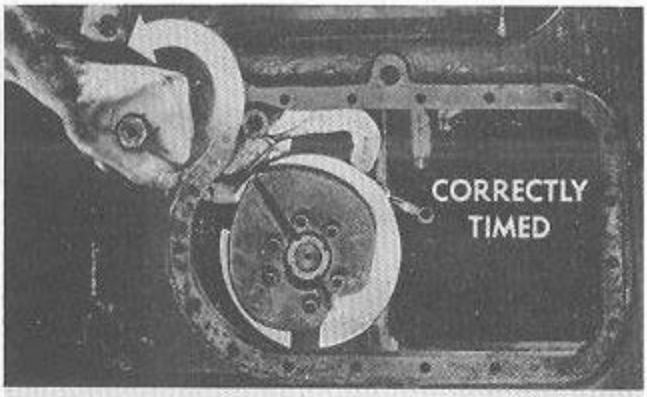
REASSEMBLY STEP 2

Now for operation 2—the check for correct timing. This means that the timing plunger must ride the long segment of the timing cam during each cycle. To check for correct timing, . . .

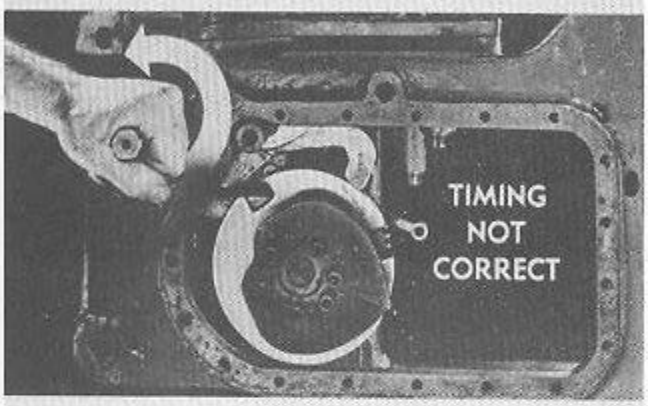


. . .pull the no-reverse latch linkage in the direction of this arrow. You can't see what this does, but it pulls the no-reverse latch from its notch in the no-reverse cam. Then, . . .

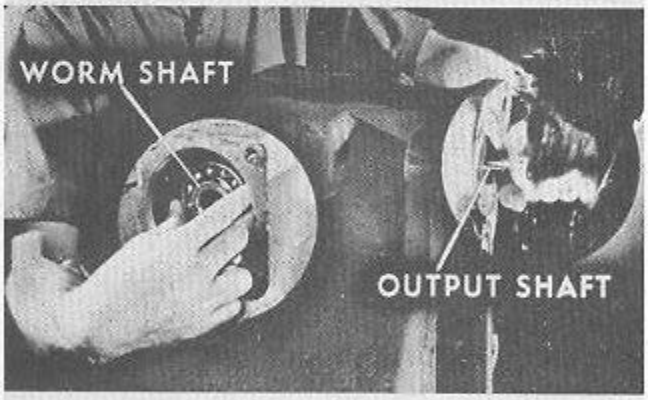




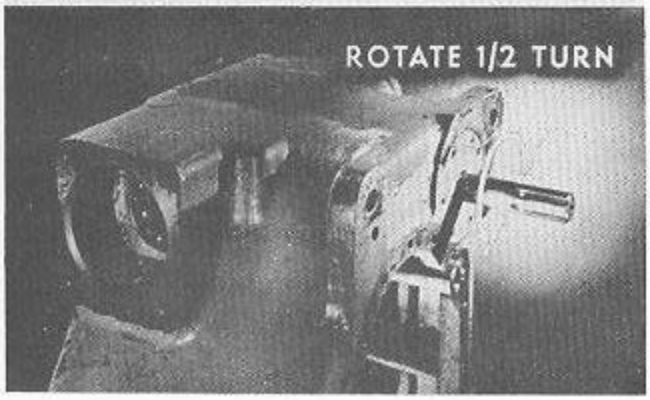
. . .rotate the output shaft. If the unit is correctly timed, the timing plunger will come out of its notch and will ride over the long segment of the cam.



The timing is <u>not</u> correct when the plunger contacts the short segment, as shown here. If this should occur, the following steps must be taken,

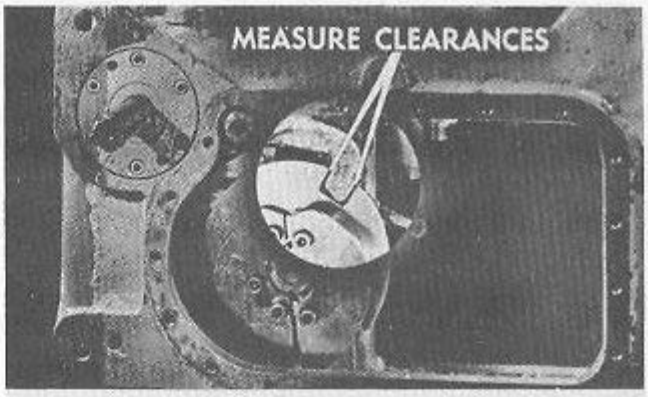


Withdraw the worm shaft, after first taking off the locknut and holding the output shaft to prevent it from rotating. Pull out the worm shaft until the bevel gears are disengaged. This disconnects the output shaft from the timing mechanism. Next, . . .

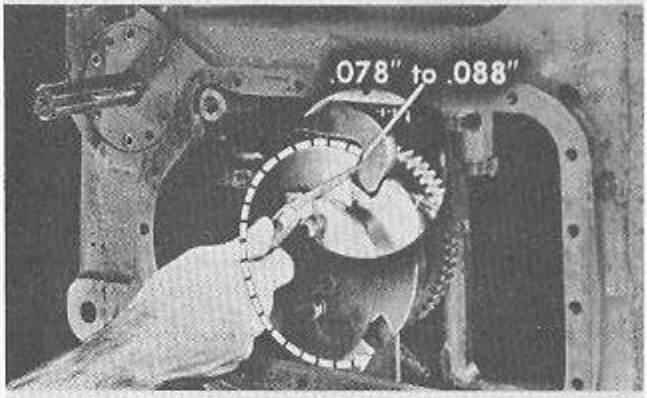


. . .rotate the output shaft half a turn. This solves your problem. Now, the timing plunger will ride the long segment. The next step in checking for correct timing. . .

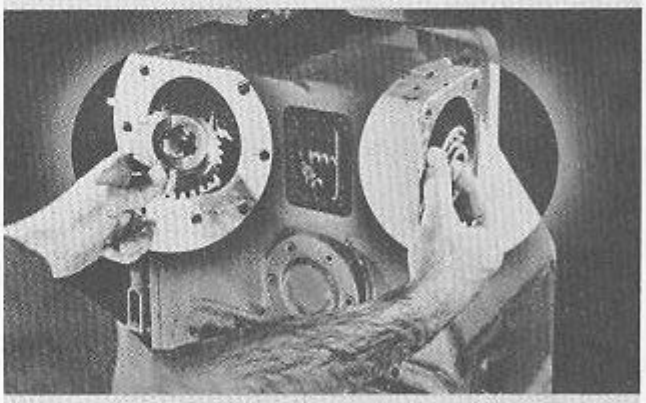
. . .is to measure the indicated clearance. For the timing plunger to lift free of the notch at the right time there should be a clearance. . .



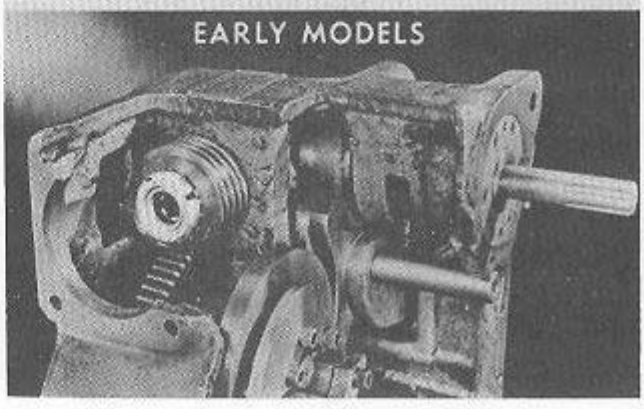
. . .of from 78 to 88 one-thousandths (.078 to .088) inch between the timing plunger and the side of the notch nearest the long segment of the cam. If this clearance does not exist, . . .

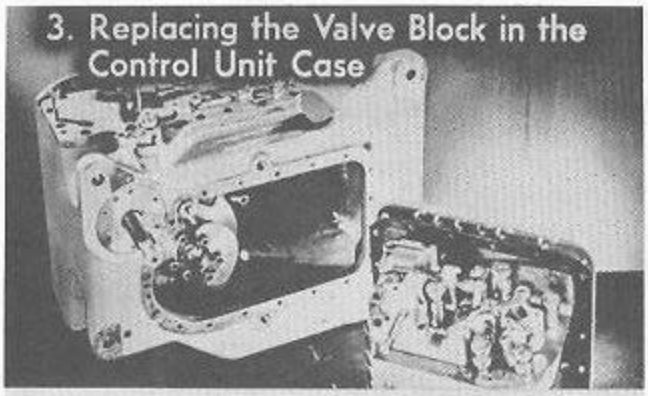


. . .engage a different set of teeth on the bevel gears and keep on trying until the desired clearance is obtained. If the bevel gears have scribe marks the job is simpler—just line up the marks. By the way, . . .



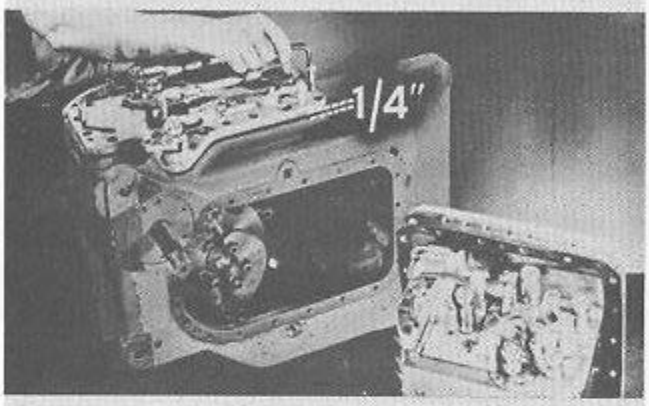
. . .on some early models you'll find the locknut at the worm end of the worm shaft. The timing procedure for these older models will be found in OP 735.



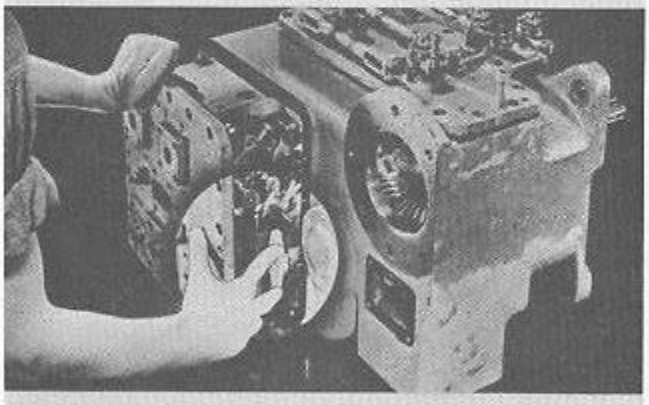


REASSEMBLY STEP 3

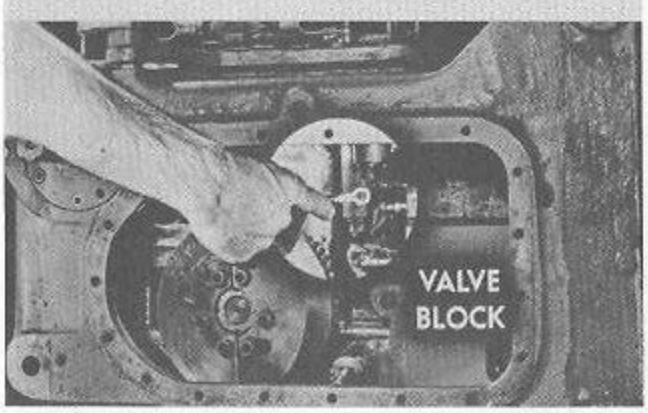
The third operation is—replacing the valve block in the control unit case. Be sure first. . .



. . .that the side plate is raised about one-fourth inch.

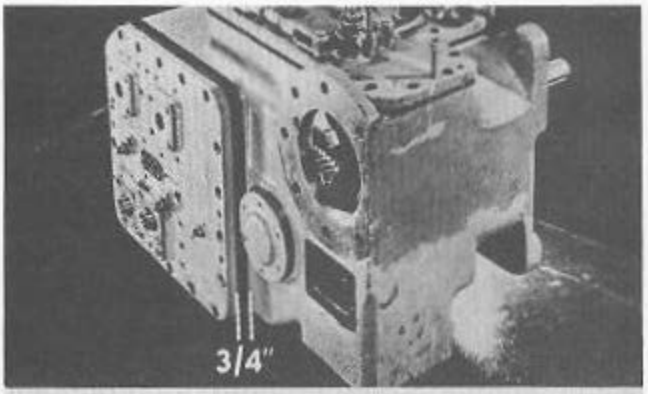


While sliding the valve block into place be careful not to allow the T-shaft to rotate out of position, as it has a tendency to hang up on the worm wheel.

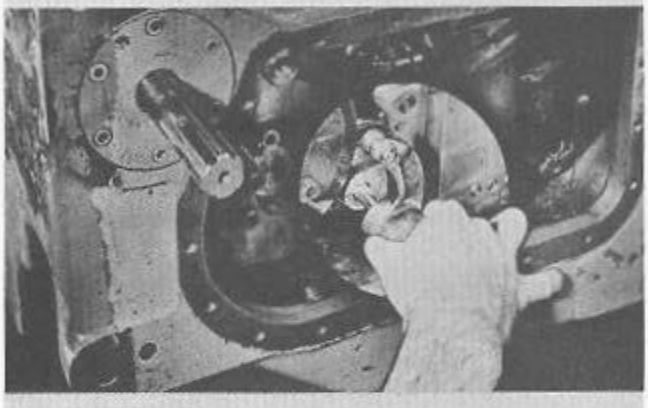


When the valve block is almost in final position, lift the no-reverse latch linkage clear to prevent bending the linkage. Then, . . .

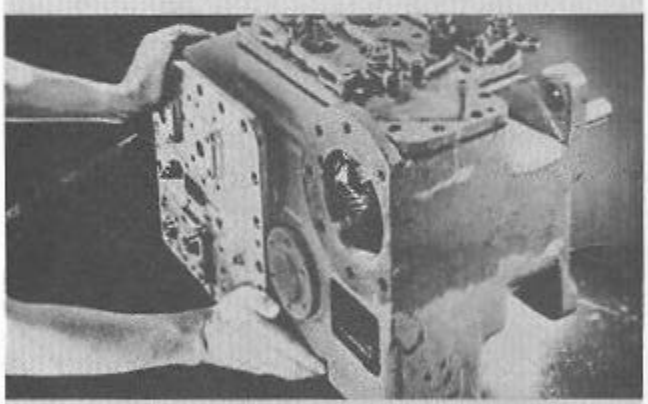
. . .when the valve block is only about three-fourths inch away from its securing position, . . .



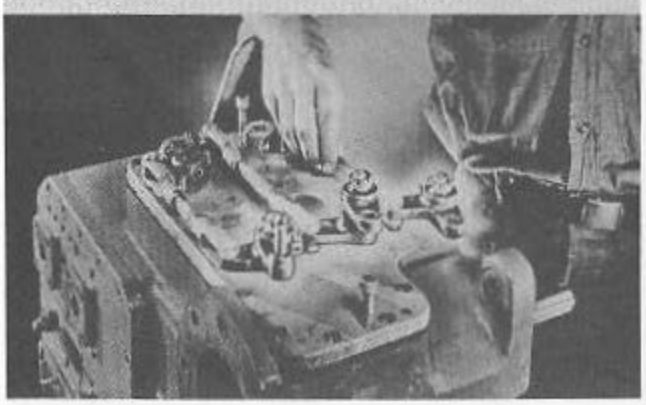
. . .place the rocker arms on the T-shaft. Don't attempt to adjust them at this time. Just make sure they are resting on the T-shaft.

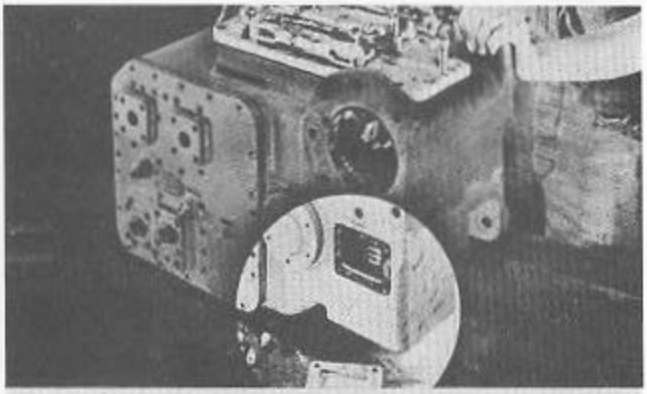


Now, bring the valve block completely into place and secure it with Allen bolts. While the side plate is still raised, . . .

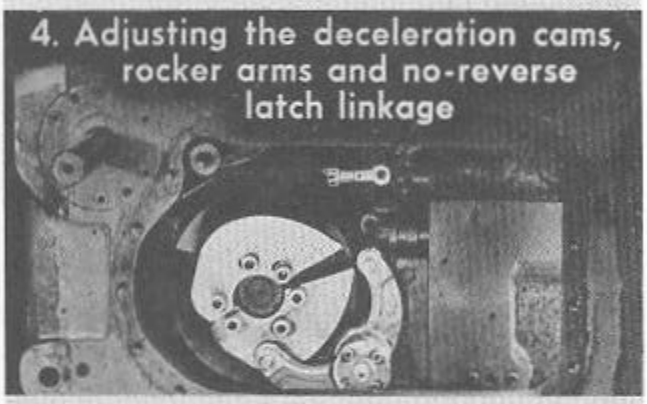


. . .position the three cranks to engage with the valve heads.



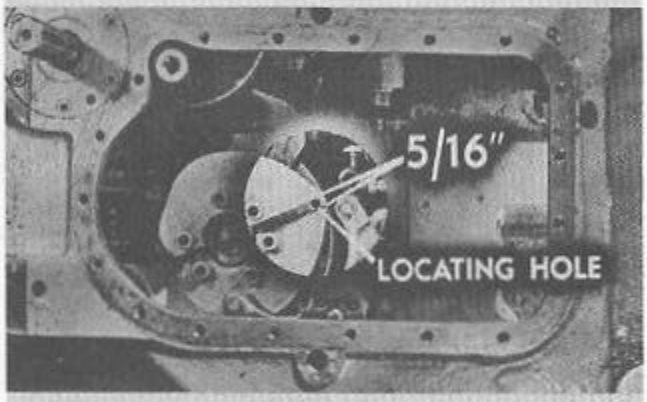


Now, set the side cover plate in place and put back the small inspection cover on the bottom of the unit. This completes replacing the valve block in the control unit case.

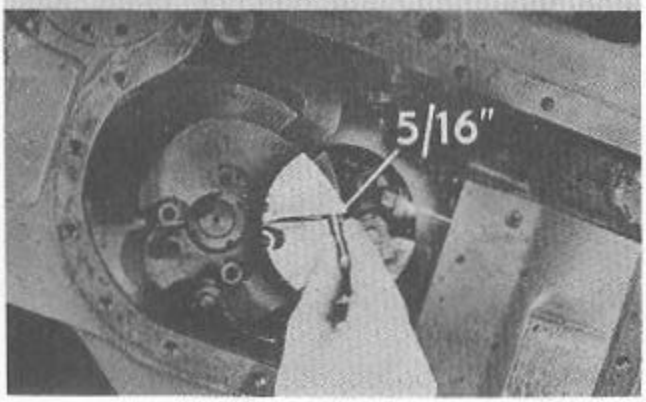


REASSEMBLY STEP 4

The fourth job is adjusting the deceleration cams, the rocker arms, and the no-reverse latch linkage. You'll have to adjust the deceleration cams if they were separated from the timing cam during disassembly, or if the adjusting bolts have become loosened.

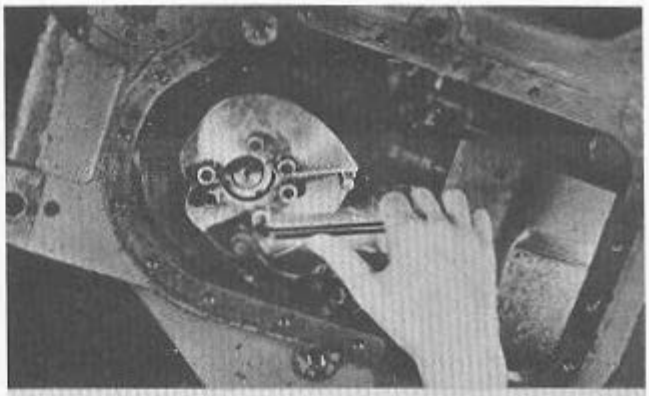


This shows the proper adjustment—when there is a clearance of five-sixteenths inch between the points of the cams. You'll find a locating hole in the timing cam to help you obtain this clearance. Set the deceleration cams so that the locating hole is visible. Then, . . .

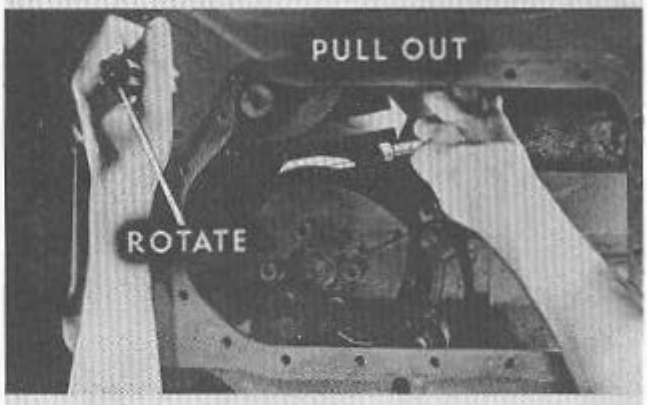


. . .place a 5/16-inch metal rod in the locating hole. Move the deceleration cams to engage this rod. The points of the cams, of course, will then be five-sixteenths inch apart and that's your adjustment.

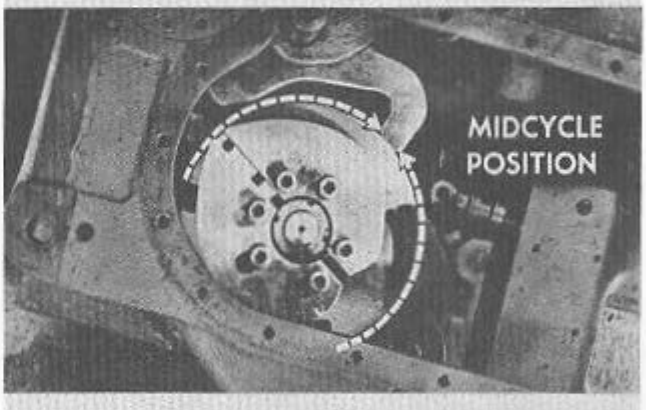
Finish up by tightening the adjusting bolts, and the cams are secure. That takes care of the deceleration cams. The rocker arms are next. We placed them on the T-shaft previously, but now we must adjust them.



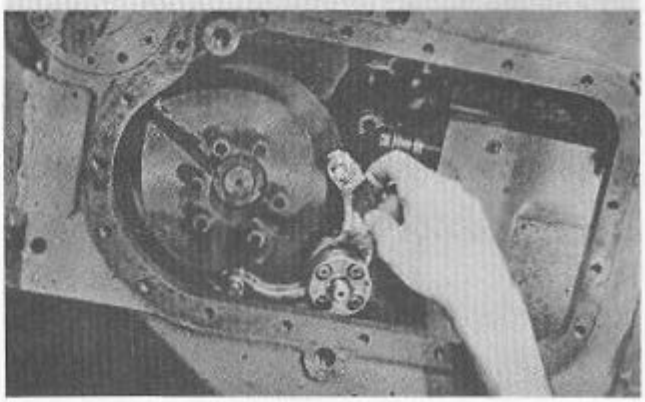
First, pull out the no-reverse latch by means of the linkage so that the latch clears the notch of the no-reverse cam. Then, rotate the output shaft. . .

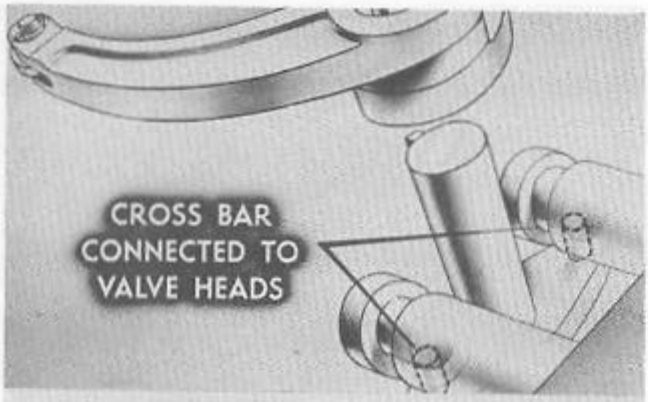


. . .until the cam assembly reaches mid-cycle position. This is approximately the center of travel of the cams. This position is necessary. . .

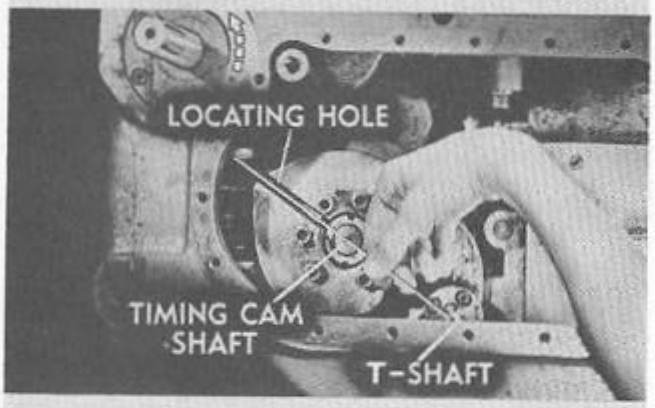


. . .in order to slide the rocker arms all the way down the T-shaft.

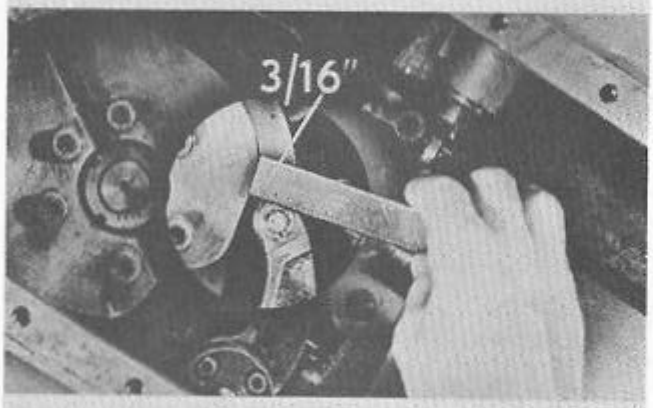




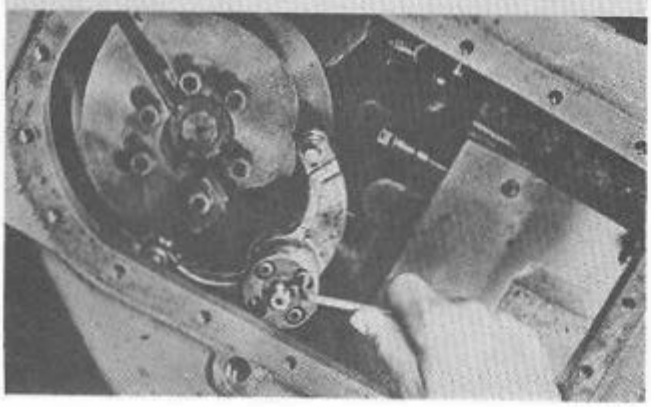
Make sure that the crossbar is connected to the valve heads. That is, the pins must fit in the valve head grooves. Then, drop the rocker arms down and secure them. Before the rocker arms can be adjusted, however, the cam assembly must be properly positioned. To do this, . . .



. . .rotate the output shaft until the locating hole, the timing cam shaft, and the T-shaft are in a straight line. This is true midcycle.

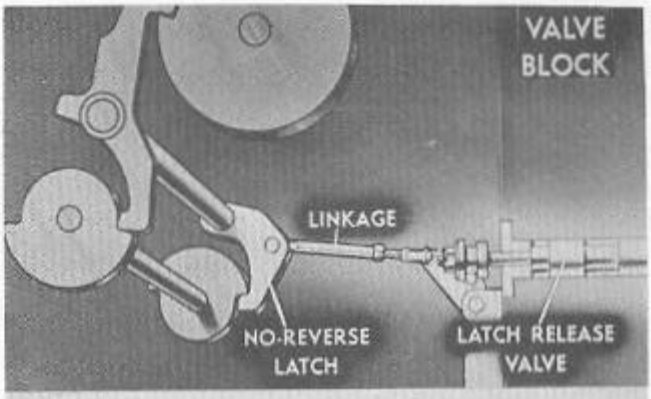


Then be sure there is a clearance of three-sixteenths inch between the rollers and the cam. If there is not, . . .

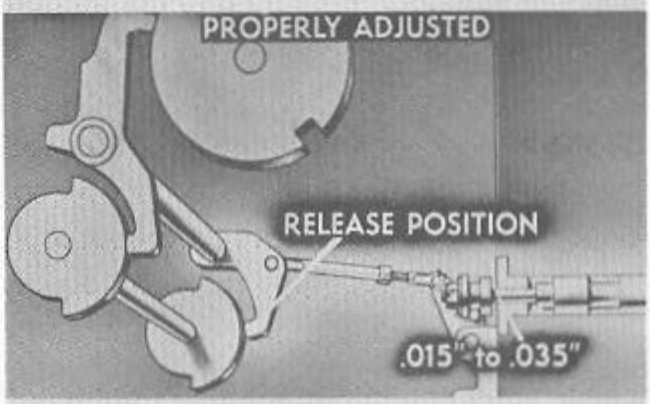


. . .loosen the rocker adjusting bolts and adjust the rocker arms until this 3/16-inch clearance is obtained. To get an overall idea of this next adjustment. . .

. . .let's look at this schematic view of the linkage connecting the no-reverse latch with the latch release valve in the valve block.

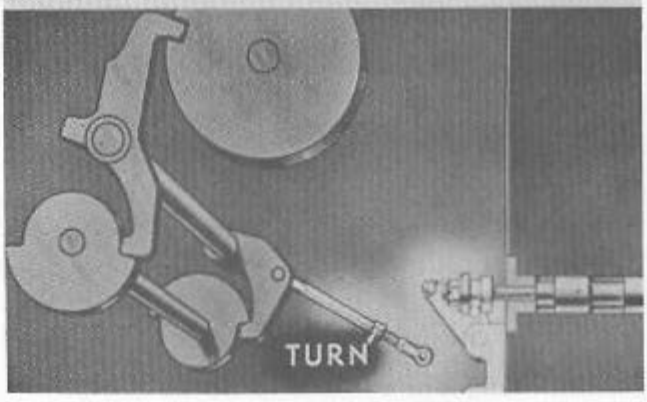


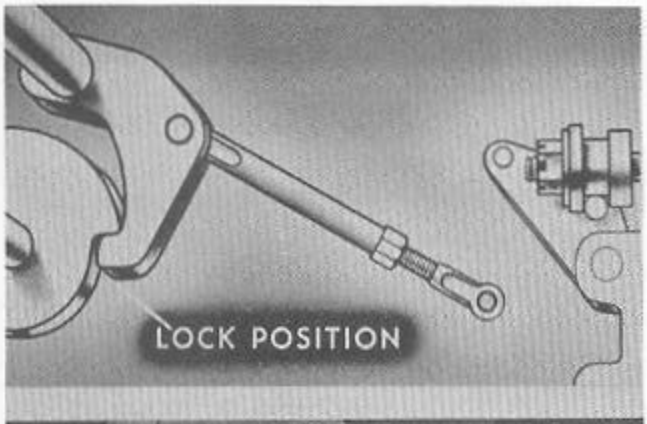
When the linkage is properly adjusted and the no-reverse latch is in RELEASE position there should be a clearance of from 15 to 35 one-thousandths (.015 to .035) inch between the collar of the latch valve and the valve block. If this clearance does not exist. . .



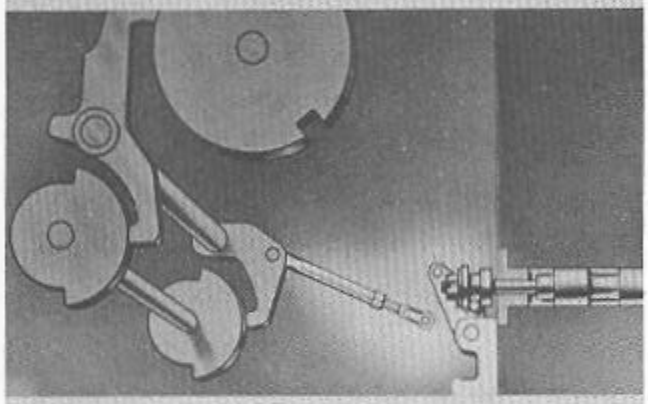
. . .the linkage is not properly adjusted. And the no-reverse latch won't clear the no-reverse cam when the latch valve moves at the start of each cycle, as indicated. All right, how do you adjust it?

Disconnect the linkage and turn it in the proper direction. Then, reconnect it and see if the latch release valve has the proper clearance. Remember this though, to disconnect the linkage and also to reconnect it. . .

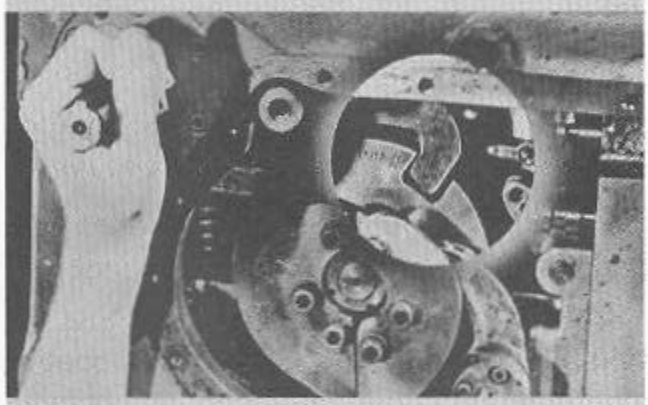




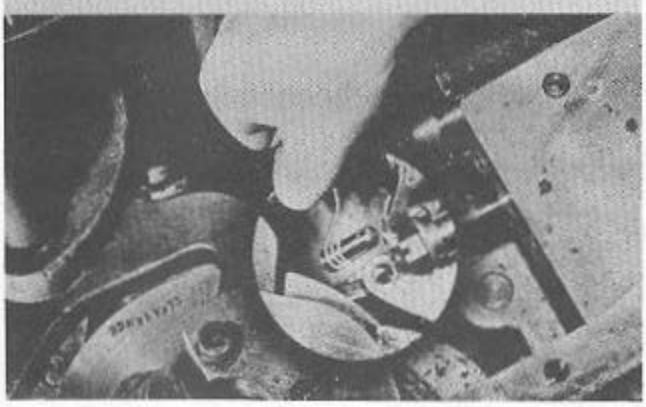
. . .the no-reverse latch must be in the LOCK position where spring tension is at a minimum. All right, got the general idea? Then let's go into this procedure more thoroughly.



Here's where we left off with the control unit. The no-reverse latch was in the RELEASE position and the linkage was disconnected. The first step in measuring is to connect the linkage. We know this must be done with the no-reverse latch in the LOCK position so, . . .

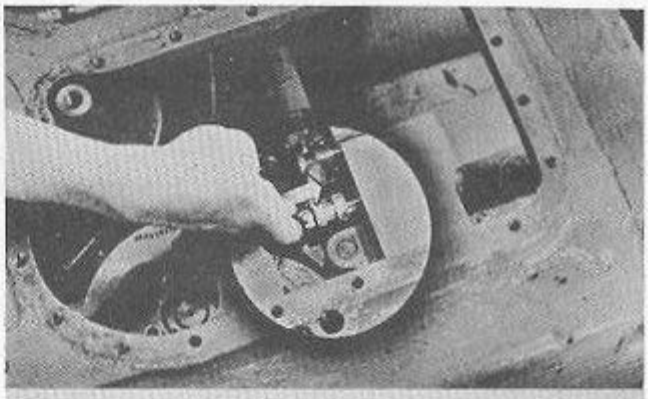


. . .rotate the output shaft until the timing plunger drops in the notch in the timing cam.

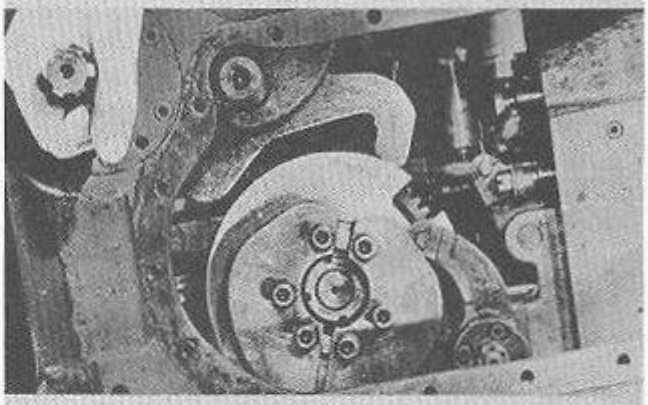


Now, replace the pin connecting the linkage to the latch release valve. Wrap a piece of wire around the head of the pin to guide it into the hole.

The measurement must be made with the no-reverse latch in the RELEASE position. So we push the latch release valve into the valve block. This lifts the no-reverse latch clear of the no-reverse cam. Then, . . .

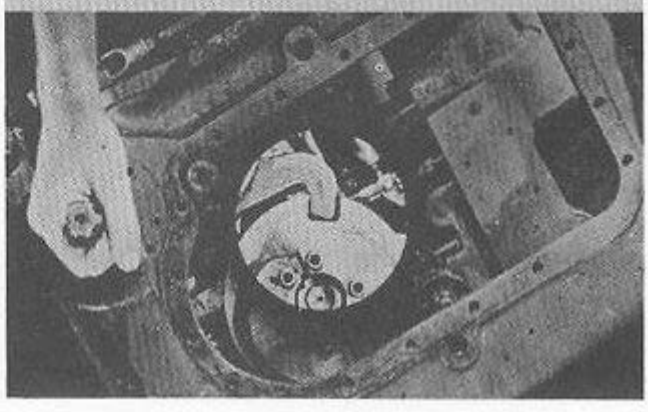


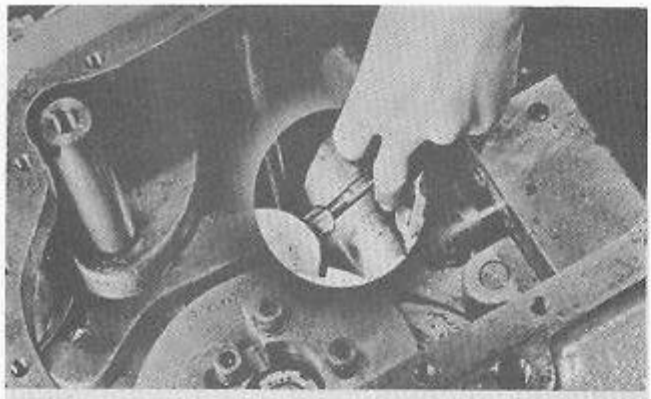
. . .rotate the output shaft until the timing plunger rides the surface of the timing cam. This will move the no-reverse latch to the full RELEASE position.



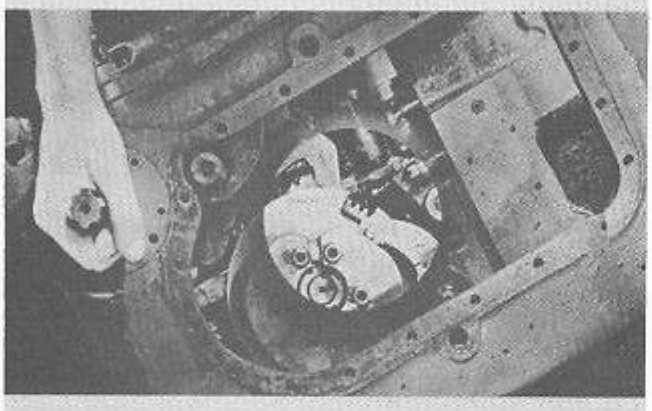
Now, if the clearance between the latch valve collar and the valve block falls within the range of from 15 to 35 one-thousandths (.015 to .035), you're okay. It's properly adjusted. But, if it does not, you have some more work to do.

Rotate the output shaft until the timing plunger enters the notch. This puts the no-reverse latch in the LOCK position necessary to disconnect the linkage.



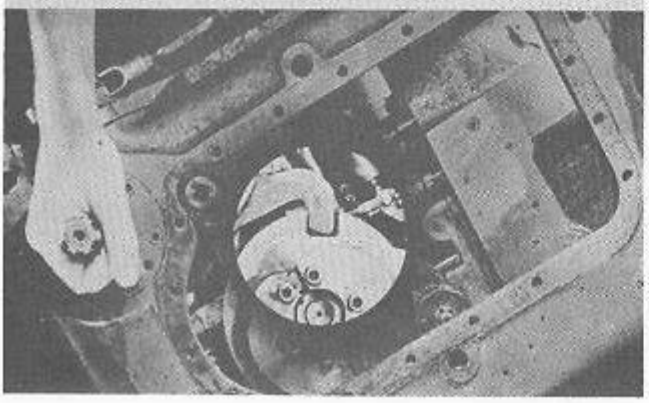


Then, disconnect this linkage, adjust it as required, and reconnect it. Check again to see if your adjustment has been accurate. Do it this way.



Rotate the output shaft until the timing plunger rides the surface. The no-reverse latch is now in RELEASE position. Then, . . .

. . .again measure the clearance at the latch valve collar. This process of connecting, measuring, disconnecting, and adjusting must be repeated until the clearance falls within the required range of from 15 to 35 one-thousandths (.015 to .035) inch. Then, with the no-reverse latch linkage correctly adjusted. . .

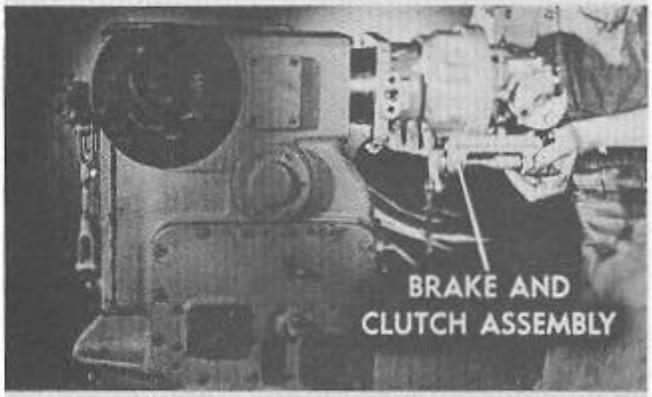


. . .finish the cycle. This completes step 4.

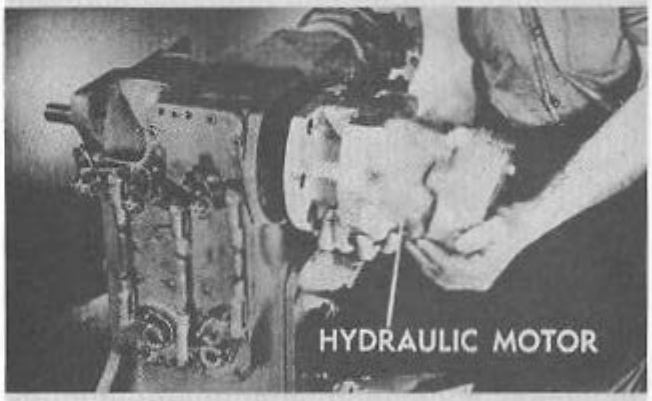
REASSEMBLY STEP 5

Now for the fifth and final operation—replacing the external units. First of all, the by-pass valve crank assembly is put back.

The brake and clutch assembly is next replaced. . .

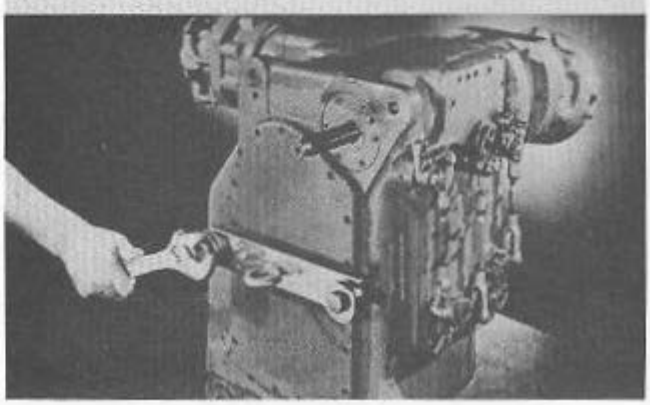


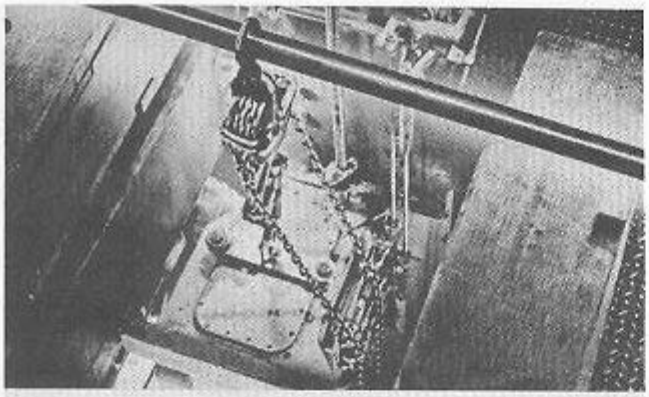
. . .and then, the hydraulic motor. The control unit is now completely reassembled. Next, let's replace it on the hoist.



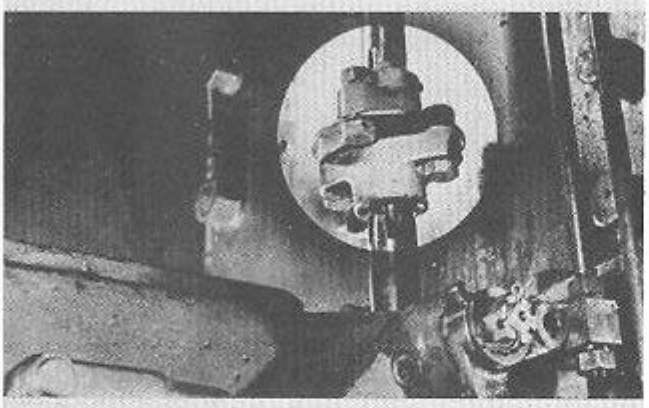
REPLACEMENT

Replacement of the control unit starts with installing the readymade bar and padeye.

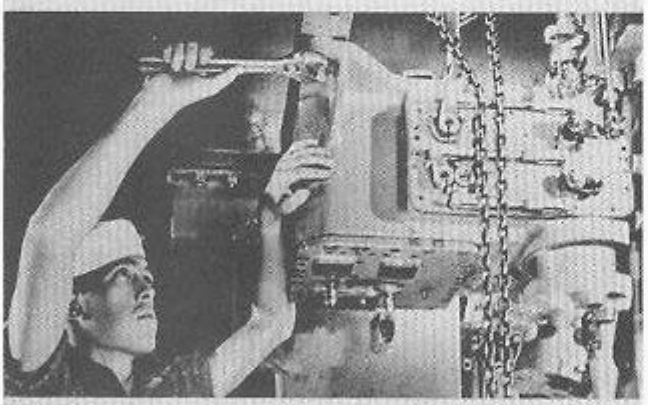




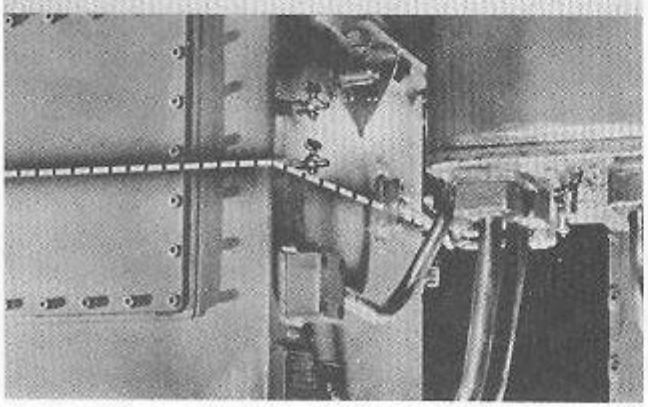
Then, with a chain fall or block and tackle, raise the control unit into place on the projectile hoist.



Be sure the splined output shaft is properly engaged. Then, . . .

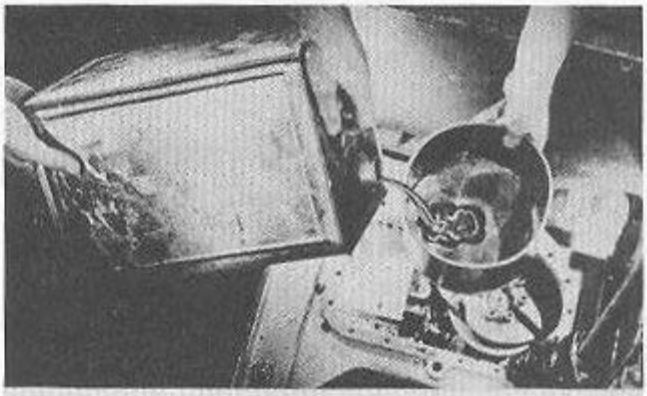


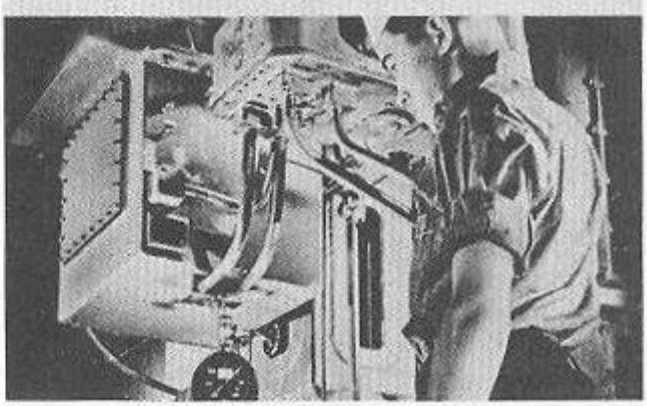
. . .bolt the control unit securely in place and put back all pipes and connections. At this point the system is empty. So, . . .



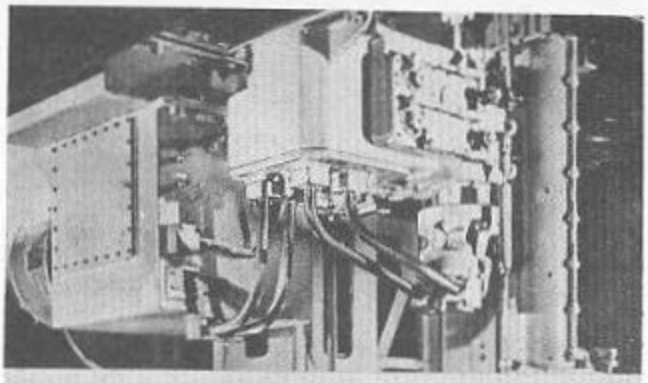
. . .fill the tank to the lower petcock level, 20 gallons you know, . . .

. . .and 2 more gallons in the control unit case. Don't forget to run the fluid through a fine mesh screen.





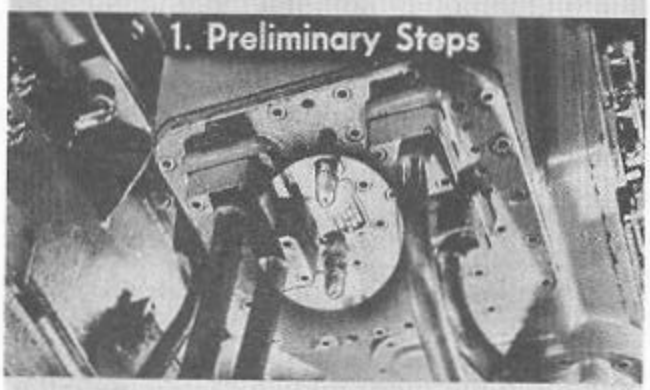
All right, the control unit is replaced. And you can breathe a sigh of relief. But, make it a short sigh. You're not finished yet. A number of adjustments must still be made. We'll take these up in the next chapter.



The control unit has been reassembled and replaced on the hoist, but a number of adjustments must still be made. Let's concentrate on the important adjustments. The obvious ones you know.

ADJUSTMENT OPERATION STEPS

Adjustment of the control unit involves five major operations; first, the preliminary steps necessary to make proper adjustments; second, adjusting the relief valve; third, final adjustment of the rocker arms; fourth, final adjustment of the deceleration cams and needle valves; and fifth, a final check to see that all adjustments have been properly made. Let's take these in order beginning with. . .



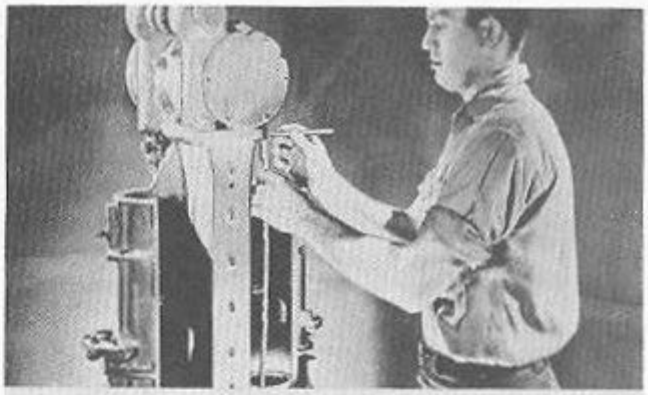
STEP 1

. . .first, the preliminary steps. We start with the two deceleration needle valves at the bottom of the control unit. After removing the acorn nuts and loosening the locknuts, . . .

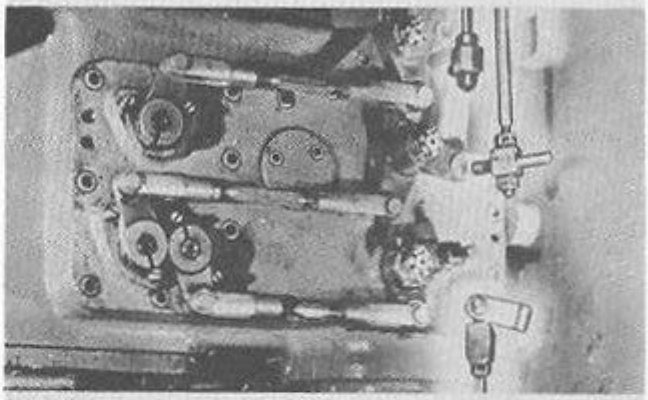
. . .we close these needle valves tightly by screwing them in. We will see why later on.

Now, we install a pressure gage in the pressure line at the tank and then, . . .

. . .we check the positions of the flights and, if necessary, we readjust them as will be explained in a later chapter in this section. Finally, . . .



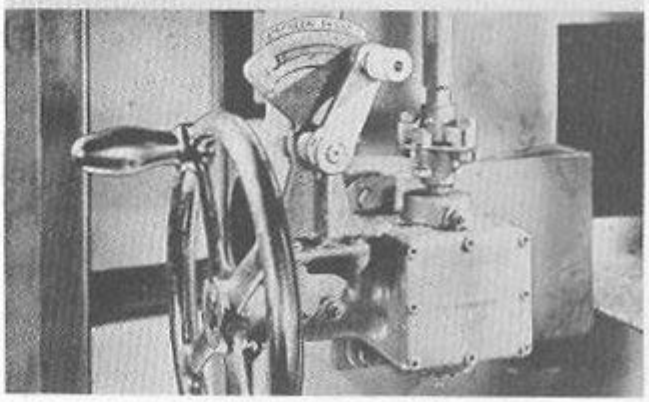
. . .we leave the control linkages hanging free. This completes our preliminary steps and we are ready for. . .

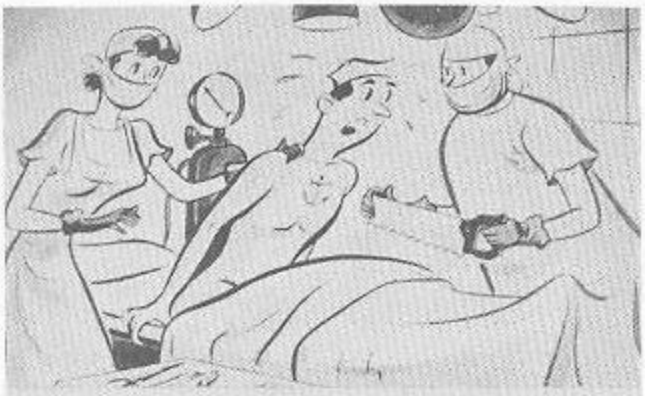


STEP 2

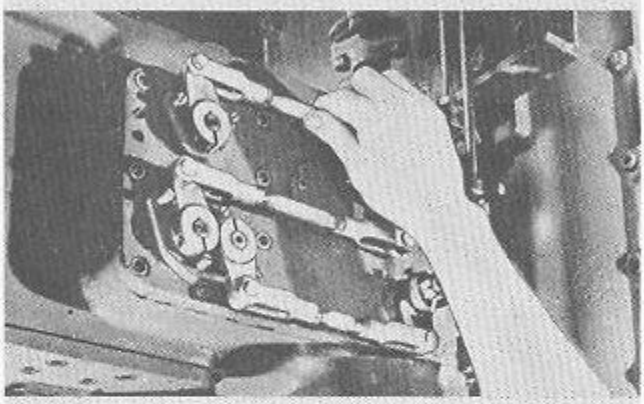
. . .action number 2-adjusting the relief valve. We must make sure that this valve will bypass hydraulic fluid at 800 pounds pressure per square inch, which is the proper setting to decelerate the hoist for the end of the cycle. Before adjusting it. . .

. . .turn on the power and let the control unit run for about 5 minutes to circulate the hydraulic fluid thoroughly and to vent any air that may have entered the system. However, do not permit the hoist itself to operate during this period.

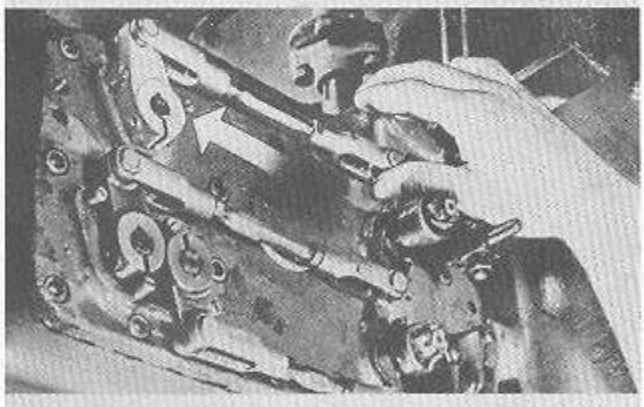




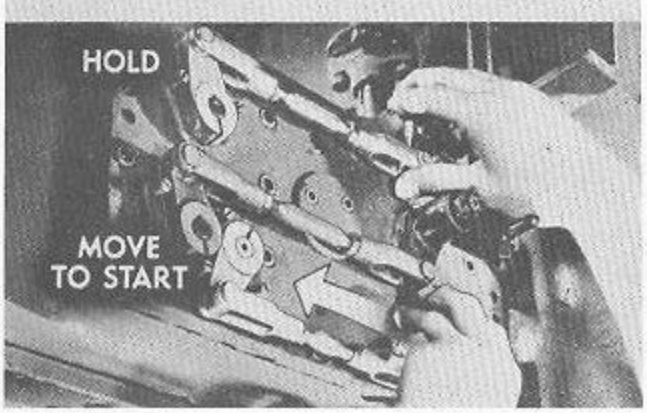
Now comes a ticklish operation—. . .



. . .seeing whether the hoist will operate properly or not. This is done by inching the flight up the hoist a short distance at a time moving the unloading valve crank by hand. Let's see just how this is done.

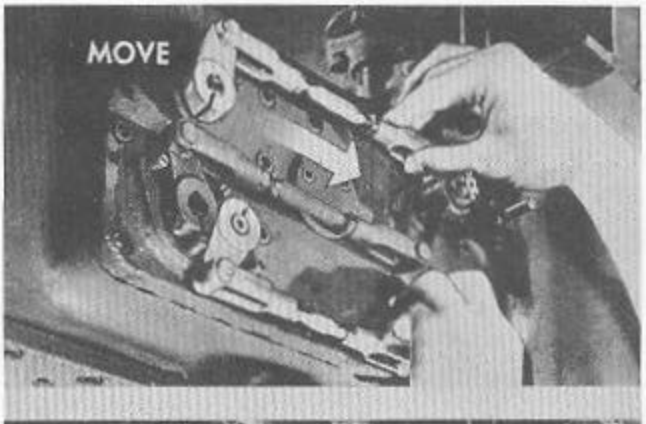


First, move the unloading valve crank to the hoist position, that is, with the crank arm to the left. The hoist is now ready to operate. Then. . .

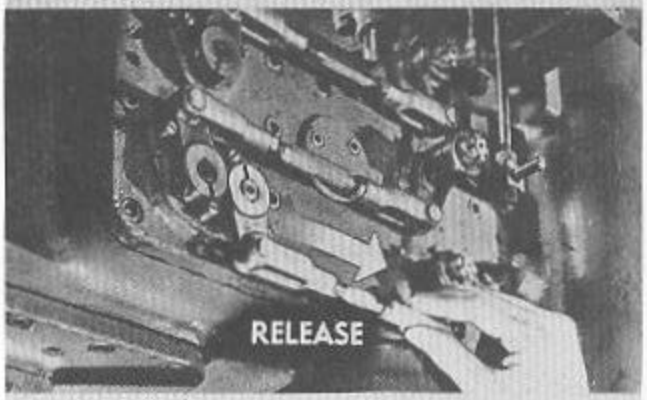


. . .hold the unloading valve in hoist and move the starting valve crank to the START position. This will release the no-reverse latch and cause the hoist to operate. As soon as the cycle starts. . .

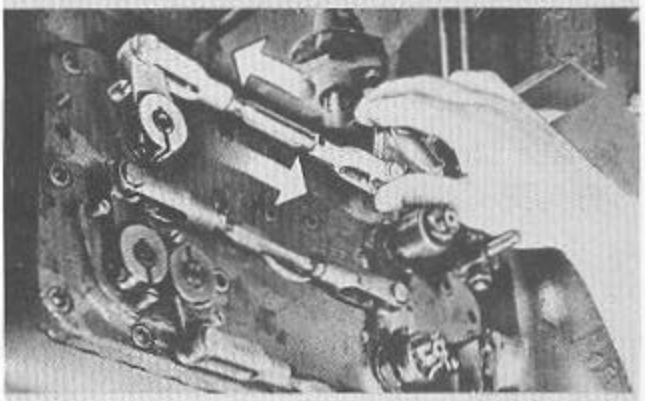
. . .permit the unloading valve crank to move to the STOP position. You have now stopped the hoist after the flights have moved a few inches, even though the starting valve crank is still in the starting position.



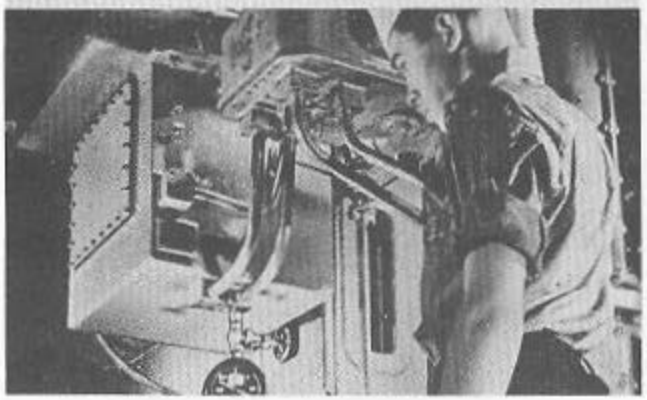
Release the starting valve crank next and allow the starting valve to return to neutral, where it will remain for the rest of the cycle.

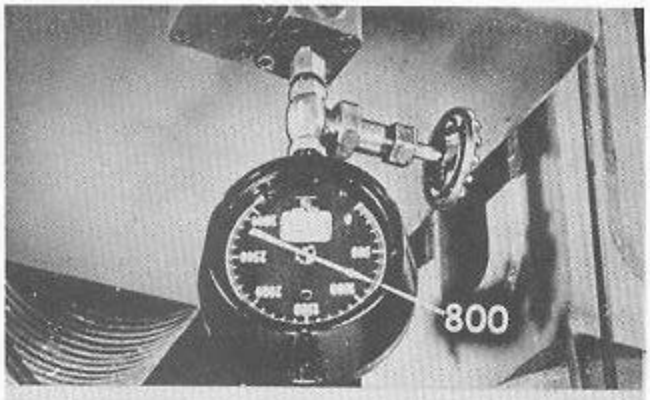


Now, shift the unloading valve crank back and forth between the HOIST and STOP positions so as to move the flight only a short distance at a time. As you do this. . .



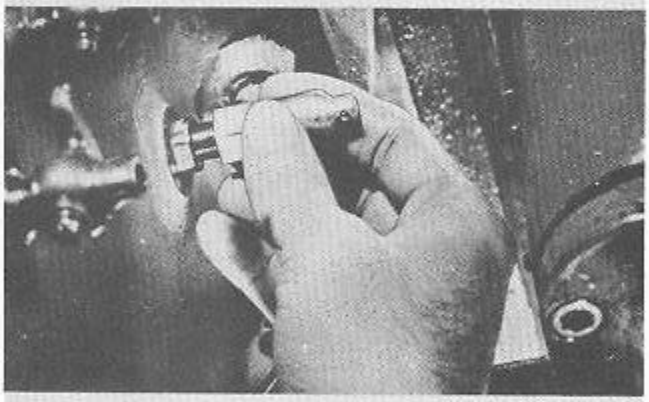
...watch the pressure gage. As the hoist nears the end of the cycle the relief valve lifts and the reading should be. . .



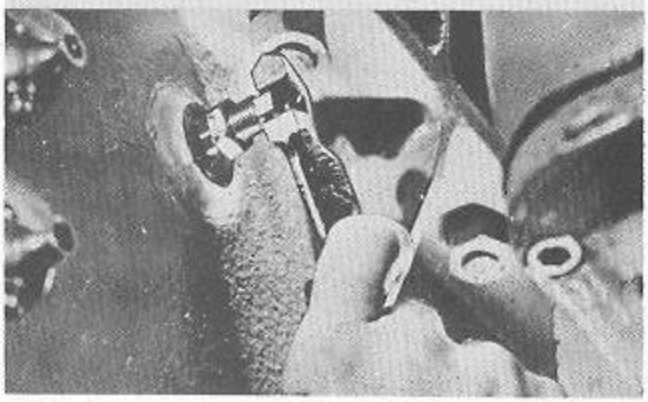


. . .800 pounds. If it is not. . .

. . .the relief valve must be adjusted. To do this. . .



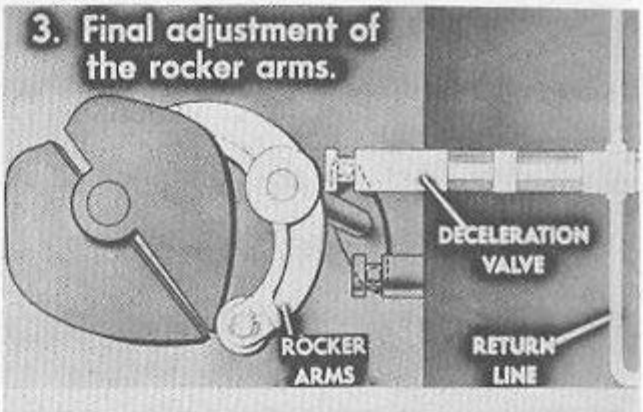
. . .remove the acorn nut and loosen the locknut. Then. . .



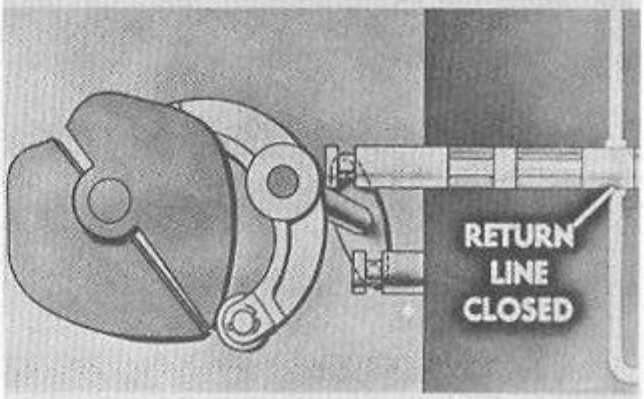
. . .to increase pressure, turn the adjusting screw in. To decrease pressure, turn it out. Increase, in; decrease out. Repeat operating the hoist and adjusting the screw until the pressure gage reads 800 pounds during the deceleration period.

STEP 3

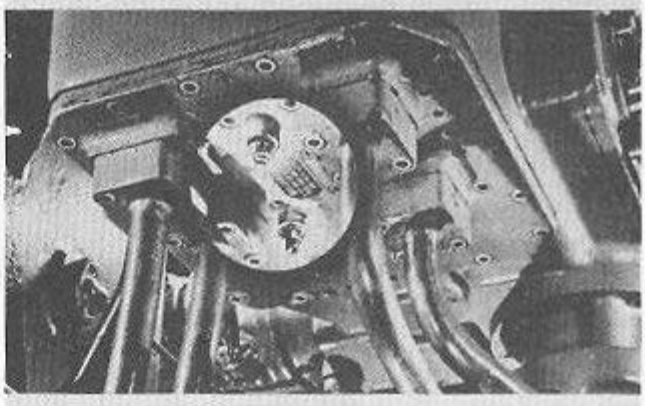
Third operation is the final adjustment of the rocker arms. These rocker arms move the deceleration valve to close the return line at just the right point in the cycle. To make this adjustment. . .



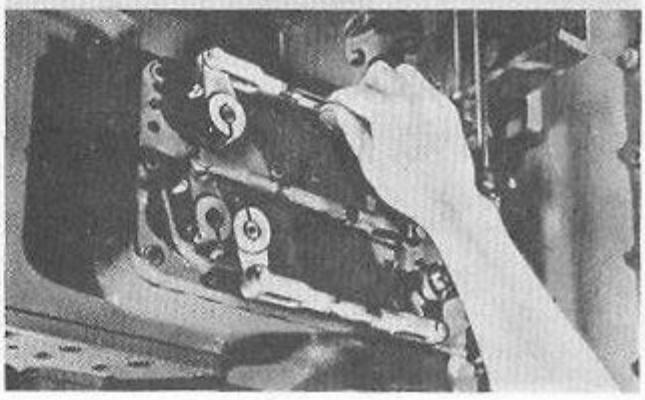
. . .we must know at what point in the cycle the return line is closed. This line is entirely closed when. . .

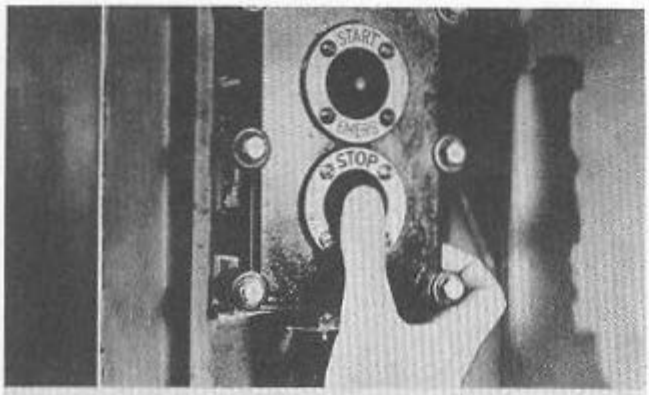


. . .with the needle valves closed the hoist comes to a stall. So, the first problem is to determine this stalling point. We find the stalling point. . .

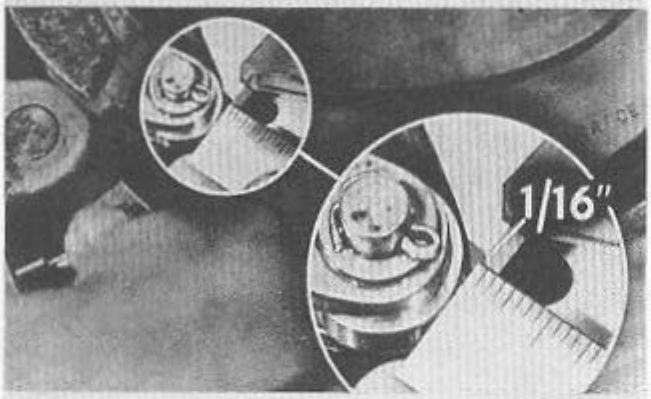


. . .by inching the flights as before until the hoist comes to a stall. As soon as this stalling point is reached. . .

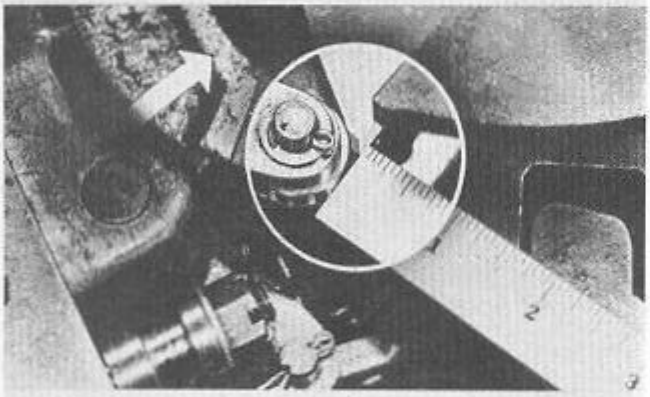




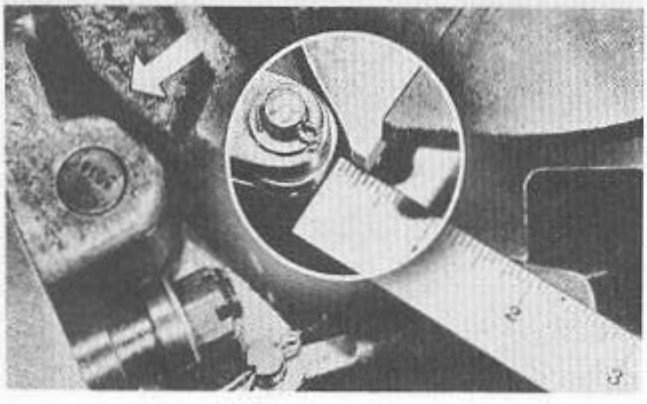
. . .press the STOP button. This way the hoist can't start while you're working on the rocker arms. The stalling point should occur. . .



. . .when the cam has turned just enough so that the straight edge of the cam projects one-sixteenth of an inch past the roller.

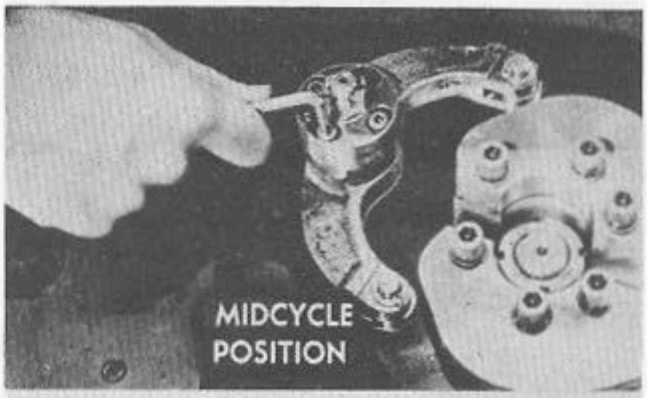


If the roller is adjusted too close to the center of the cam, the cam will move the rocker arm to stall the hoist before our one-sixteenth inch measurement is reached. To remedy this. . .

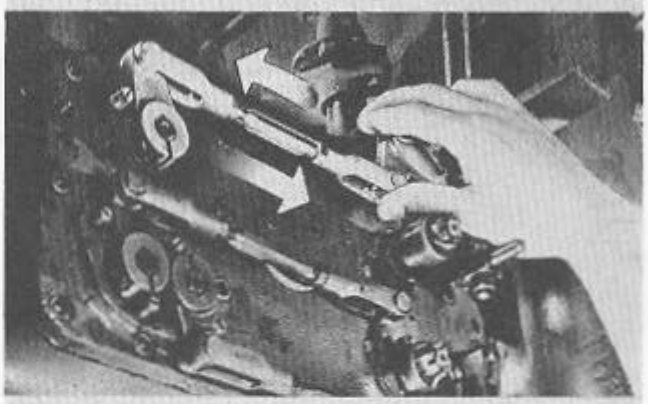


. . .move the rocker arm the way this arrow points (away from the center of the cam). Move the rocker arm toward the center of the cam if the cam turns too far, as shown by the scale, or if it fails to stall the hoist. Before moving the rocker arms, however, . . .

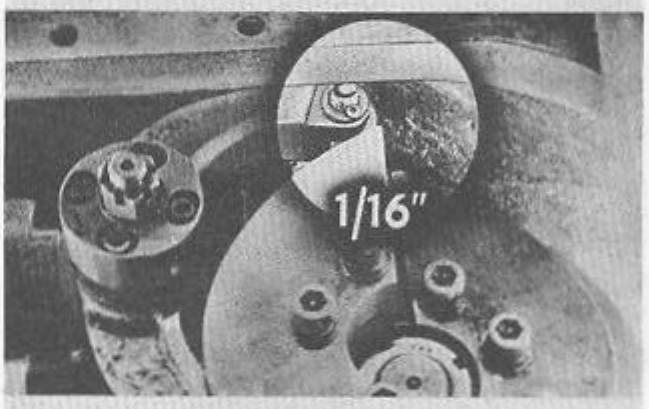
. . .operate the hoist to approximately mid-cycle position. Then, loosen the screws in the rocker arm hub. Move the arm as required and tighten the screws so that the adjustment will not be lost. Finally, . . .



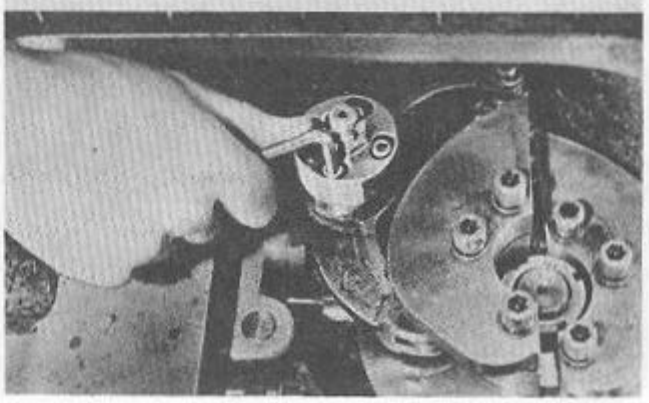
. . .with the power back on, again stall the hoist by shifting the unloading valve crank as before. If the required measurement of one-sixteenth of an inch is still not obtained, try, try again.

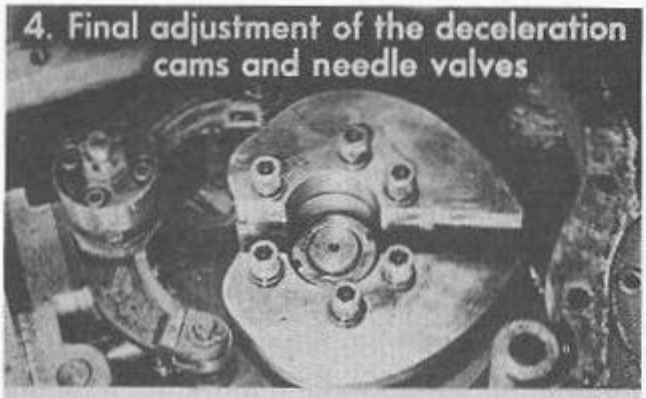


Adjust the second rocker arm the same way to get the one-sixteenth inch measurement, being careful not to disturb the setting of the arm already adjusted.



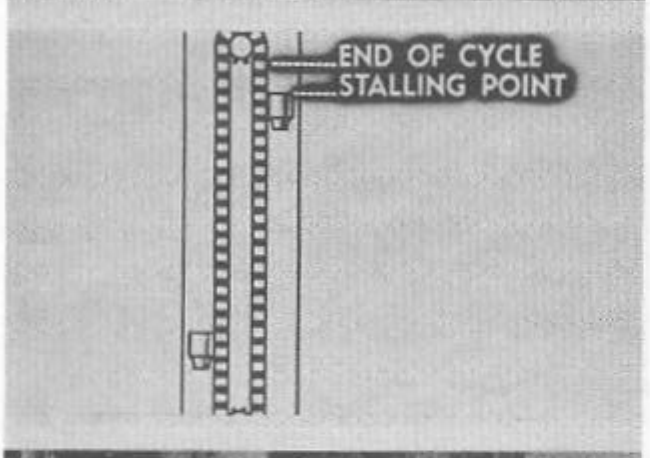
Complete the operation by tightening all the adjusting screws to make sure the rocker arms will not change position.



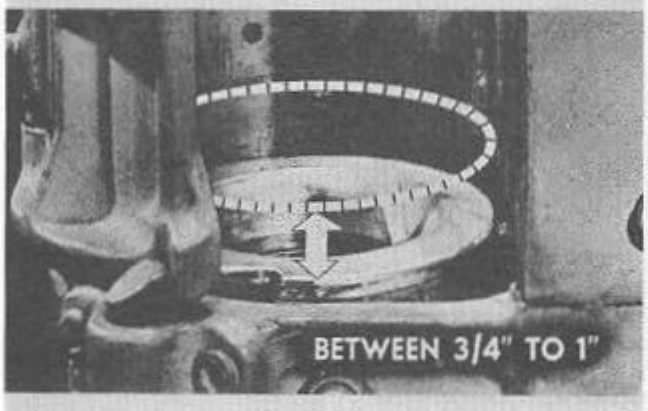


STEP 4

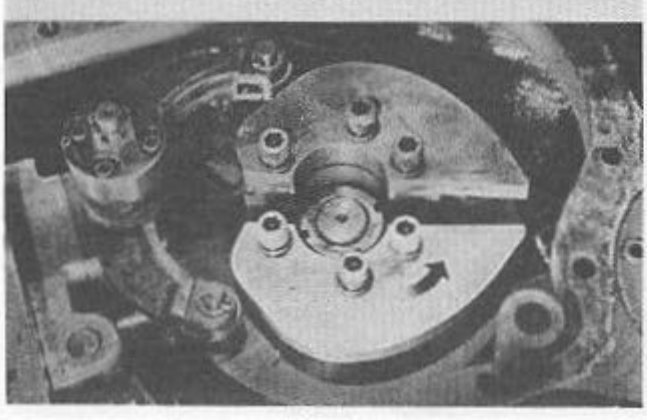
Fourth step is the final adjustment of the deceleration cams and the needle valves. The final adjustment of the cams is made to obtain the correct distance of travel. . .



. . .between the end of the cycle and the stalling point. This distance, or creeping period, . . .

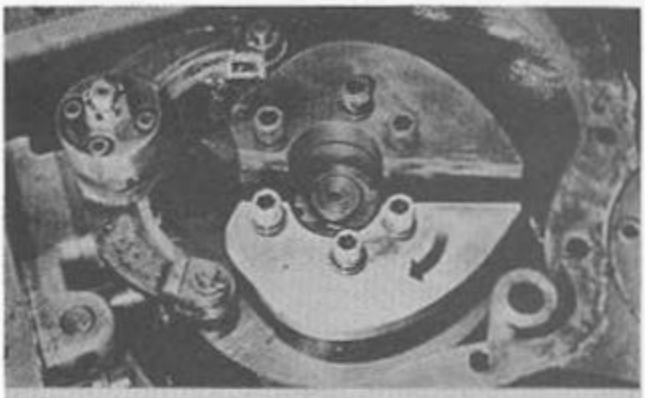


. . .is measured at the upper end of the hoist and should be between three-quarters and one inch. If this distance is greater, the overall cycle time will be too long. If the creeping period is less, there will be insufficient buffing action. That's why we make this adjustment. Now let's see how we do it.

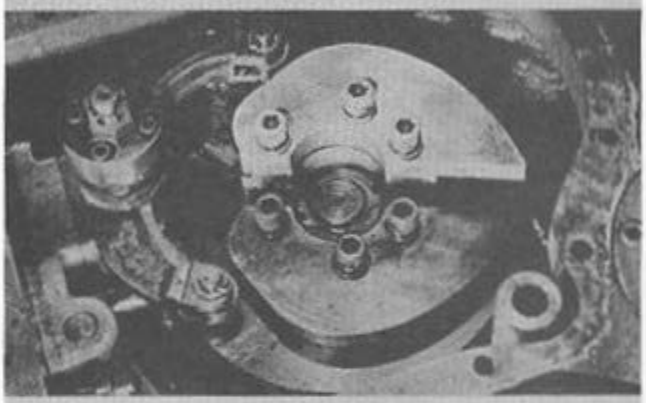


First, make sure the hoist is operated to midcycle position. Now we will move the deceleration cams in relation to their respective rocker arms in order to increase or decrease the creeping period. Let's adjust the bottom cam first.

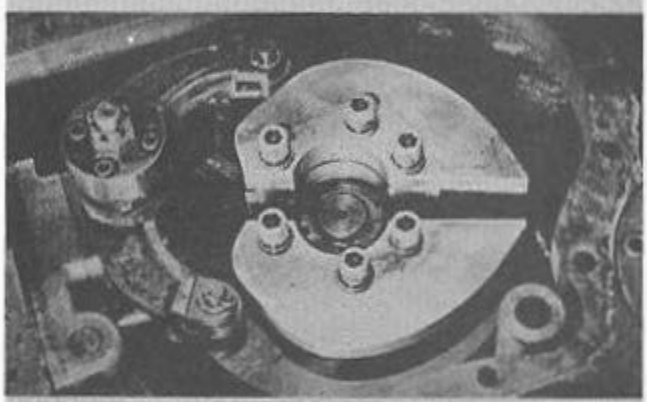
To decrease the creeping period move the cam the way this arrow points—toward the other cam.



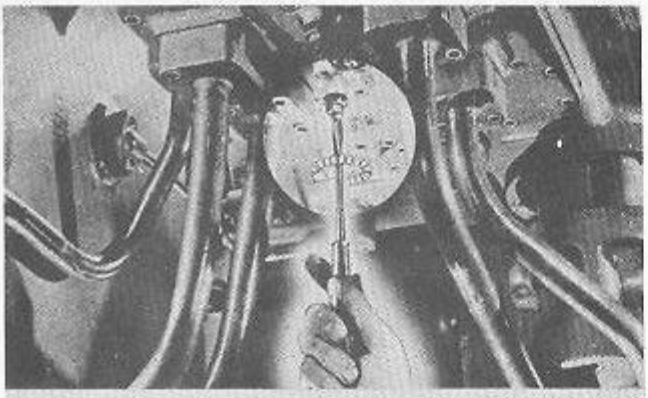
To increase the creeping period, move the cam the other way—away from the second deceleration cam.



Adjust the second cam the same way and, after the adjustment on each cam, don't forget to tighten the adjusting bolts. After these adjustments have been made, . . .



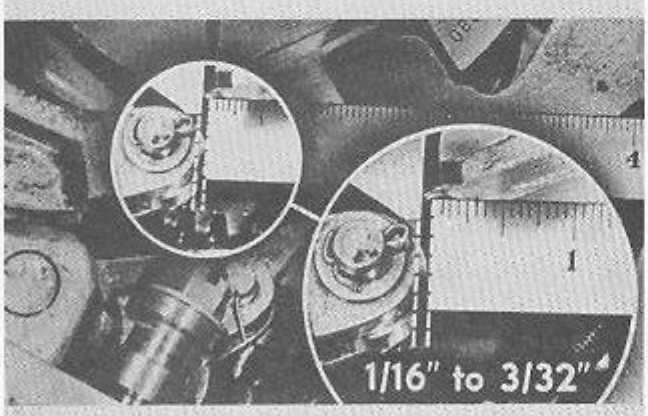
. . .check the distance each flight travels during its creeping period. That takes care of the cams. Now, let's adjust the needle valves to obtain the desired final buffing action. To do this, . . .



. . .slowly screw out each needle valve and test the hoist until you get a smoothly decelerated stop within the desired cycle time of 1.8 to 2 seconds. That's all there is to the needle valve adjustment.

STEP 5

Fifth step is a final check to see whether all adjustments have been properly made. Up to now we adjusted the rocker arms with the cams in the midcycle position. But this final check must be made with cams at the end of the cycle position, as shown here. At the end of the cycle position. . .

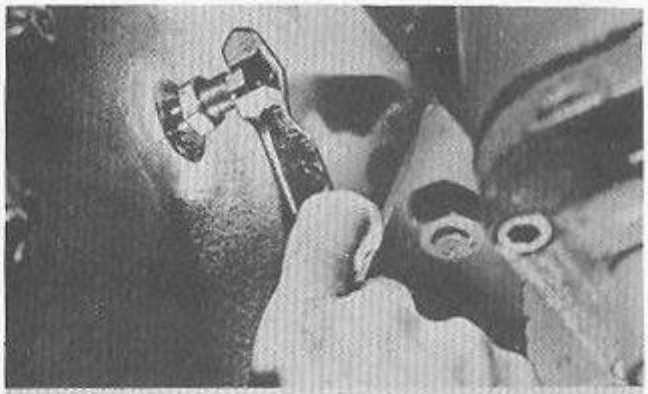


. . .the roller on each rocker arm should extend past the deceleration cam one-sixteenth to three thirty-seconds of an inch. If they do extend this required amount you've done a good job and you know all adjustments have been properly made. Now let's review briefly the main points in adjusting the control unit after replacing it on the hoist.

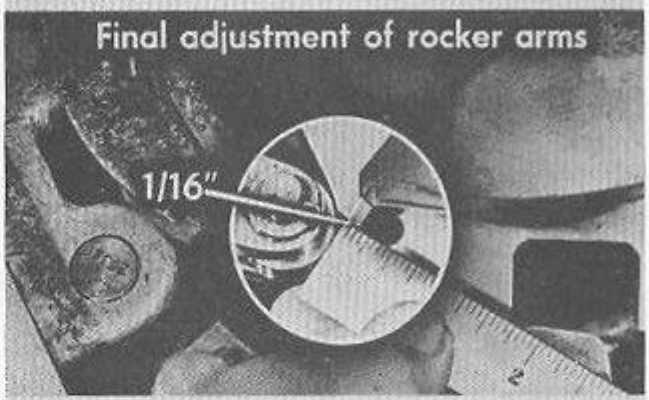
REVIEW OF STEPS

Adjusting the relief valve is point number one to remember. Inch the flight up the hoist a short distance at a time. Then, check the pressure gage for a reading of 800 pounds during deceleration. Remember, . . .

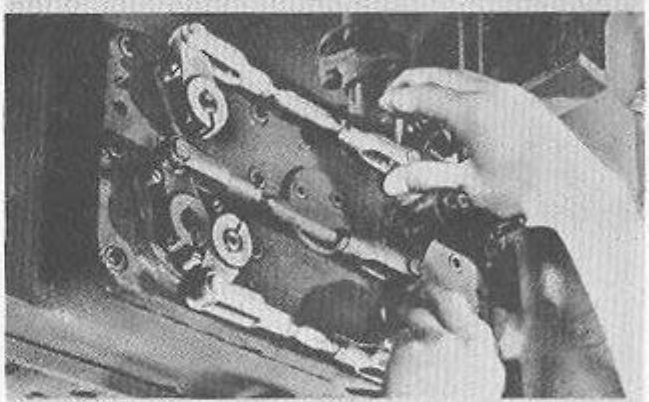
. . .to increase pressure, screw in the relief valve. To decrease, screw it out.



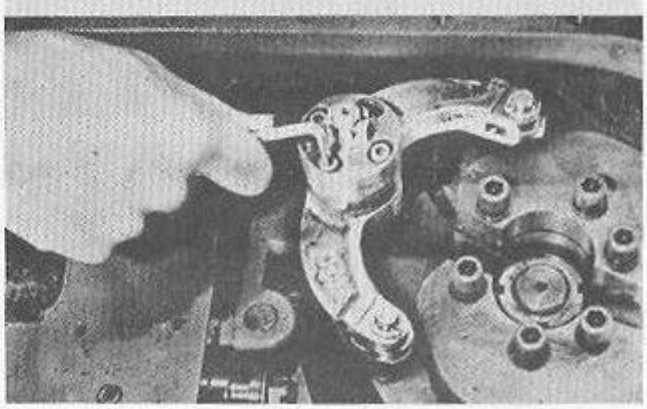
Make final adjustment of the rocker arms for a one-sixteenth inch clearance. To do this, . . .

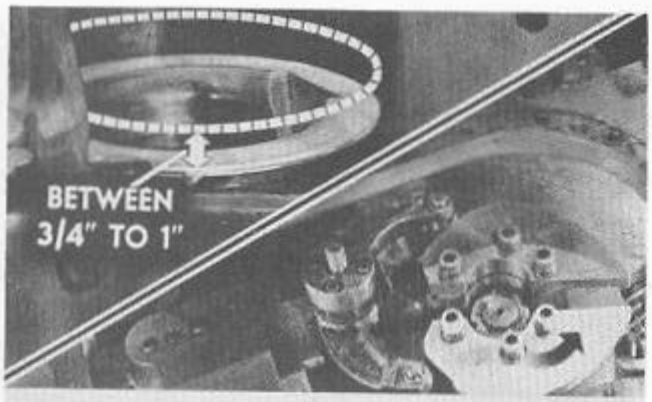


. . .stall the hoist with the needle valves tightly closed.

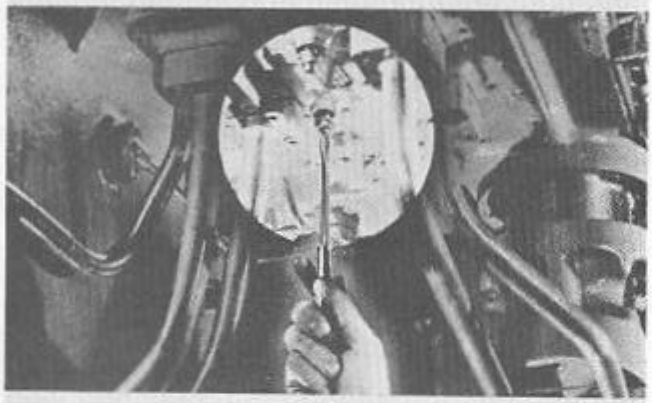


And adjust the rocker arms for proper clearance.

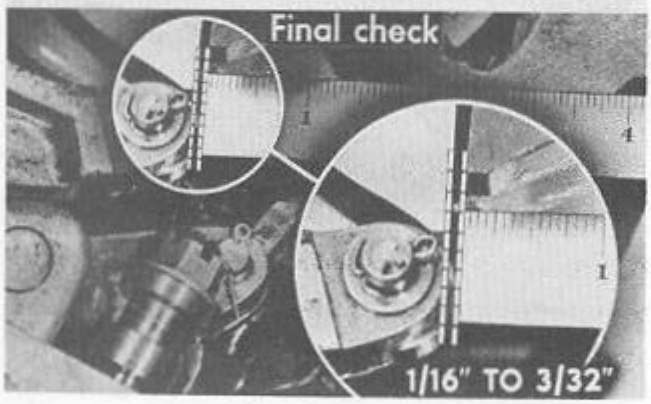




Make a final adjustment of the deceleration cams for a creeping period between three-quarters and one inch. Remember, moving one cam toward the other one will decrease the creeping period.



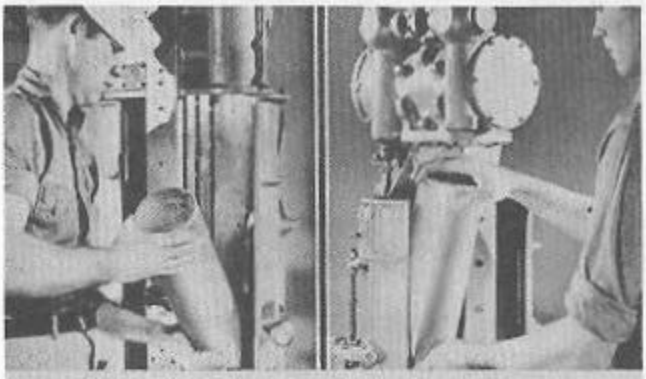
Adjust the needle valves to obtain the final buffing action, and. . .



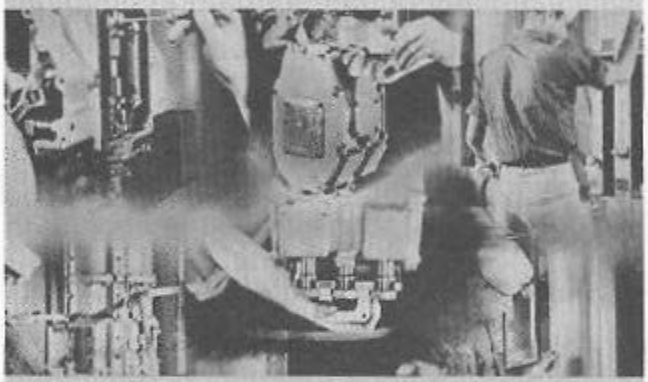
. . .make a final check to see that all adjustments have been properly made. If so, at the end of the cycle the roller on each rocker arm will extend past the deceleration cam one-sixteenth to three thirty-seconds of an inch. Well, that's that. Be sure you know thoroughly each of these important steps. Remember, even after the control unit has been reassembled and replaced on the hoist, proper adjustments are vitally necessary.

CHAPTER 27—ADJUSTMENT—PART ONE

One sure way to guarantee that the projectile hoist will be ready when it is needed is to keep all parts properly adjusted at all times.

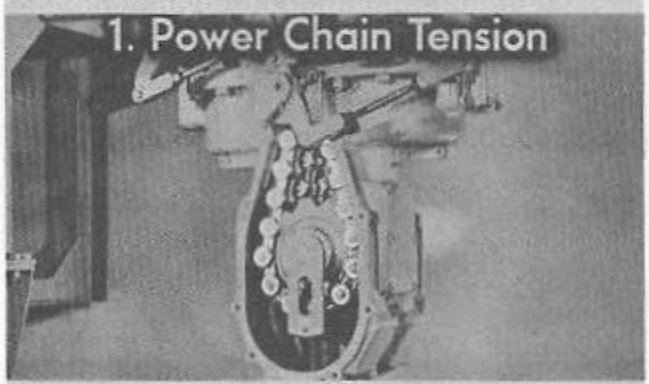


The various parts do not often need adjustment, but when adjustments are required it is necessary to know how to make them accurately. In this chapter we will consider these adjustments at the lower end of the hoist which you may have to make from time to time.



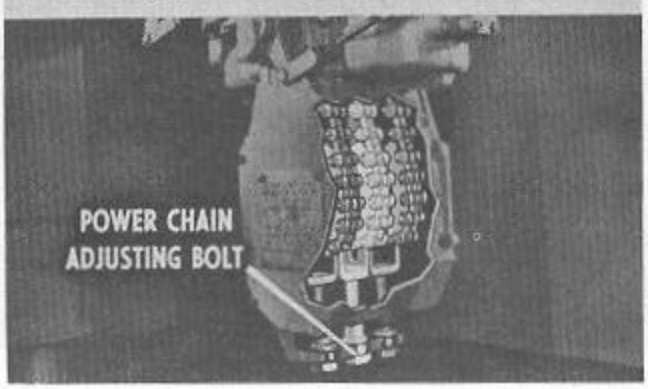
ADJUSTMENT STEPS

These adjustments may be divided into five main groups. One, power chain tension; two, fuze-setting chain tension; three, lower end control gear; four, lower and ejector mechanism; and five, manual bypass valve control linkage. Let's start. ., .

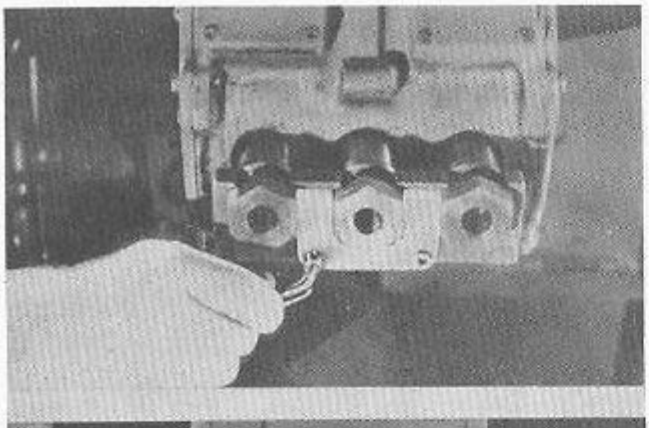


STEP 1

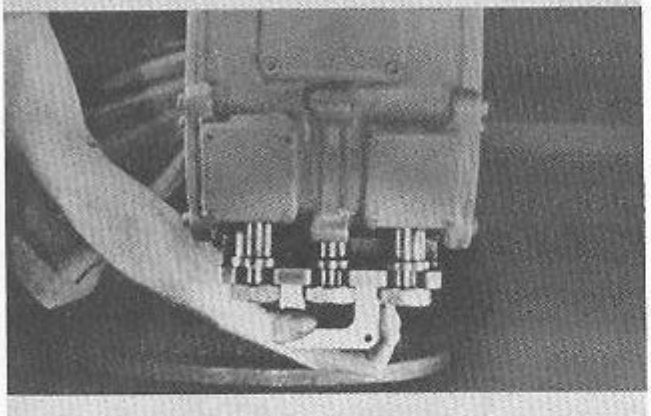
. . .with the first one—power chain tension. If this chain does not have the right amount of tension the hoist will not operate properly. The first step is to adjust for approximate tension. This is done. . .



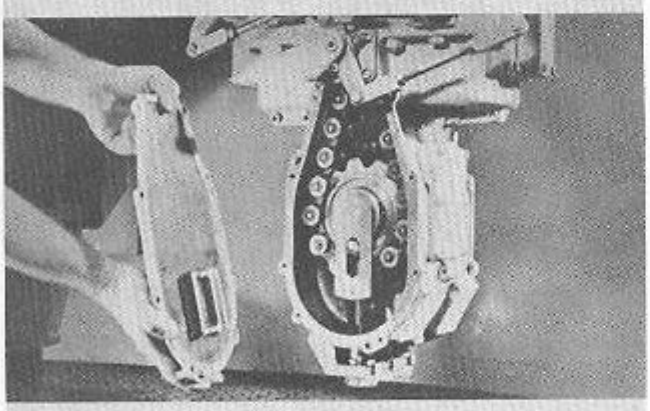
. . .by turning the power chain adjusting bolt. Notice that this bolt is the center one. Before adjusting the bolt. . .



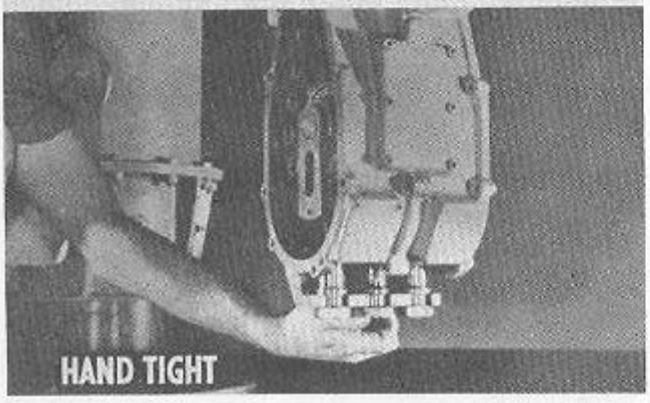
. . .remove the locking bar. Then, . . .



. . .back off the center bolt until the power chain is slack. The amount of slack can be observed. . .

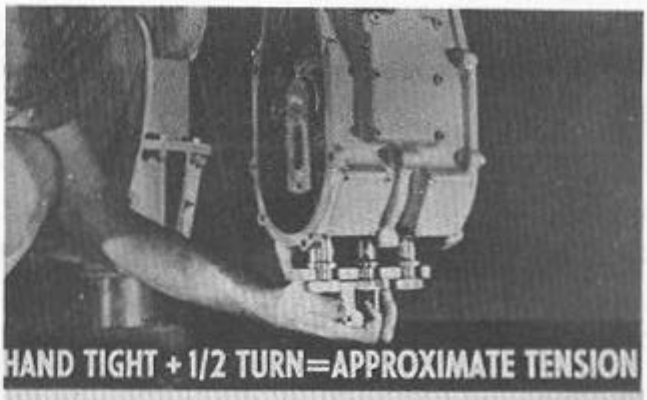


. . .by removing the inspection cover. Now, . . .



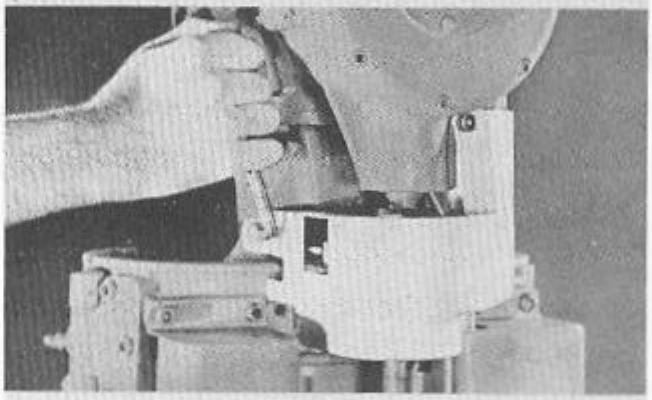
. . .screw the power chain adjusting bolt handtight. You know, just use your fingers.

Then, with the locking bar add one-half turn. The power chain is now adjusted for approximate tension. Next, we must adjust the chain for exact tension. To do this, . . .

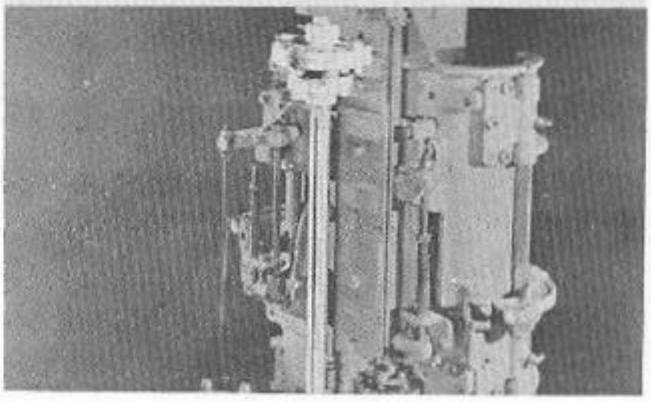


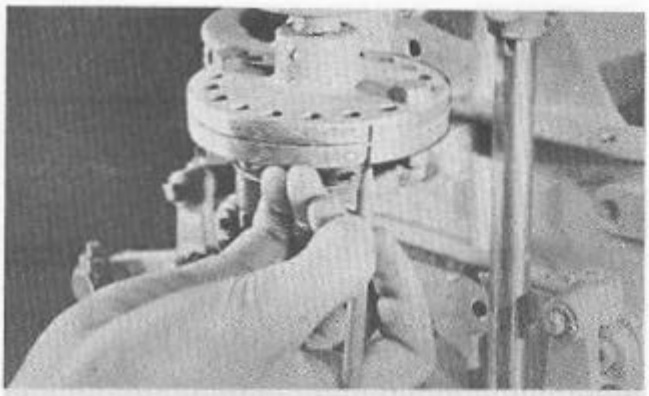
. . .operate the hoist manually until the flights are at approximate midcycle. Then, . . .

. . .go to the upper end of the hoist and take the cover off the adjustable coupling on the main drive shaft.

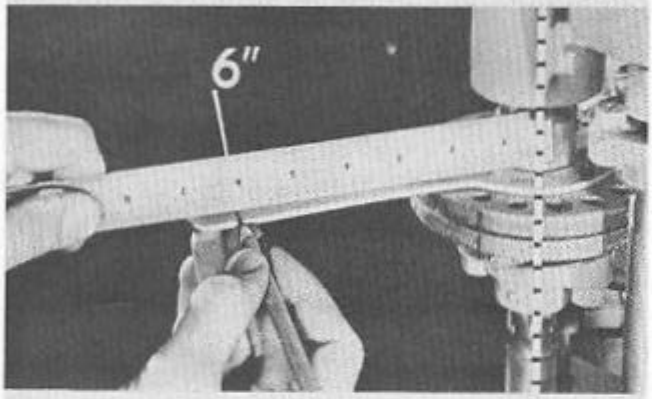


We are going to disconnect this coupling and measure the tension on the power chain. But, before we do this, . . .

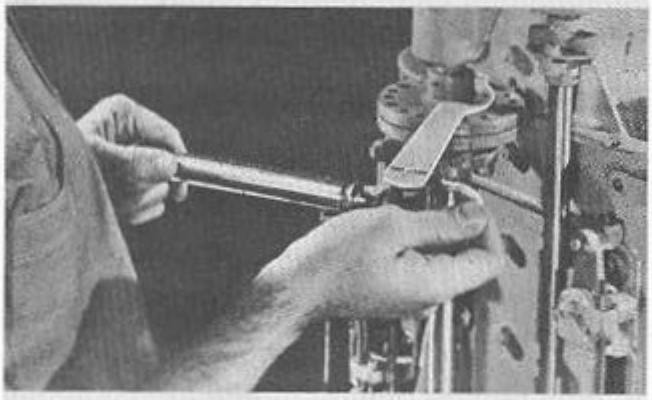




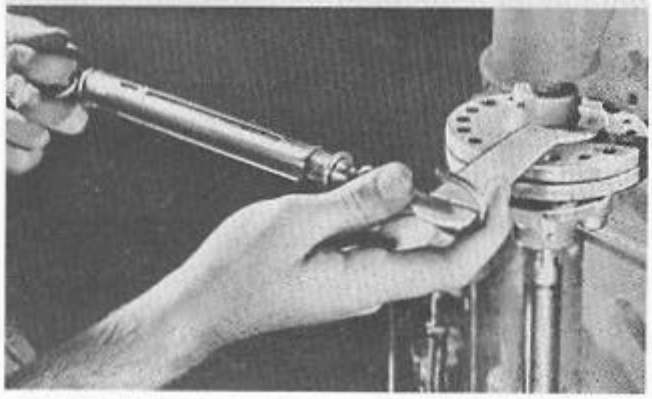
. . .place scribe marks on each half of the coupling. These marks will help you reconnect the coupling properly. Now, disconnect it, . . .



. . .and attach a spanner wrench to the upper half of the coupling. Then, mark off 6 inches up the handle from the center line of the drive shaft.

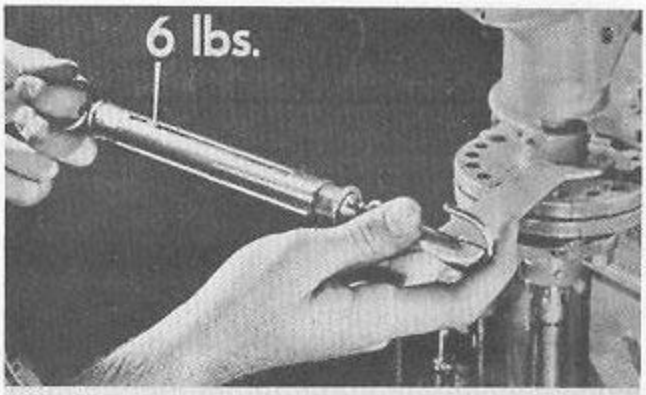


Next, attach a spring scale at the 6-inch mark.

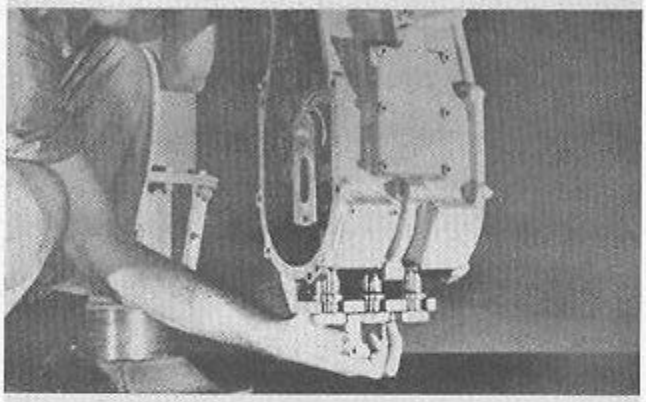


Hold the scale at right angles to the wrench handle and pull on the scale until the shaft rotates. Watch the scale. It should read. . .

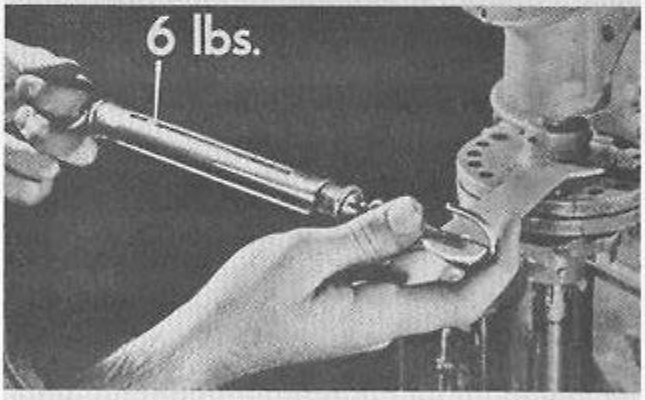
. . .6 pounds while the shaft is rotating. It may be necessary to repeat the test several times before you get an accurate reading. Be sure not to rotate the shaft through a complete revolution. If you do, the flights will be out of adjustment when you reconnect the coupling.



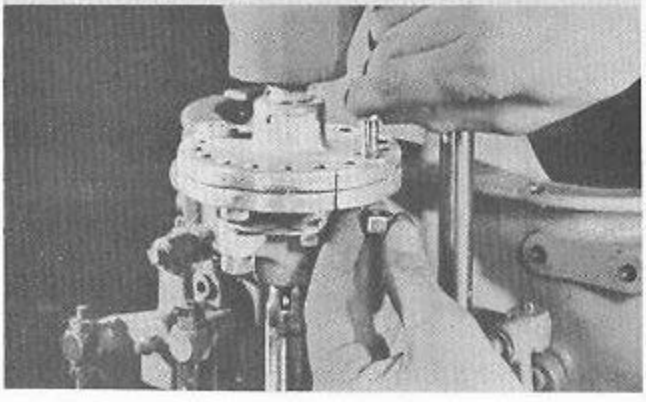
If the required 6-pound pull is not obtained, a correction is made by further adjusting the center bolt, and. . .



. . .repeating the scale test until you do get a 6-pound pull. When you do have a correct reading. . .

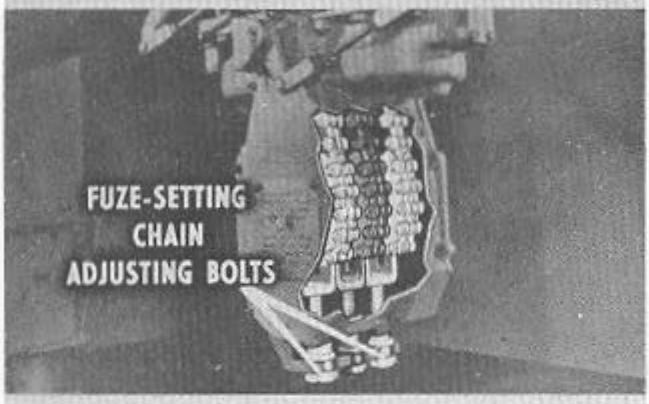


. . .line up the scribe marks and reconnect the coupling. The power chain tension is now properly adjusted.

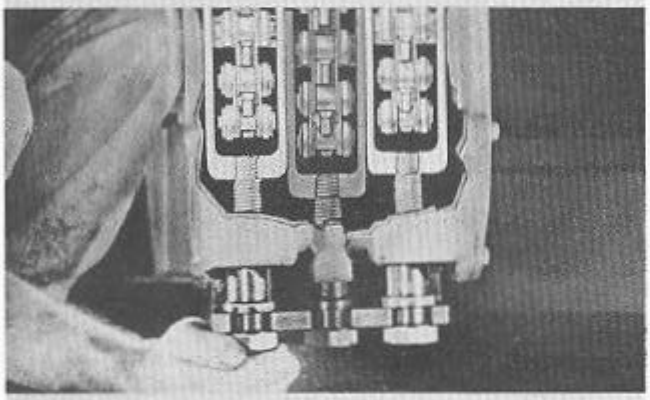


STEP 2

The second adjustment is for the fuze-setting chain tension. Improper tension means the fuzes will not be set accurately. The first step is to adjust the chains for approximate tension.



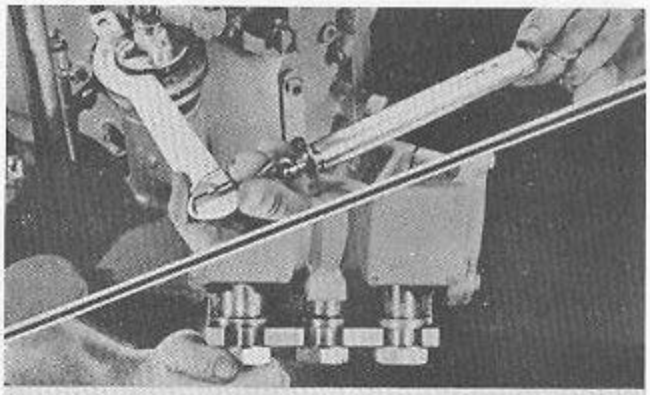
The fuze-setting chain adjusting bolts are the two outside ones. All right now, . . .



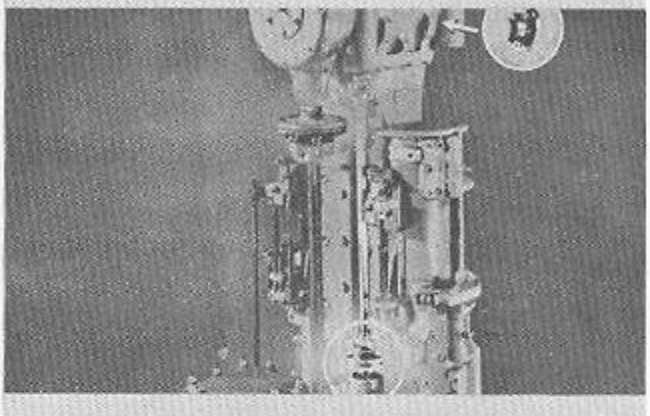
. . .back off the outside bolts 'till each chain is slack.

Then, adjust the bolts hand-tight and add one-sixth of a turn. The fuze-setting chains are now adjusted for approximate tension. To obtain the exact tension. . .

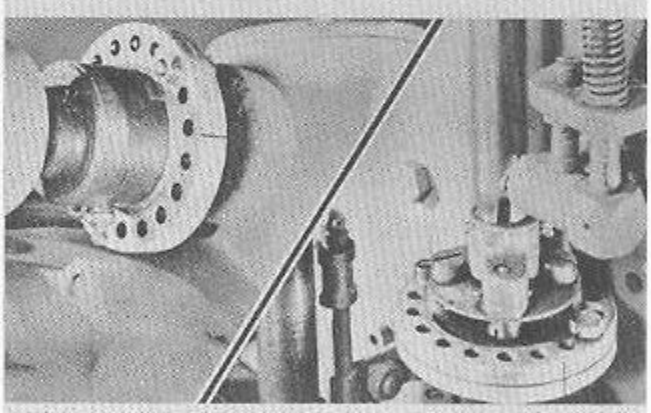
. . .we will first measure the tension at the proper couplings. Then we'll adjust the respective bolts. The tension is measured. . .



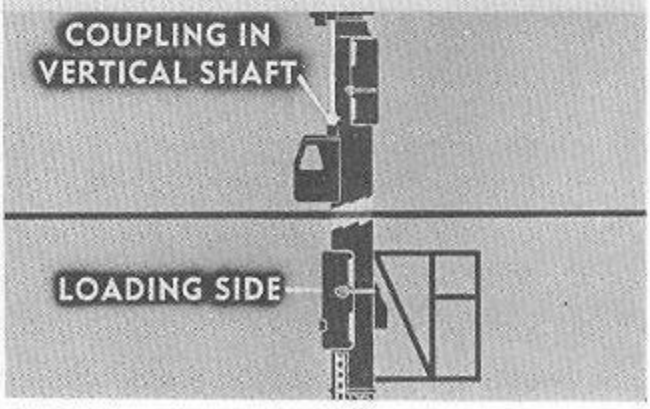
. . .at these two couplings. The lower one, located on the vertical fuze-setting drive shaft, controls one chain. The upper one, on the horizontal cross shaft, controls the other chain.

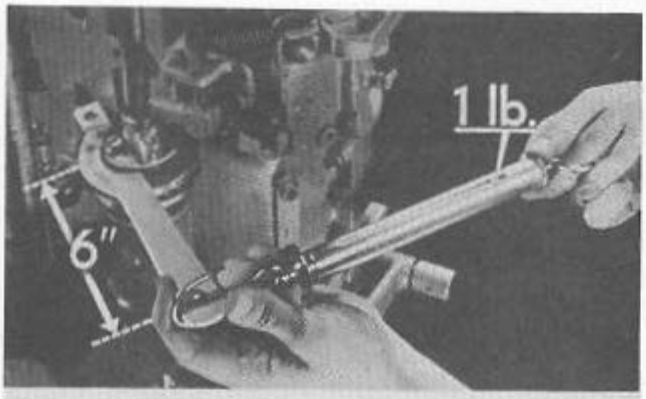


Place scribe marks on each coupling and then disconnect each one.

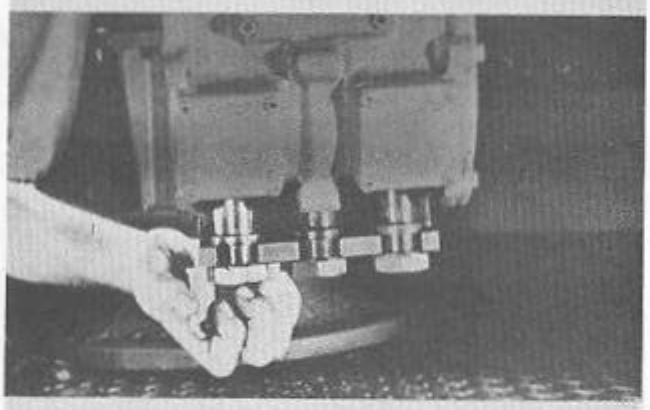


First, we shall measure tension on the coupling in the vertical shaft. This coupling controls the tension on the fuze-setting chain nearest to the loading side of the hoist.

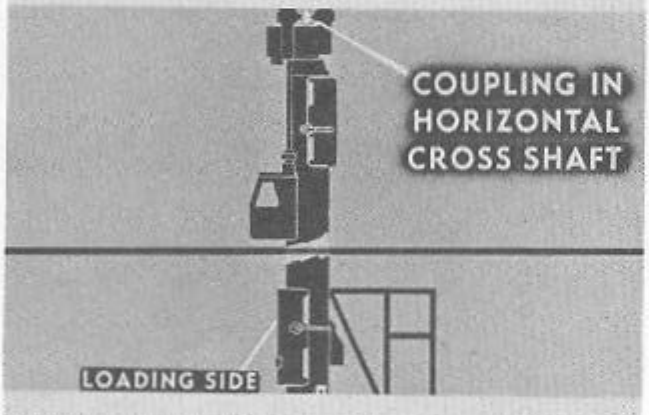




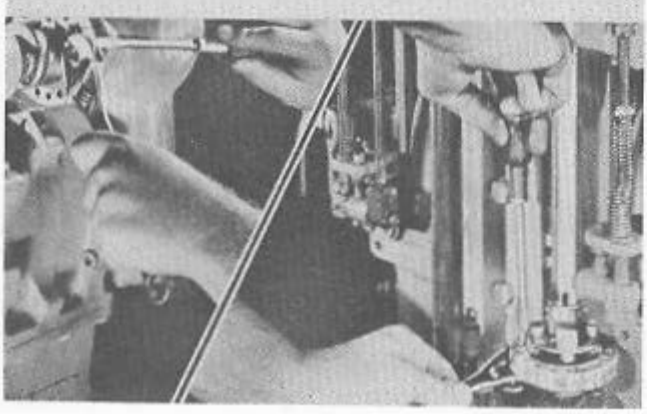
First, attach a spanner wrench and scale to the upper half of the vertical coupling. Measure the drag as we did for the power chain tension. The scale should read 1 pound in this case. If it does not, . . .



. . .then adjust the bolt nearest the loading side of the hoist until the scale does read 1 pound.



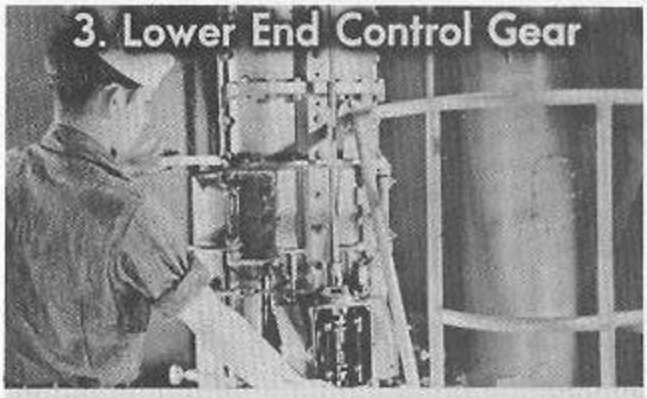
Repeat the operation on the coupling on the horizontal cross shaft. Notice that the adjusting bolt to be used is the outer one farthest from the loading side. After both chains are adjusted for a 1-pound drag, . . .



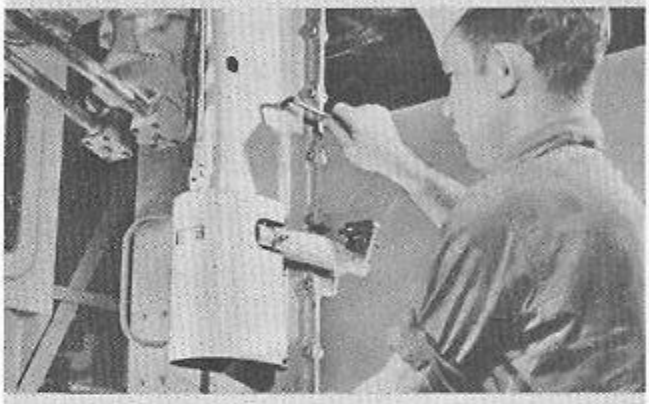
. . .line up the scribe marks on both couplings and reconnect them. Both fuze-setting chains are now properly adjusted for tension.

STEP 3

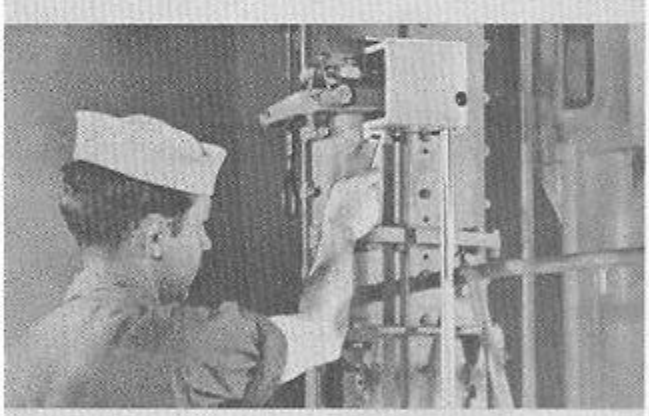
The third group of adjustments is made on the lower end control gear. These mainly concern the various linkages that control the automatic operation of the hoist. To begin these adjustments on the lower end control gear, . . .



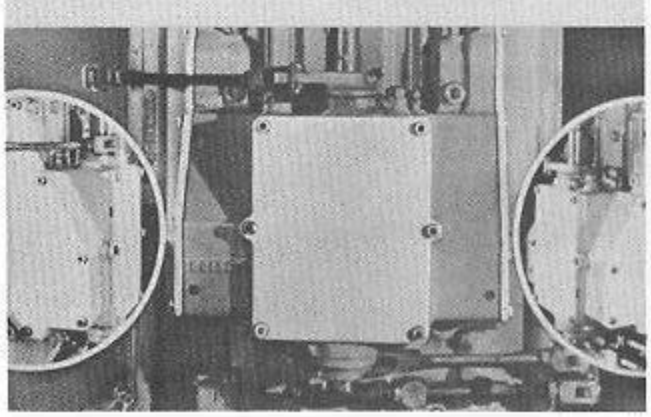
. . .first, disconnect and remove the indicator cover over the manual starting handle.

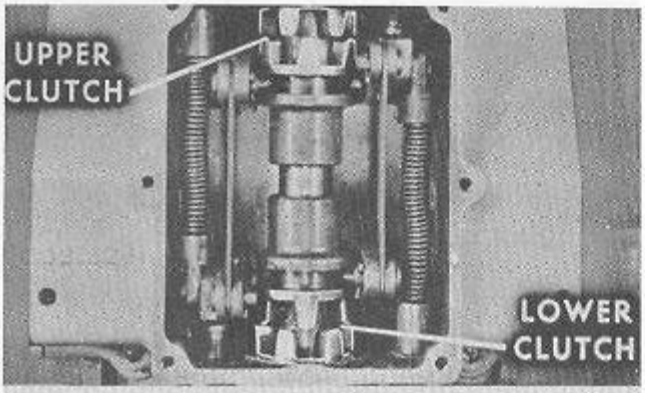


Also, remove the cover from the cross shaft at the upper end of the vertical control shaft.

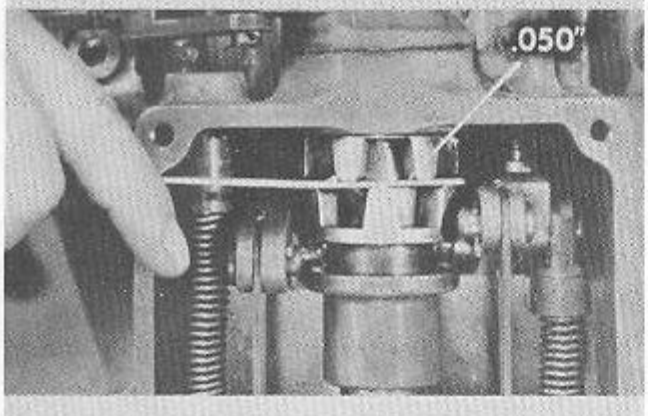


Then, on the clutch box, remove the back cover plate and 2 side plates. This will reveal. . .

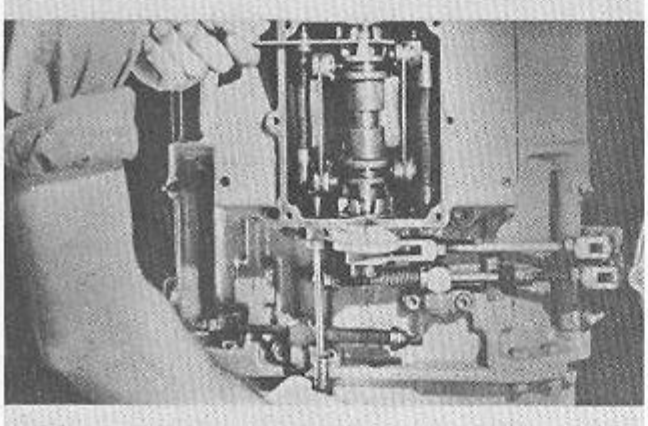




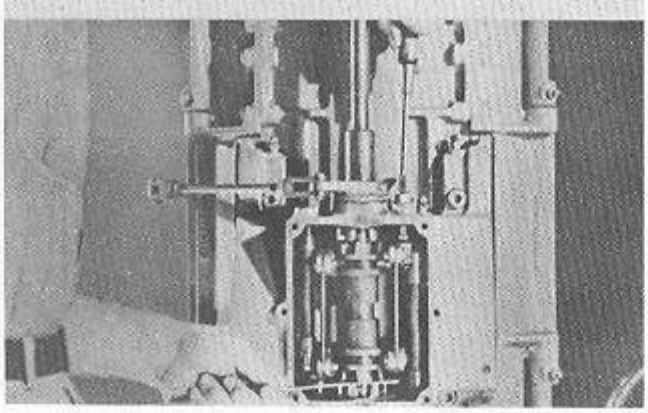
. . .the upper clutch and the lower clutch. Both clutches must be adjusted so that there will be a clearance of. . .



. . .0.050 inch between the ends of the teeth to allow the clutches to move independently when disengaged.

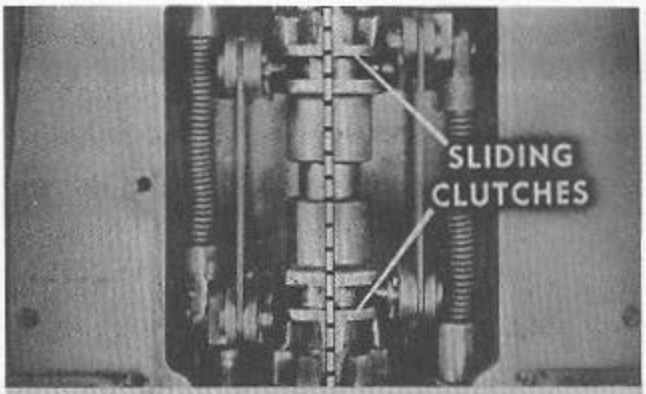


If adjustment on the upper clutch is necessary, back off the locknut on the lower stop bolt. Now, adjust the stop bolt until a clearance of 0.050 inch is obtained.

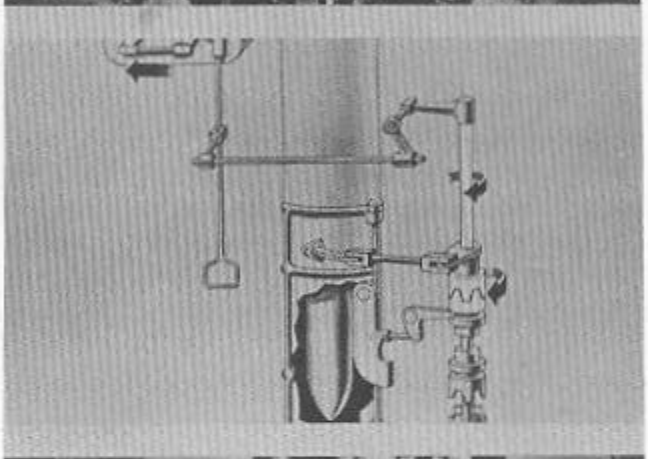


If adjustment on the lower clutch is necessary, then use the upper stop bolt.

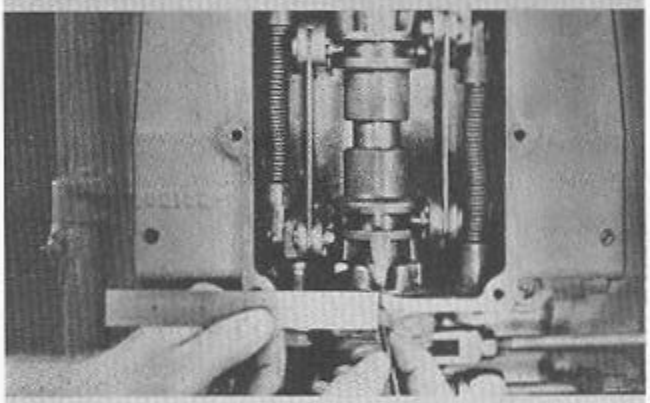
Now, we must line up the front teeth of the sliding clutches with the vertical center line of the box. Why? Well, because. . .



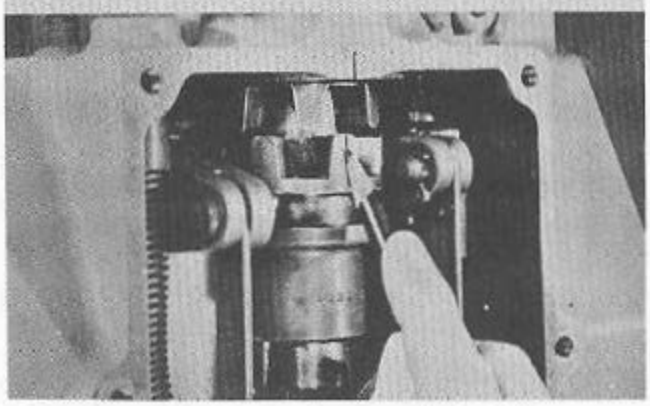
. . .we need to make sure that the clutches will engage and rotate the vertical control shaft so as to move the starting valve to full starting position when the hoist is loaded and the door is closed. We begin. . .

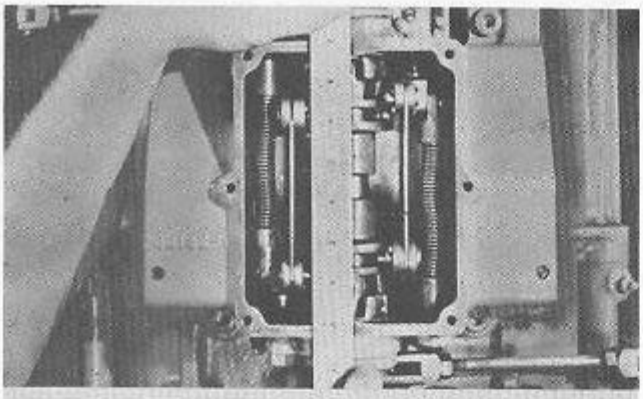


. . .by placing scribe marks at the exact center of the top and bottom ledges.



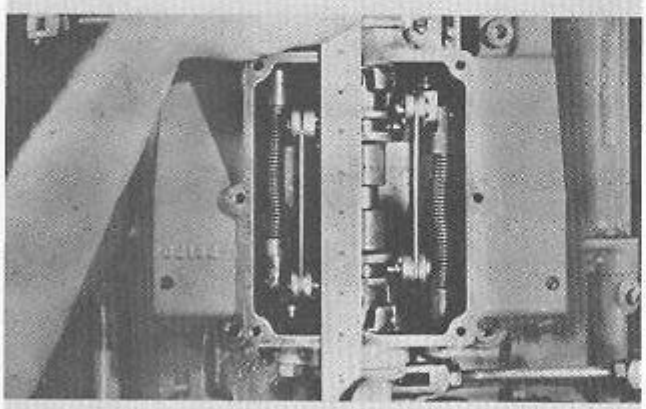
Then, scribe a mark at the center of the front tooth in one of the sliding clutches.



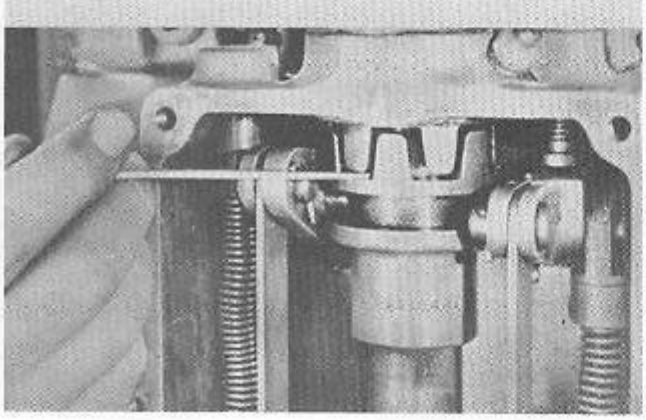


Now, with a straight edge, connect the scribe marks on the box. The scribe mark on the tooth should line up with the other scribe marks. If not, . . .

. . .adjust the spring stop rod at the upper end of the vertical control shaft until. . .

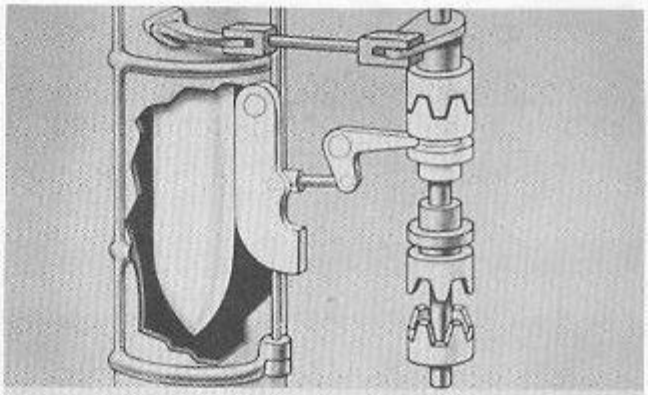


. . .the scribe marks are in line. Both the upper and lower clutches will not accurately rotate the vertical control shaft.

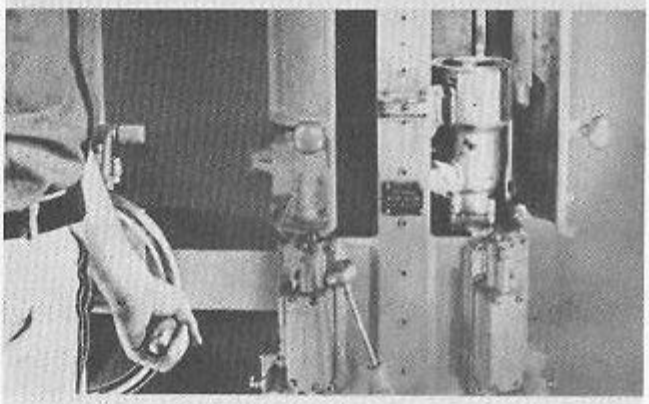


The next step in adjusting the lower end control gear, is checking clearances at the clutches for the control cam. The proper clearance is necessary so that. . .

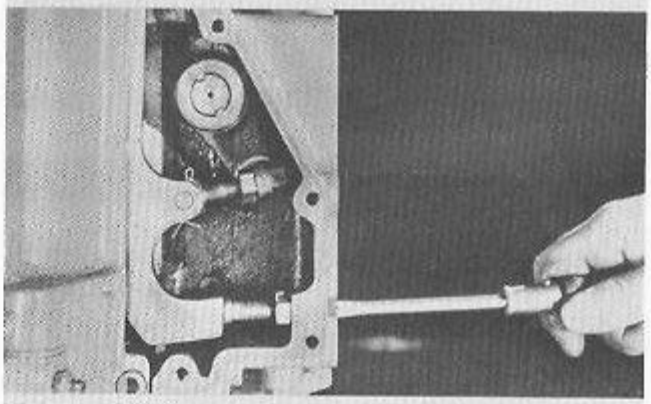
. . .when the lower end is loaded the control cam will bring the clutch teeth into engagement with sufficient engaged clearance. To make this adjustment. . .



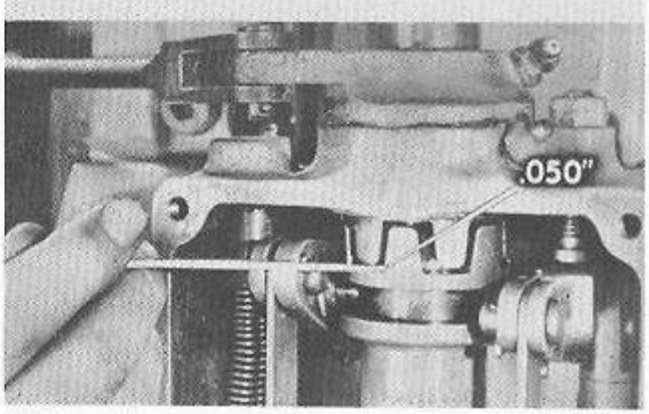
. . .run up the empty fuze pot in manual until the control cam is completely depressed. To make sure that the cam is completely depressed, . . .

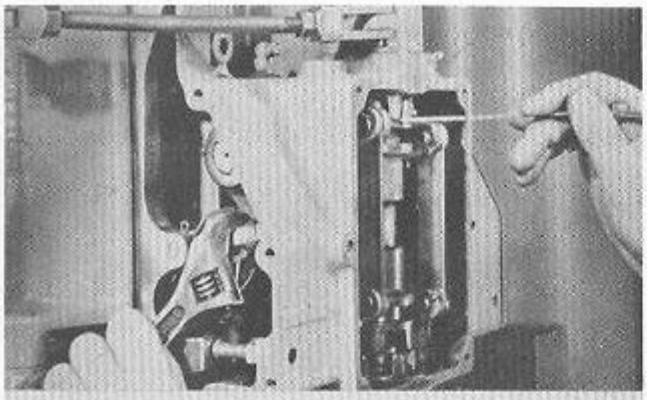


. . .it may be necessary to back off on the control cam stop bolt in the clutch box.

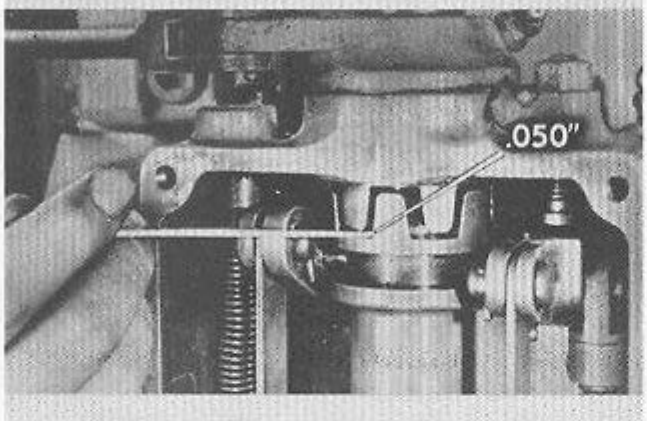


With the cam completely depressed, there should be a clearance of 0.050-inch between the end of the teeth and the bottom of the notches. If we do not have this exact clearance, . . .

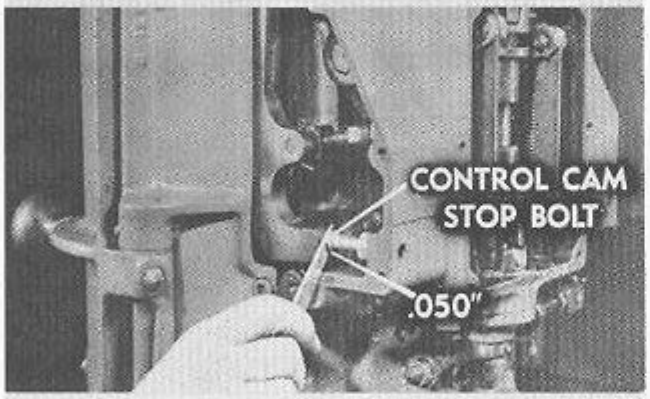




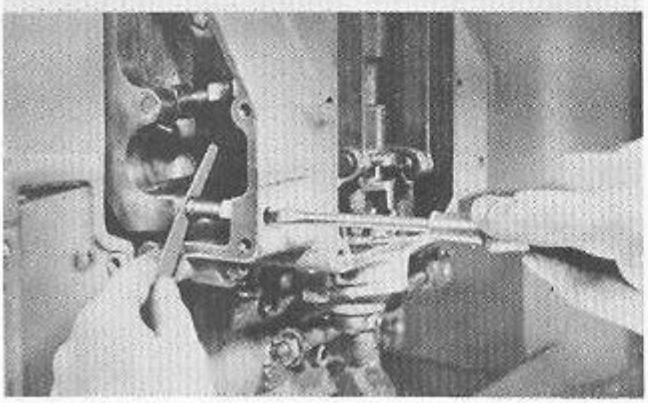
. . .we adjust the control cam connecting link in the side of the clutch box until the 0.050-inch clearance is obtained. After this adjustment is made, do not move the fuze pot until the next adjustment is completed. Because, . . .



. . .in order to maintain the 0.050-inch clearance we must make sure that the control cam itself does not overtravel when depressed. Overtravel is limited. . .

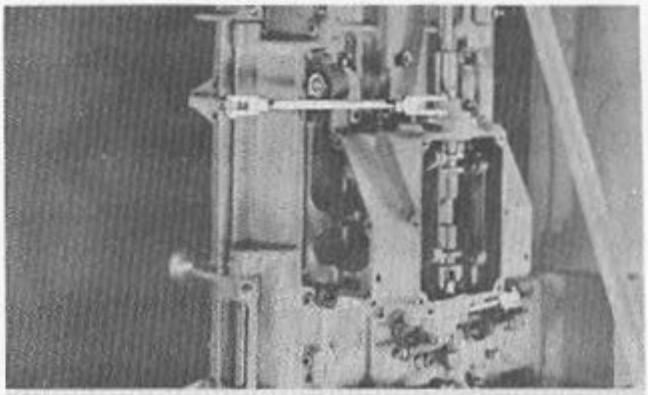


. . .by the control cam stop bolt. A clearance of 0.050 inch between this bolt and the cam will properly limit its travel. To obtain this clearance loosen the locknut on the stop bolt. . .

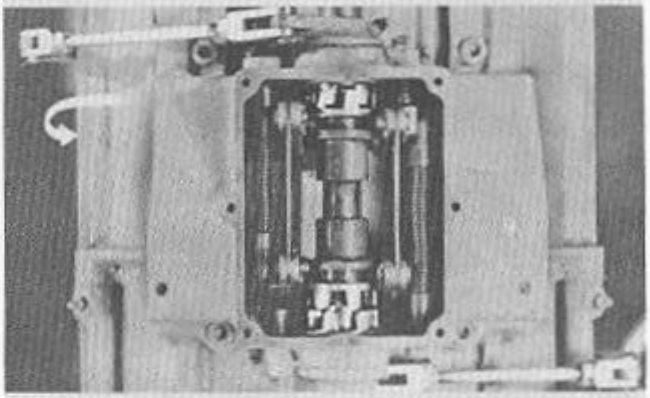


. . .and adjust the bolt through the opening at the rear of the clutch box. Make the same adjustment for the other control cam. Now, with both cams properly adjusted, we proceed. . .

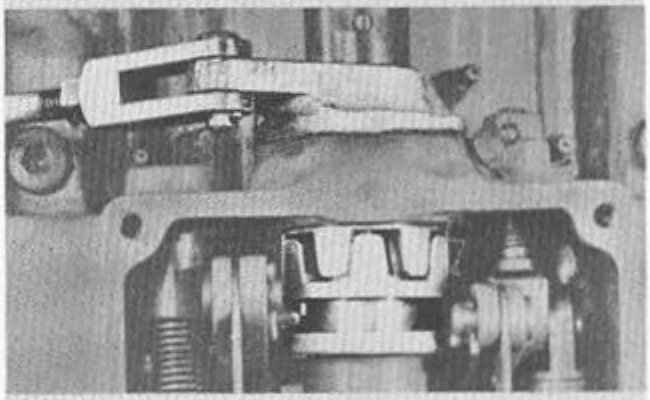
. . .with the adjustment of each of the lower door connecting rods. The purpose of this adjustment is to make certain. . .



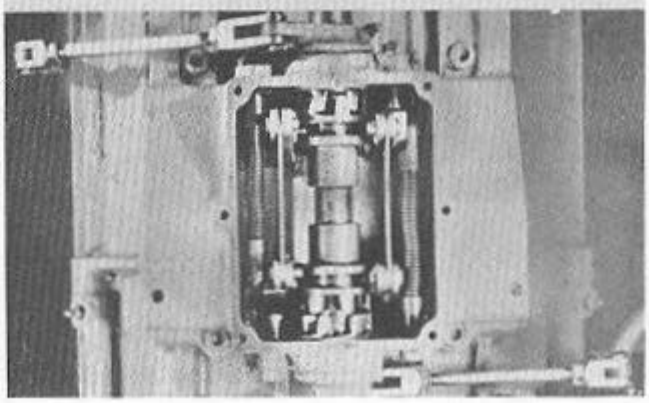
. . .that when a door is closed its connecting rod will be of proper length to move the clutch a sufficient amount to provide. . .

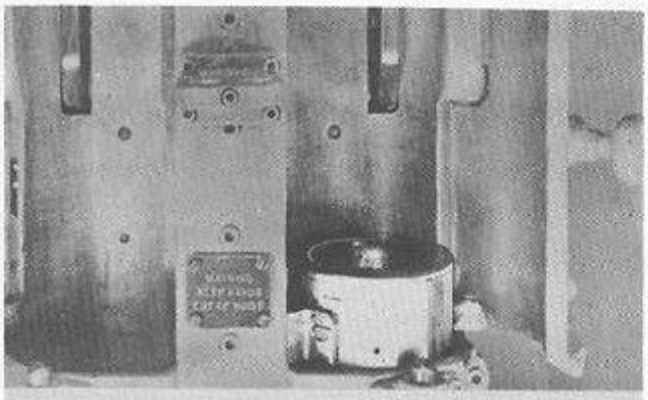


. . .the required clearance between the sides of the teeth. This clearance is necessary in order that the clutch will reengage properly when the fuze pot decends—the door being closed.

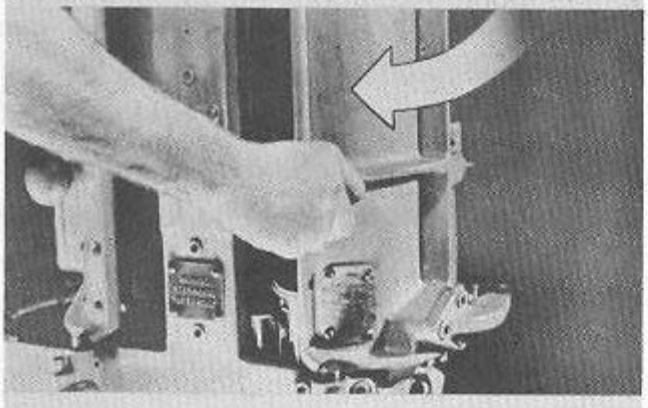


Before measuring the clearance, however, the clutch teeth must be properly engaged. To do this. . .

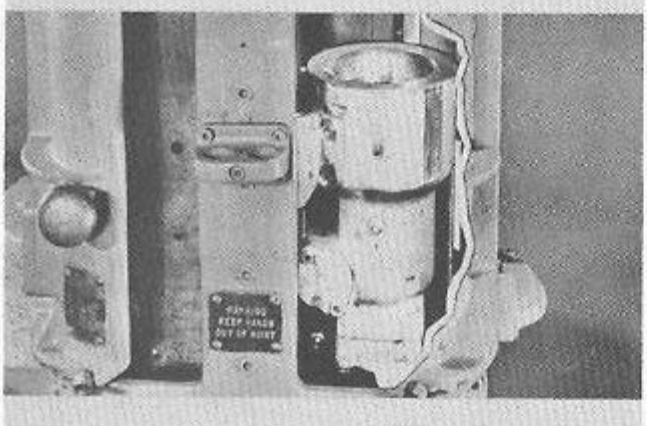




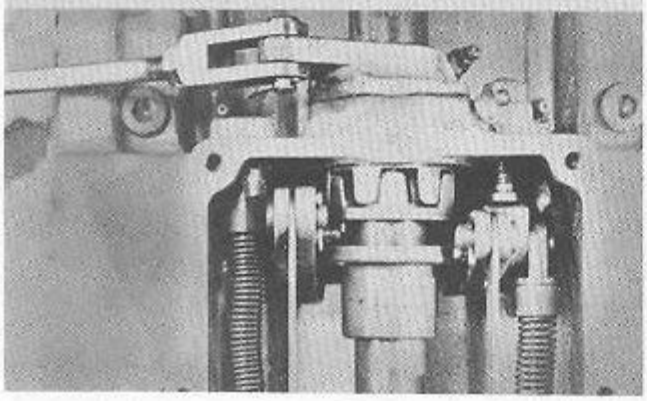
. . .you must start with the fuze pot at the lower end of the hoist. Then. . .



. . .close the door.

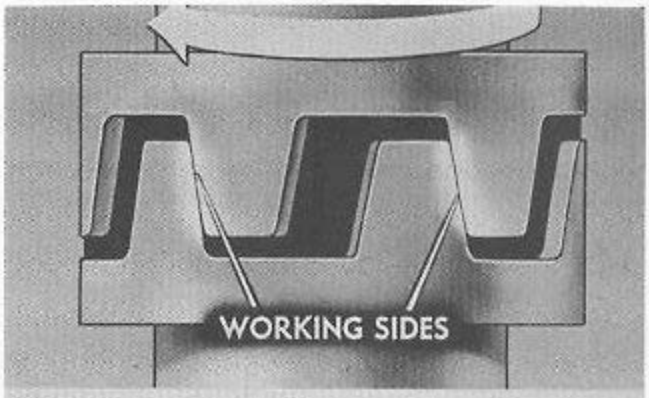


And, run up the empty fuze pot in manual until it depresses the control cam. This simulates the action of a descending fuze pot at the end of a cycle.

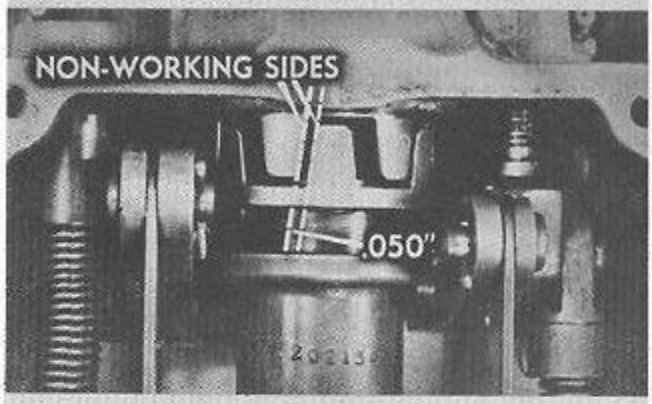


The teeth are now properly engaged to make the adjustment. Before we can measure the clearance, however, we must first know which are the working sides and which are the nonworking sides of the clutch teeth.

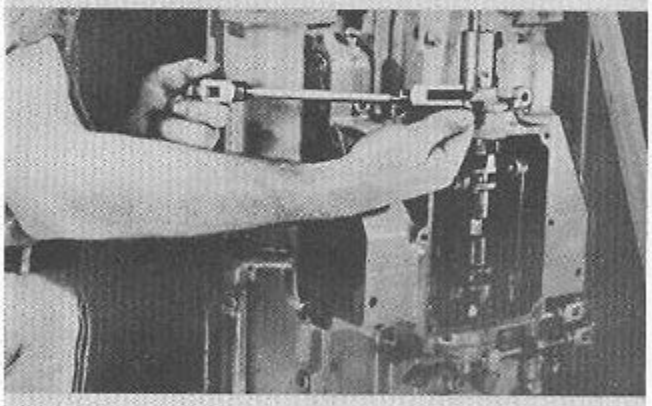
The working sides are the ones which come together because they exert or receive force. Since the opposite sides do not touch, they are called the nonworking sides. Got it?



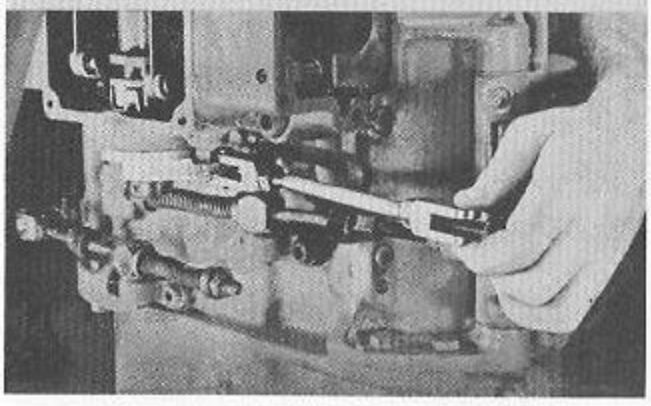
All right. Now, with the clutch teeth properly engaged the clearance between the nonworking sides should be 0.050 inch. If it is not. . .

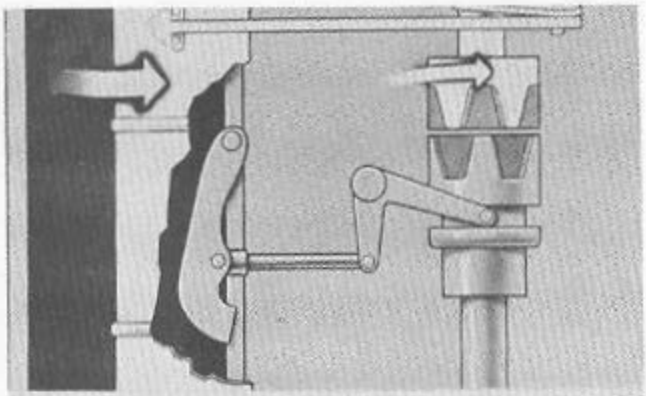


. . .adjust the length of the outboard door connecting rod until the correct clearance is obtained. Finally, adjust the other door. . .

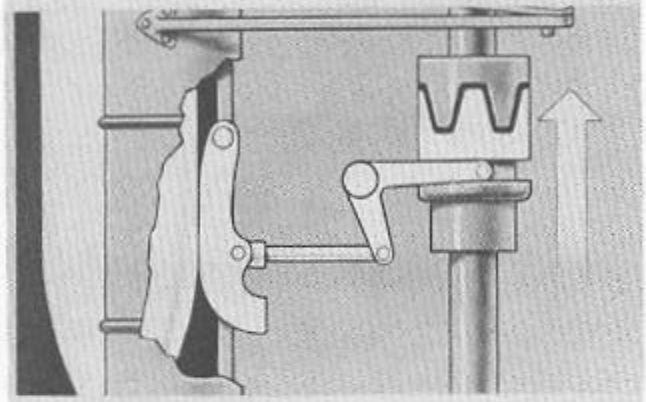


. . .in the same way by means of the lower clutch and the lower rod.

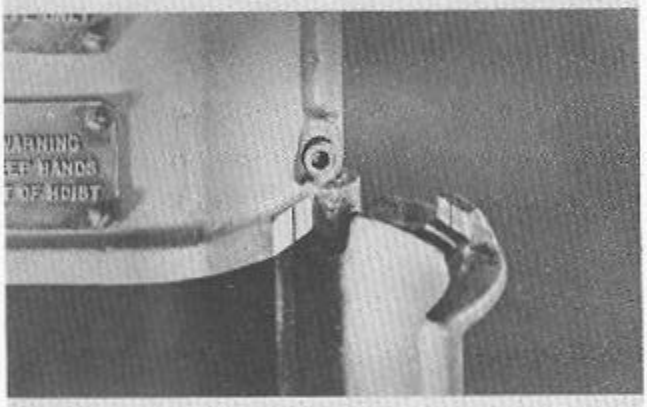




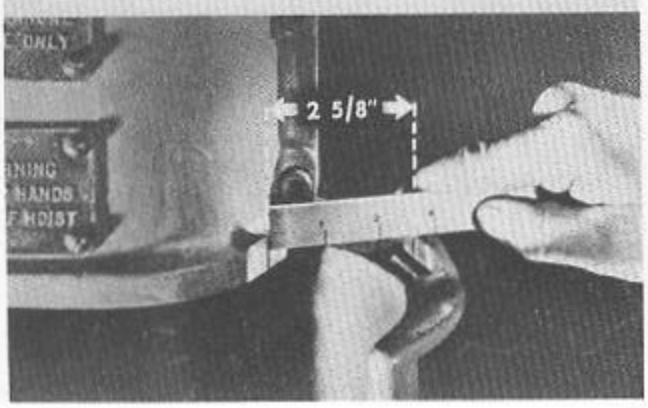
Now let's consider the adjustment of the lower doors. Remember how they work? You open the door and the upper teeth are positioned. Then, . . .



. . .as the projectile is loaded, the teeth engage. Obviously the teeth would not have engaged properly if the lower door had not opened the correct distance.

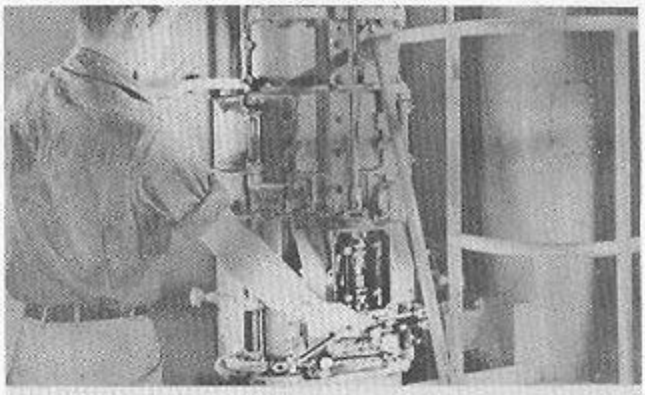


The distance the door opens can be measured by scribe marks which were made when the hoist was assembled. Both doors are marked in the same way. To check the distance. . .



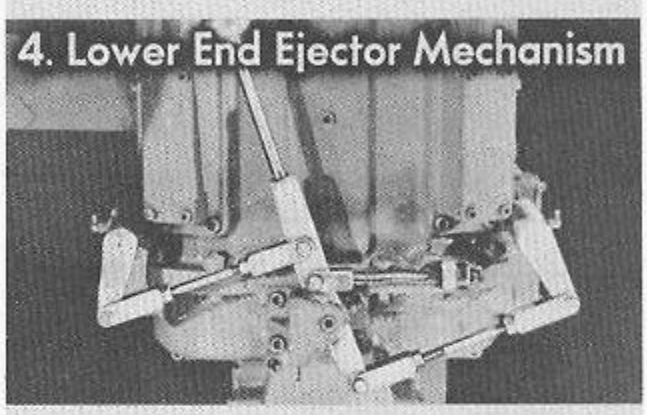
. . .open the door all the way and measure the distance between the two marks. The distance should be two and five-eights inches. If it is not, . . .

. . .adjust the stop nut on the door spring rod until you have obtained the required distance between the two scribe marks. Remember to adjust the other door. We are now ready to consider. . .

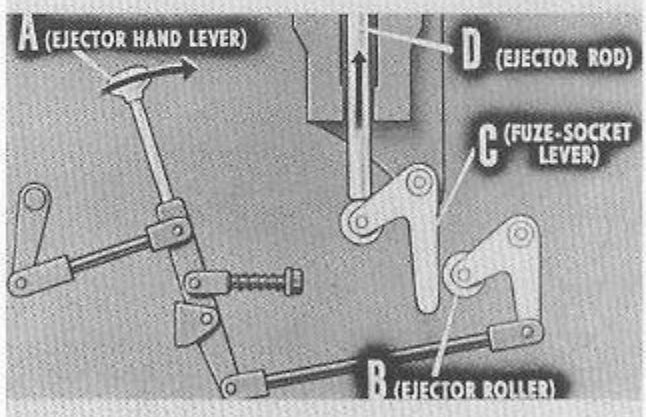


STEP 4

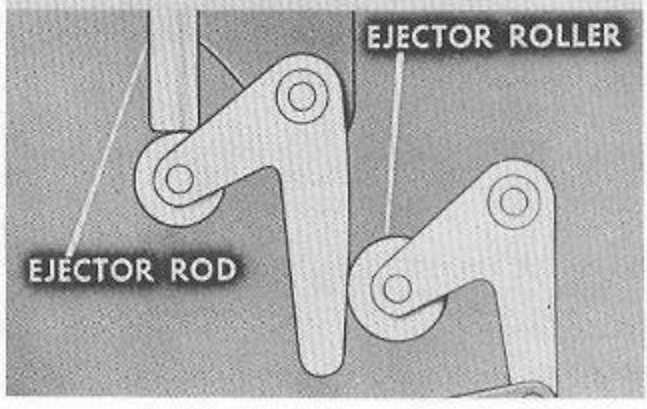
. . .the fourth step—the adjustment on the lower end ejector mechanism. The purpose of this adjustment is to ensure that moving the hand lever will raise the projectile sufficiently for repositioning or removal. To understand this adjustment let's review how the ejector mechanism functions.

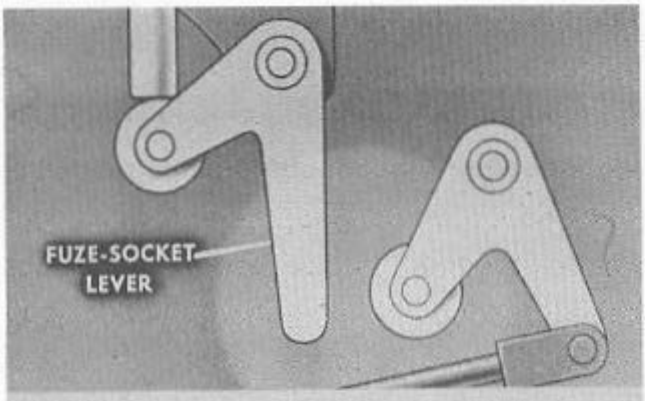


The ejector hand lever, A, when moved to the right causes B, the ejector roller, to rotate upward and contact C, the fuze-socket lever. This is pushed upward and causes D, the ejector rod, to move upward in the fuze pot.

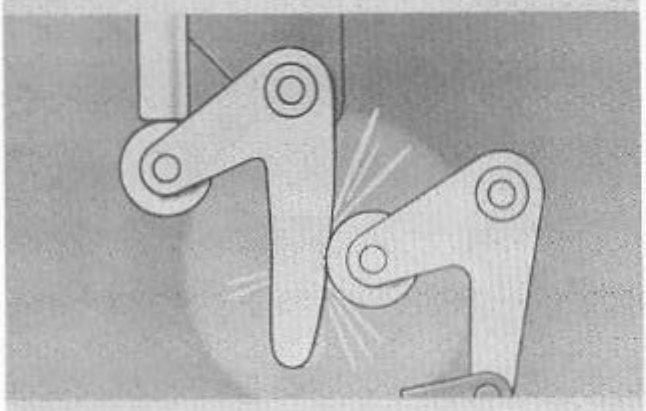


Obviously, if the ejector roller is in the correct position the ejector rod will be moved the correct distance. If the roller is out of position, two situations might occur. First, . . .

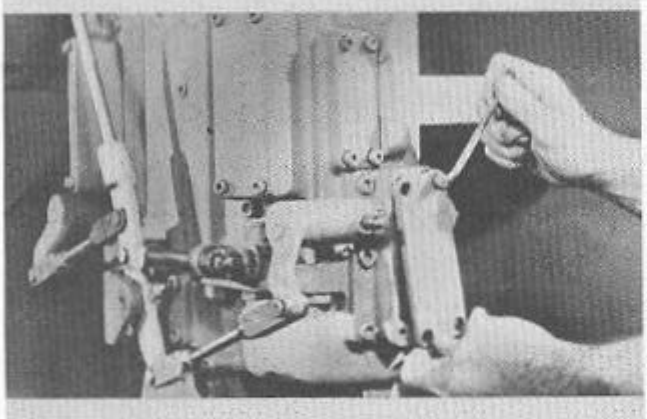




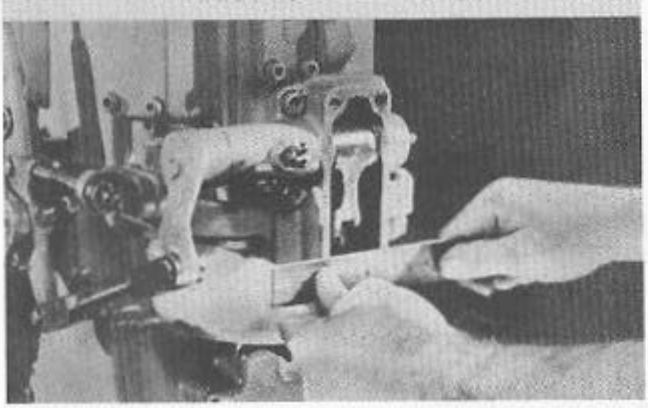
. . .if the ejector roller is too far away from the fuze-socket lever the ejector rod will not raise the projectile sufficiently. Second, . . .



. . .if the ejector roller is too close the fuze socket lever on the descending fuze pot will strike the ejector roller and possibly damage the mechanism. To correctly position the ejector roller, first, . . .

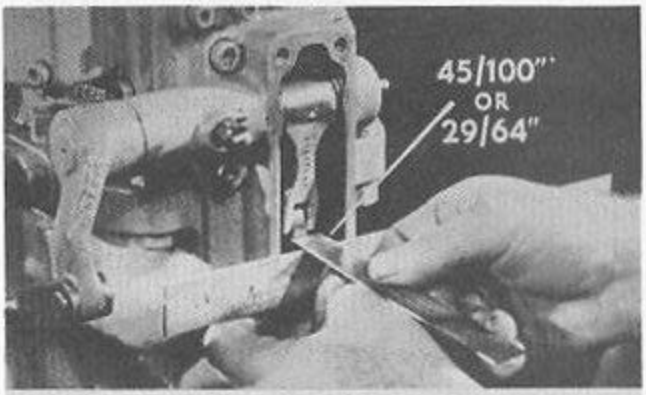


. . .remove the cover from the ejector roller housing. Leave the ejector handle in normal position at the left.

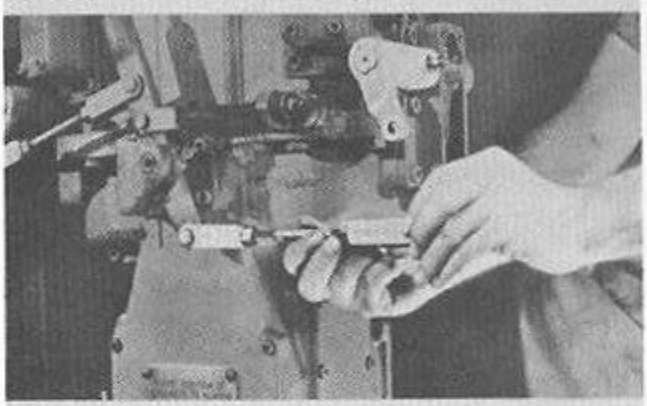


Now, place a straight edge across the roller housing.

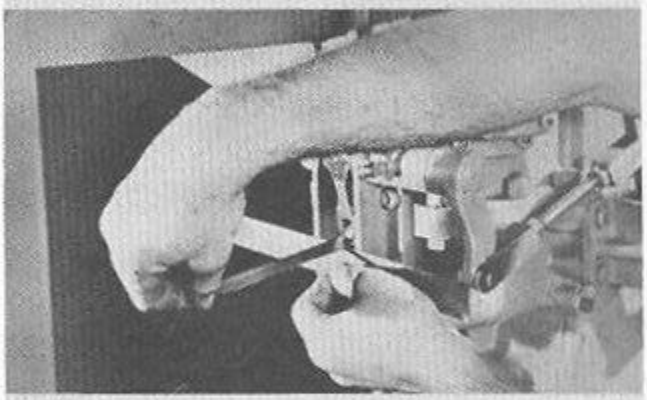
And, measure the distance from the inside edge of the straight edge to the high point of the roller. There should be a clearance of forty-five one-hundredths or twenty-nine sixty-fourths of an inch.



You obtain the proper amount of clearance by adjusting the connecting rod to the ejector roller crank.

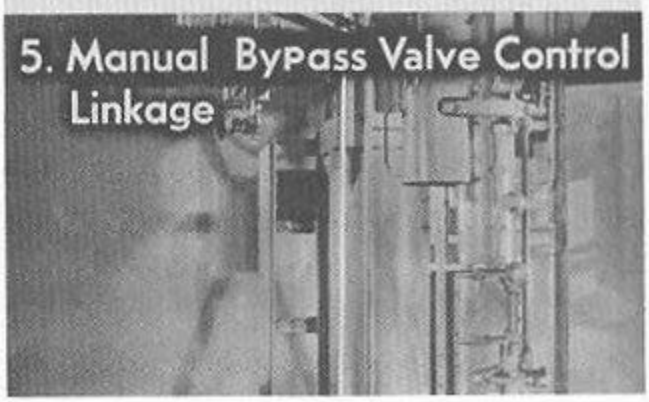


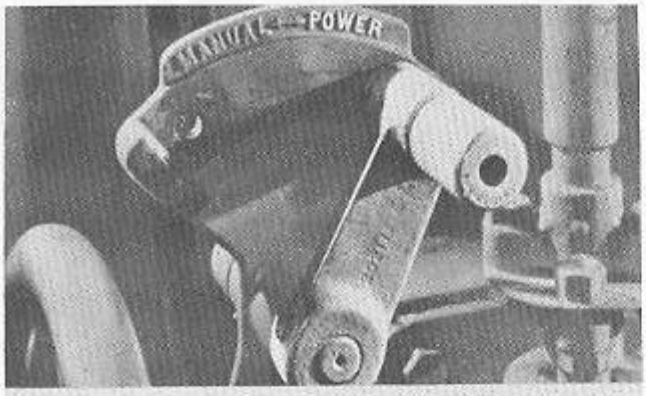
There are 2 rollers, 1 for each hoist tube. You make the adjustment for the second roller in the same way.



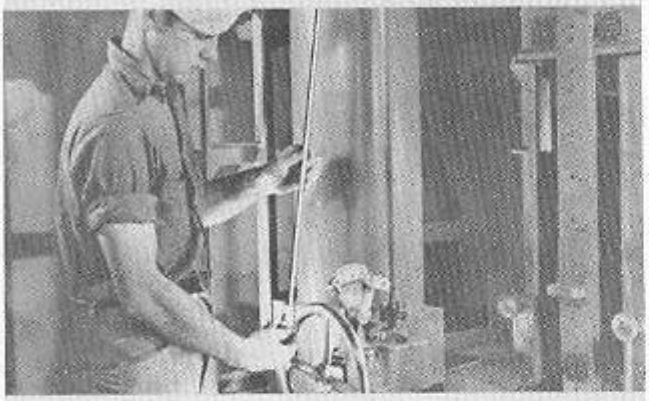
STEP 5

The fifth step concerns the manual bypass valve control linkage. This may also get out of adjustment occasionally. When this occurs, you may find that shifting the manual control lever from MANUAL to POWER control position does not move the bypass valve sufficiently to permit power operation. To adjust this linkage, first, . . .

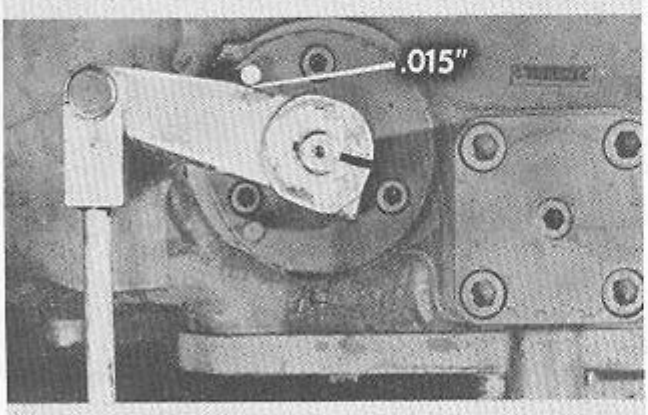




. . .set the manual control lever in the POWER position.



Then, adjust the linkage that connects the manual control lever with the manual bypass valve until. . .



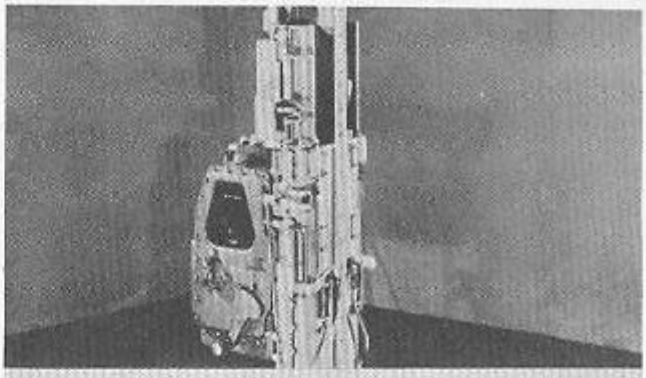
. . .there is a clearance of 0.015 inch between the manual bypass valve crank and the upper stop pin. With this amount of clearance the manual bypass valve will be in its full power position whenever the manual control lever is in the POWER position.

REVIEW

In this chapter we have discussed how to adjust the various mechanisms at the lower end of the hoist including power chain tension, fuze-setting chain tension, lower end control gear, lower end ejector mechanism, and manual bypass valve control linkage.

All adjustments are described in OP 735. Refer to it for accuracy when making these adjustments. In the next chapter we will discuss how to make adjustments on the mechanisms at the upper end of the hoist.

CHAPTER 28—ADJUSTMENT—PART TWO



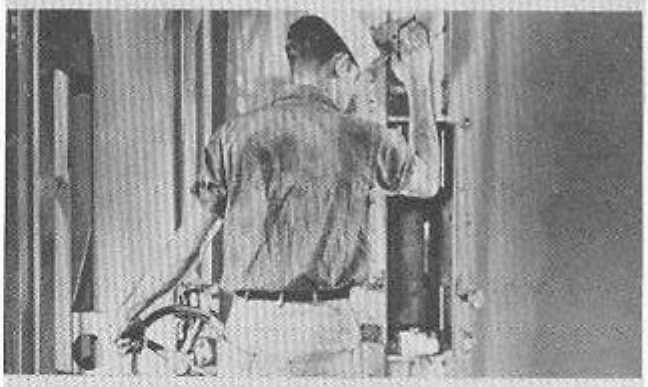
In this second chapter on adjustments we will deal mainly with those made at the upper end of the hoist.

ADJUSTMENT STEPS

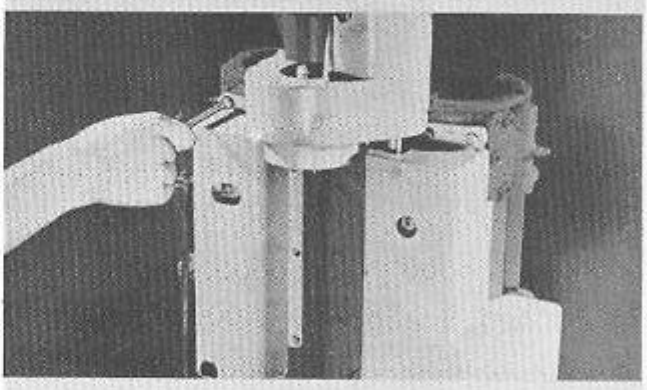
We will make adjustments on the following:

1. The flights
2. Interlock mechanism
3. Upper end ejector mechanism
4. Ejector lift
5. Stop-hoist lever
6. Interlock cam springs and upper door closing springs
7. Fuze-setting drives
8. The lower doors

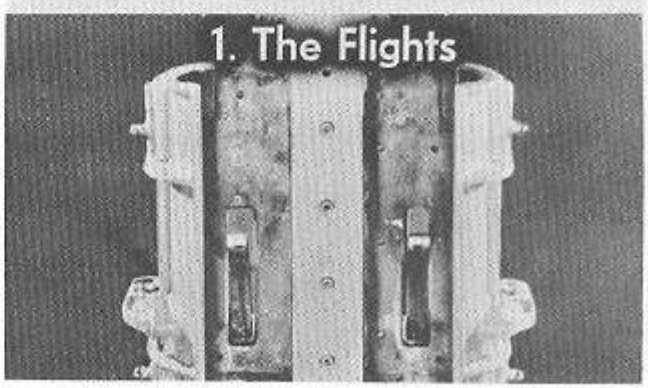
Before starting, the following preliminary steps should be taken.



Operate the hoist in manual until the outboard fuze pot is at the upper end of the hoist.



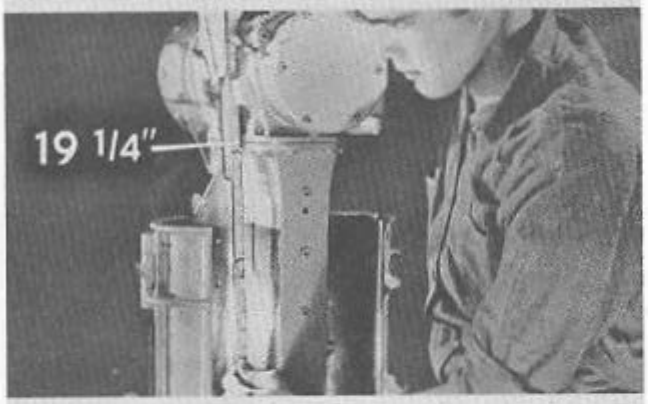
Then, remove the covers from the shafts and linkages. Now we are ready to make. . .



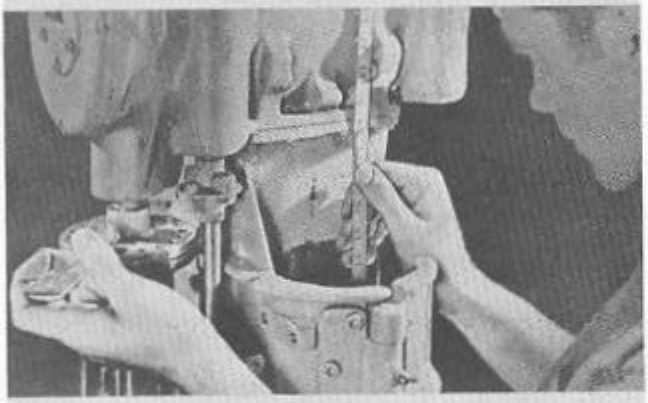
STEP 1

. . .the first adjustment—positioning the flights or fuze pots. This adjustment is necessary if the flights are thrown out of position when adjusting for proper chain tension or if the hoist jams during operation.

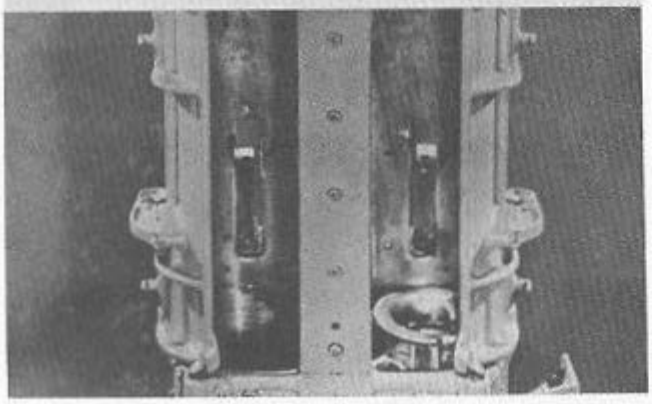
When the flights are out of position you may not be able to unload the projectile. To avoid this, keep the flights accurately adjusted. This means, . . .



. . .with the hoist at the end of the cycle, you should have 19 1/4 inches between the top of the fuze pot and the seam formed by the drive sproket housing and hoist tube. If you do not, then adjust as follows.

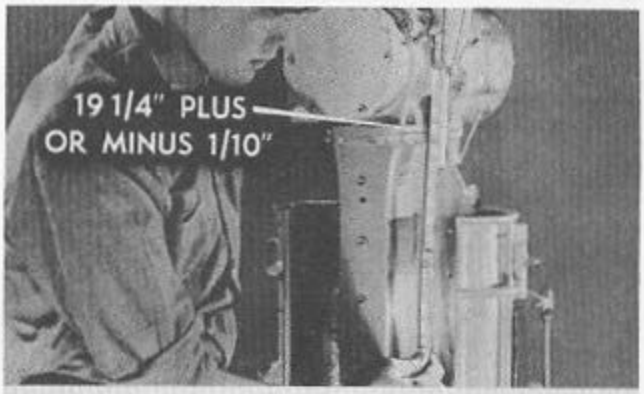


Disconnect the main drive shaft coupling and rotate the upper half, watching the scale until the required 19 1/4-inch measurement is obtained. Then reconnect the coupling.

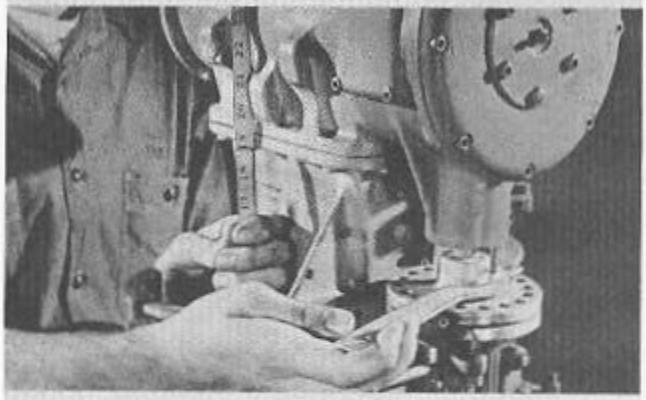


Now, bring up the inboard fuze pot by operating the hoist in manual through another cycle.

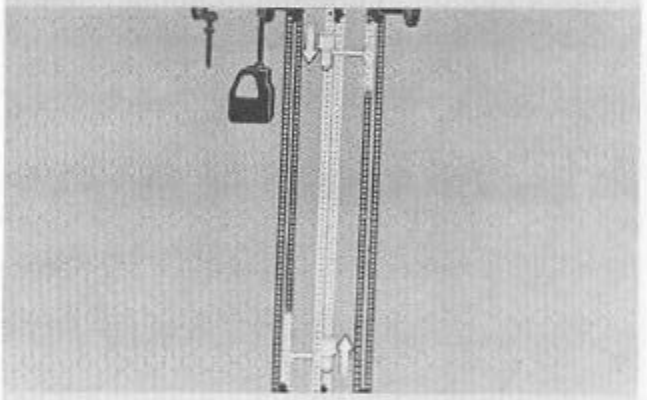
Now, measure the distance as before. It should be 19 1/4 inches plus or minus one-tenth of an inch. If it is outside these limits, split the difference between the 2 measurements like this.



Disconnect the drive shaft coupling and rotate the upper half until the fuze pot has been moved one-half the distance it was out of position. Only one-half is required, because. . .



. . .both fuze pots are attached to the same chain and moving one fuze pot also moves the other one an equal distance in the opposite direction. Reconnect the coupling after adjusting the flight.

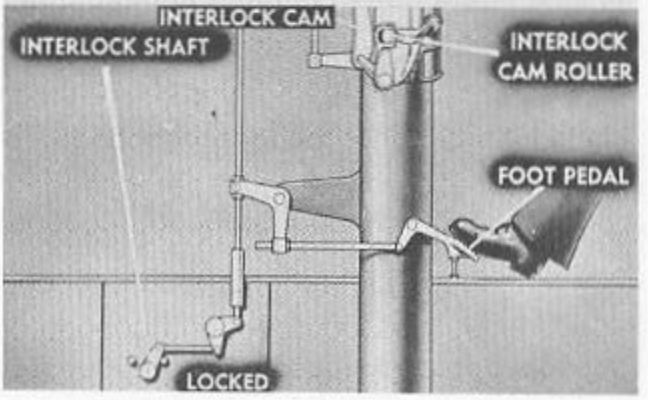


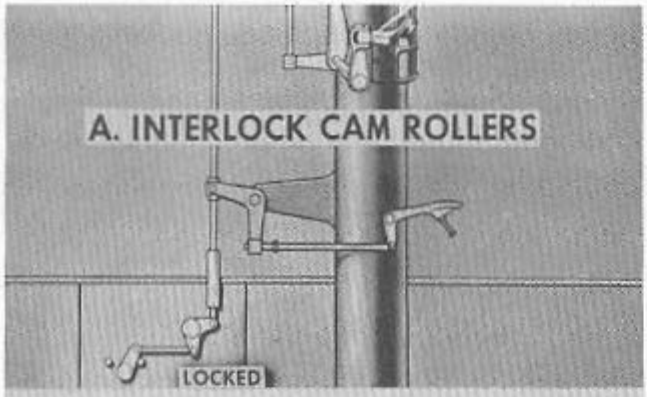
STEP 2

The second adjustment is on the interlock mechanism. There are 4 parts which may require adjustment. These are:

A. Interlock cam rollers
B. Interlock cam linkages
C. Foot pedal stop bolts
D. Foot pedal interlock linkages.

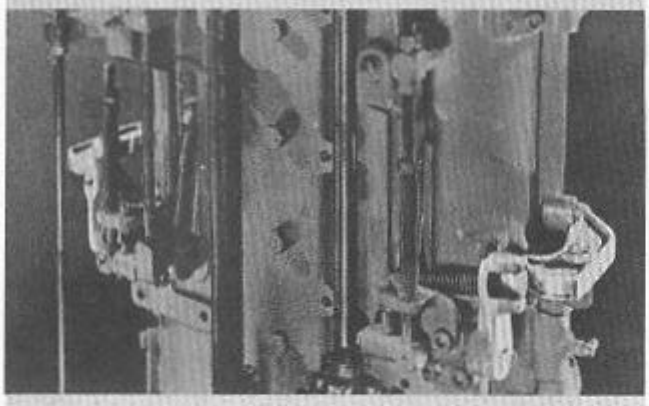
To understand these adjustments let's review how the interlock mechanism functions. When the projectile reaches the upper end, the interlock cam is depressed. This causes the interlock shaft to move to the LOCK position. Two actions hold the interlock shaft in this position—depressing the foot pedal and the upper doors moving the interlock cam rollers while the projectile is being unloaded.



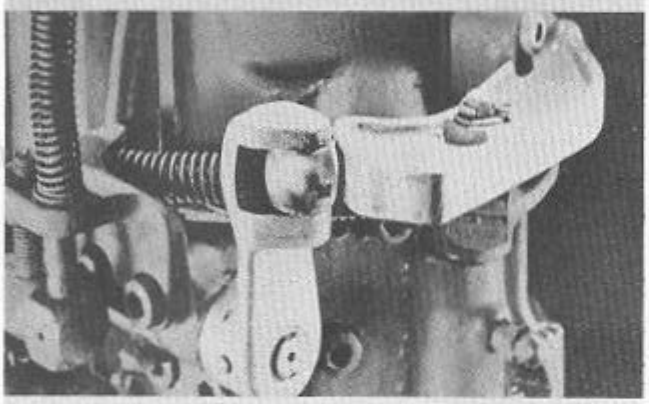


STEP 2A

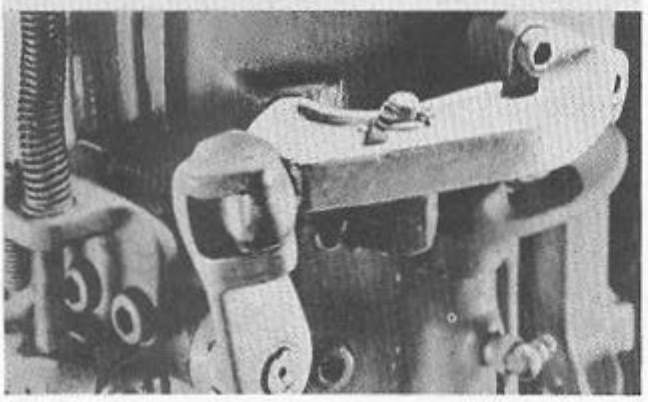
Let's see how to adjust the interlock cam rollers. Their purpose is to hold the interlock mechanism locked while the upper door is open even though the interlock cam and the foot pedal are released.



The rollers are located at the back of the hoist, one behind each door. When properly adjusted. . .

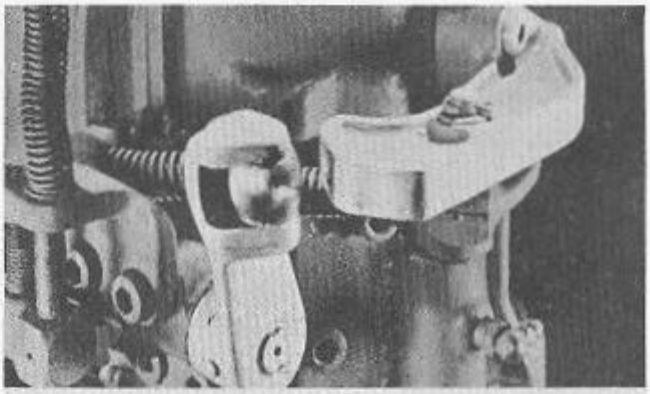


. . .the roller should just contact the door cam when the door is closed. Now when the door opens, . . .

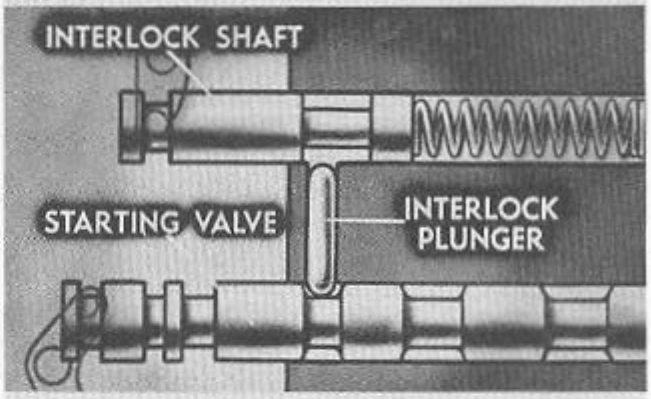


. . .the door cam will move the roller the correct distance to hold the interlock mechanism in the LOCK position even though the foot pedal and the interlock cam are released.

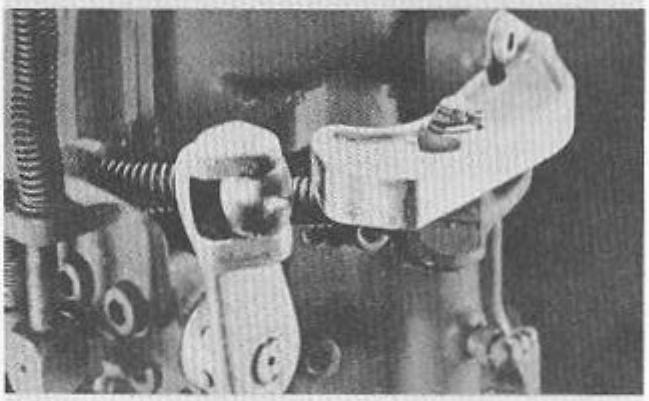
Should there be no contact between the door cam and the roller with the door closed, opening the door. . .



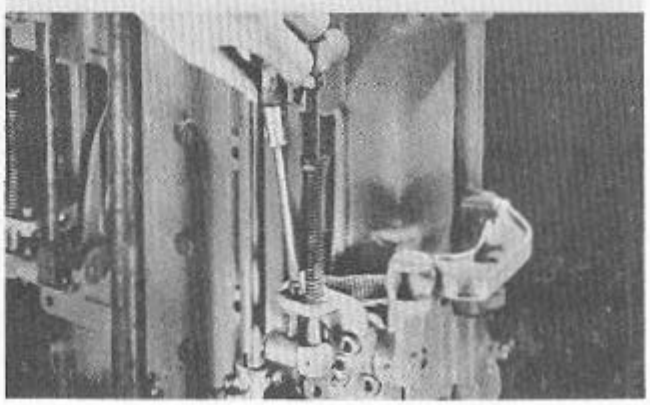
. . .will not move the interlock shaft far enough. As a result, the starting valve is not locked, because the interlock plunger is free to move up.



If there is no contact between the door cam and the roller when the door is closed, . . .

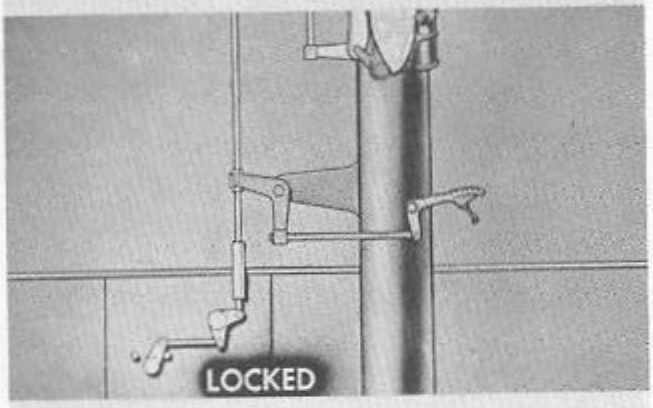


. . .adjust the stop screws in the interlock cam stop bracket until the desired contact between the door cam and the roller is obtained. Follow the same procedure in adjusting the other roller.

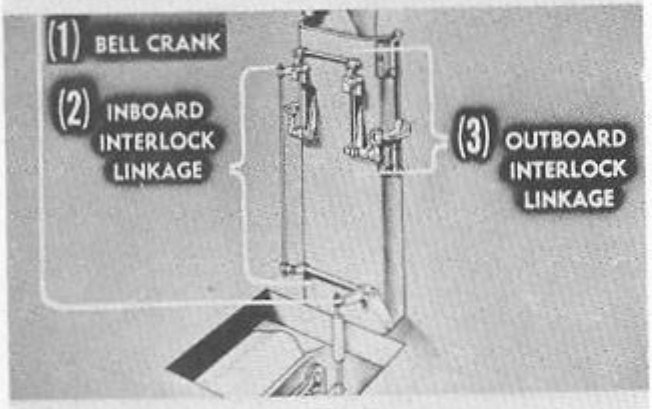


STEP 2B

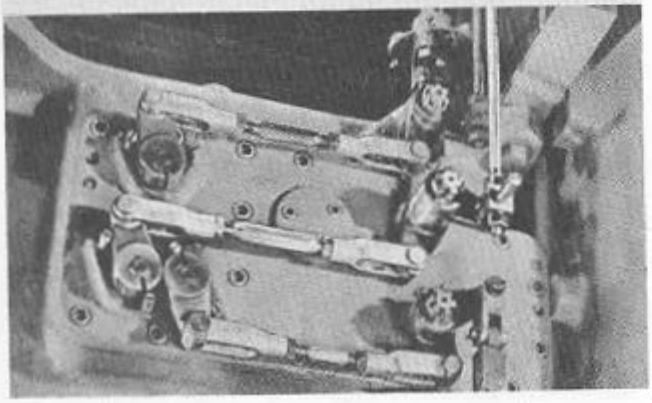
The interlock cam linkages to the interlock shaft in the control unit may also need adjusting. When this linkage is properly adjusted, . . .



. . .the interlock cam will move the interlock shaft to the locked position when the projectile reaches the top of the hoist. When out of adjustment the arriving projectile will not move the interlock shaft to lock the starting valve. Consequently, control over the starting of cycles will be lost.

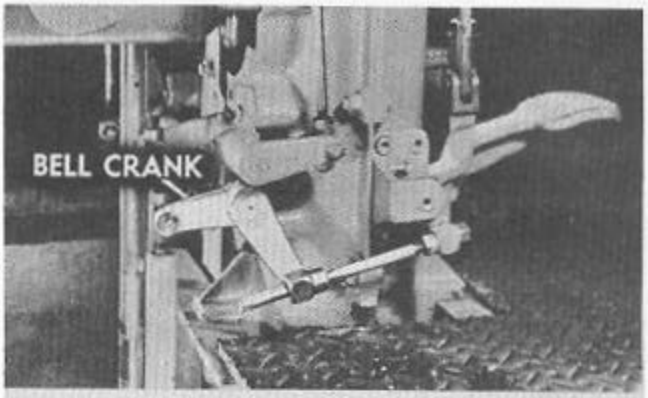


To keep these linkages functioning properly we must adjust, first, the bell crank; second, the inboard interlock linkage between the bell crank and the inboard interlock cam; and third, the outboard interlock linkage.

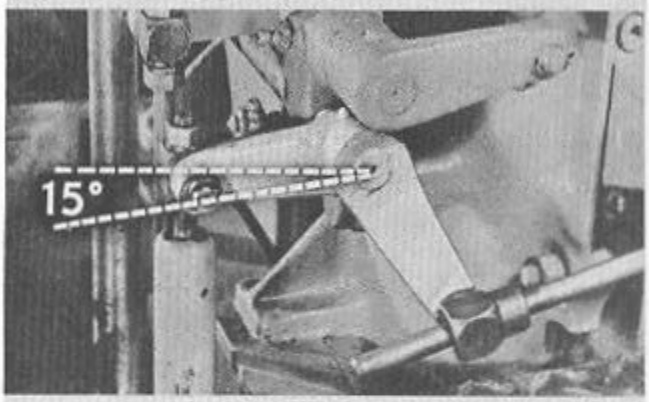


We begin this adjustment with the interlock shaft crank in the UNLOCKED position. Note that it rests against its left stop pin. Our objective is to make sure that the interlock mechanism moves this crank all the way over to the right stop pin.

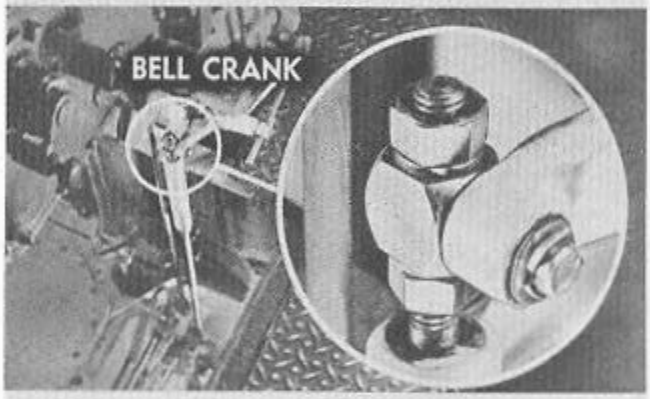
The first point to check is the bell crank in the outboard side of the linkage connecting the interlock mechanism with the control unit.



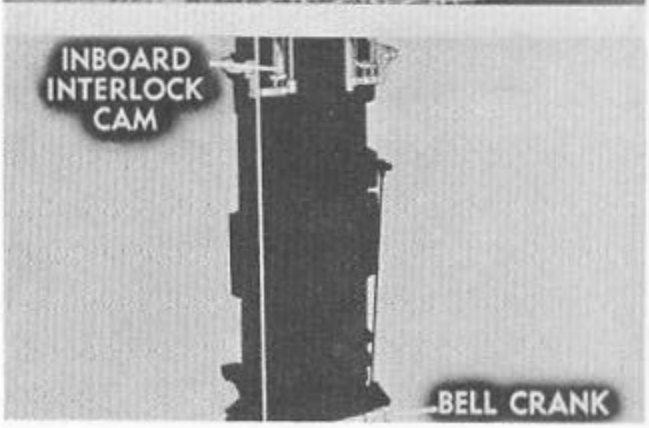
The forward end of the bell crank should be 15 degrees below the horizontal. A protractor may be used to check the angle. If adjustment is necessary. . .

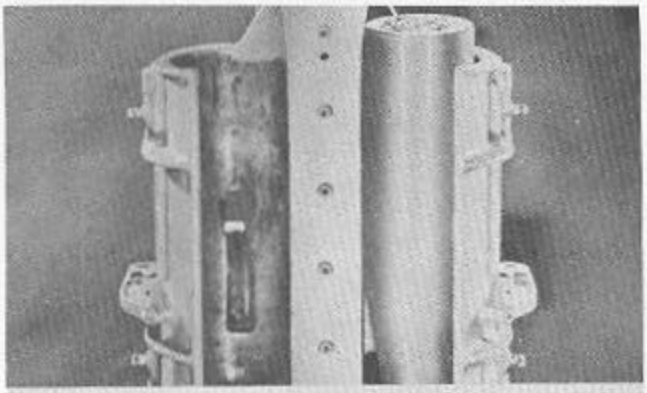


. . .adjust the nuts on the rod connecting the bell crank and the interlock shaft crank at the control unit until you obtain the correct angle. The bell crank will now be held in proper adjustment.

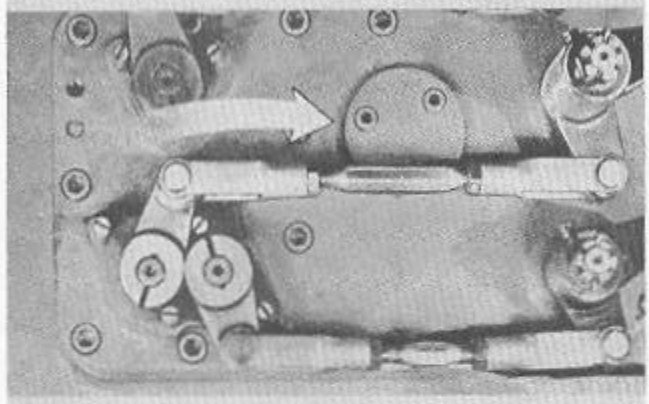


With the bell crank accurately positioned, we can adjust the linkage between it and the inboard interlock cam. When adjusting the interlock cam linkage, always adjust the inboard side first. The following steps are necessary.

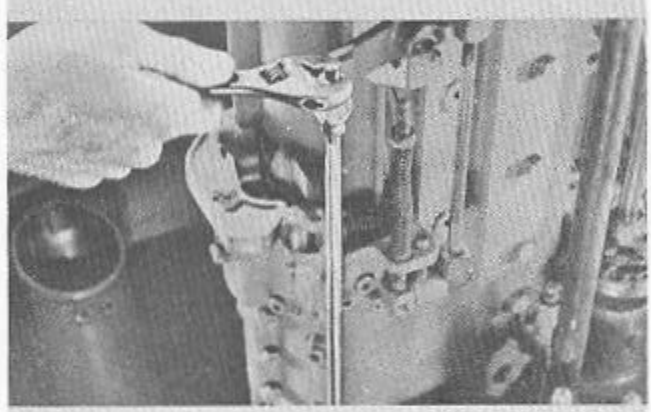




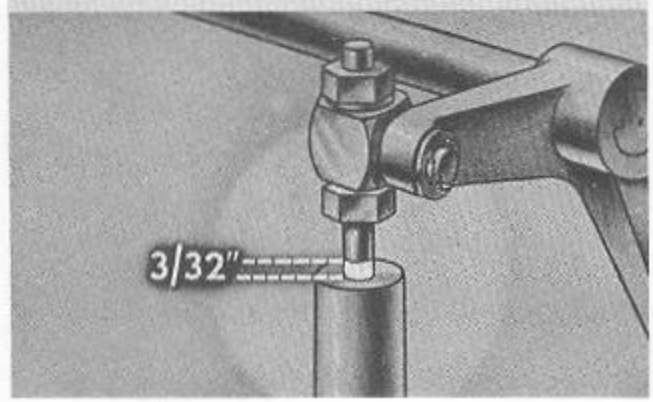
Operate the hoist manually until the inboard flight is at the upper end. To depress the cam, place a drill projectile in this fuze pot.



Note the movement of the interlock shaft crank at the control unit. The crank should have moved from its left stop pin to the right stop pin. If this full movement is not obtained, . . .

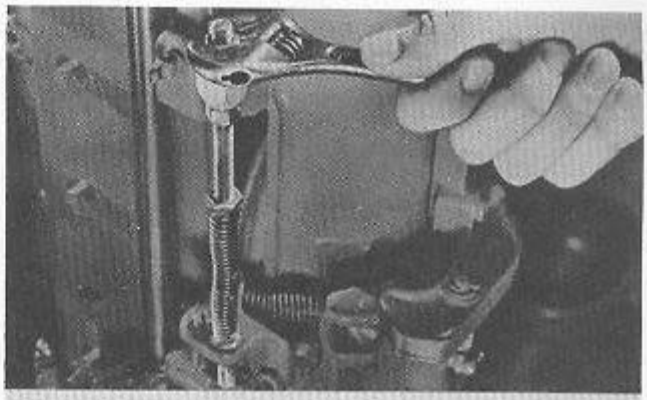


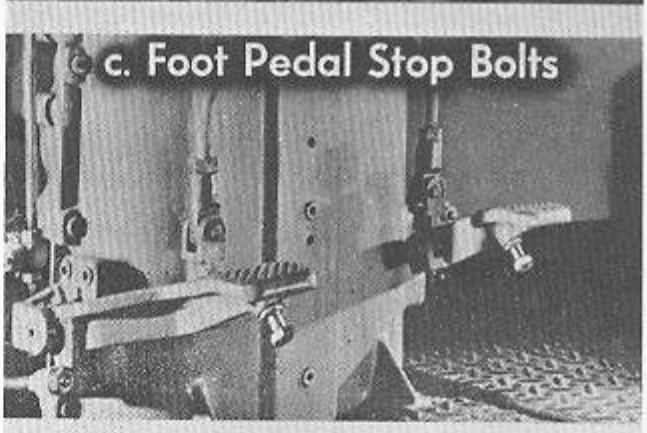
. . .adjust the length of the inboard interlock cam connecting rod until it is obtained. To make sure there is full movement of the interlock shaft, continue adjusting the connecting rod. . .



. . .until the cross shaft connecting rod has moved three thirty-seconds of an inch out of the spring cage. This three thirty-seconds of an inch overtravel ensures full movement of the interlock shaft to lock the starting valve.

Adjust the outboard interlock cam linkage in the same way using the short connecting rod in the outboard side of the linkage.

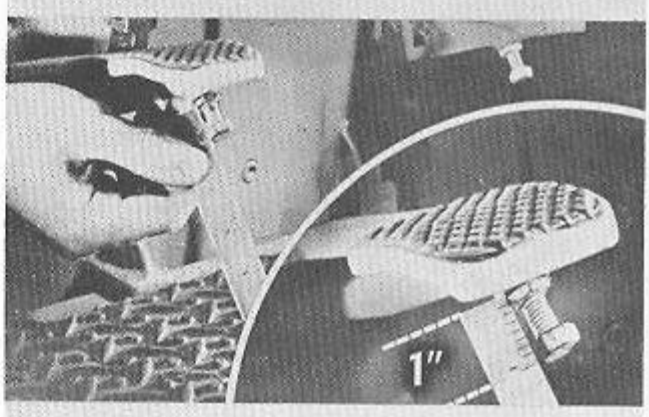


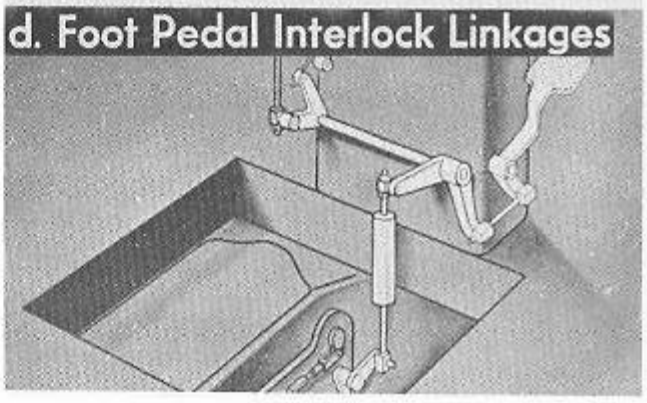


STEP 2C

You will also find it necessary to keep both foot pedal stop bolts in adjustment. If these bolts are out of adjustment, depressing the foot pedal will not have its normal effect on the various parts it controls.

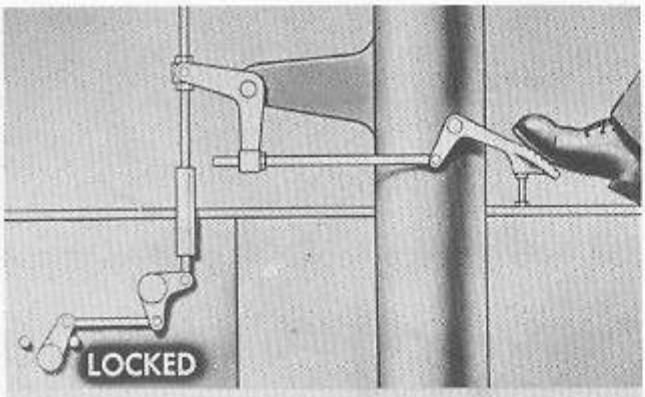
Each stop bolt should measure 1 inch from the head of the bolt to the machined surface. If necessary, adjust them to this measurement.



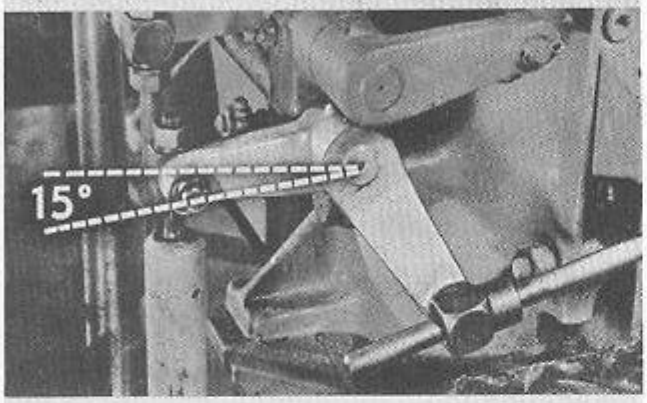


STEP 2D

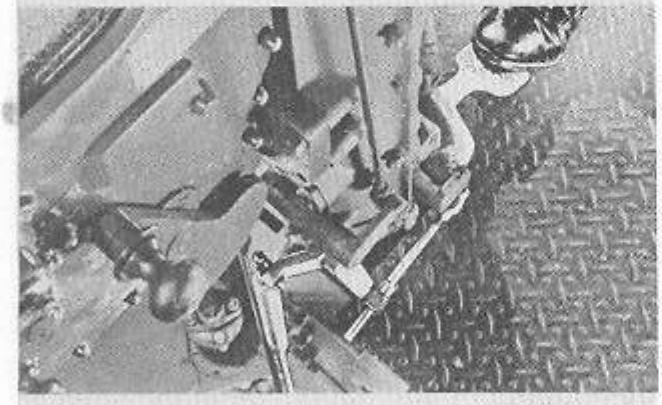
The foot pedal interlock linkages may also need adjusting. The purpose of this adjustment is to make sure. . .



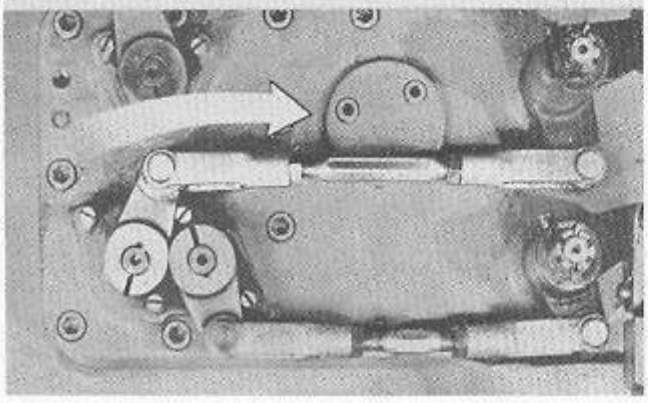
. . .that depressing the foot pedal will hold the interlock mechanism in the LOCK position when the projectile is removed. This adjustment is made with both sides of the hoist empty.



The first step is to check the position of the bell crank. This should be 15 degrees below the horizontal with the foot pedal released.

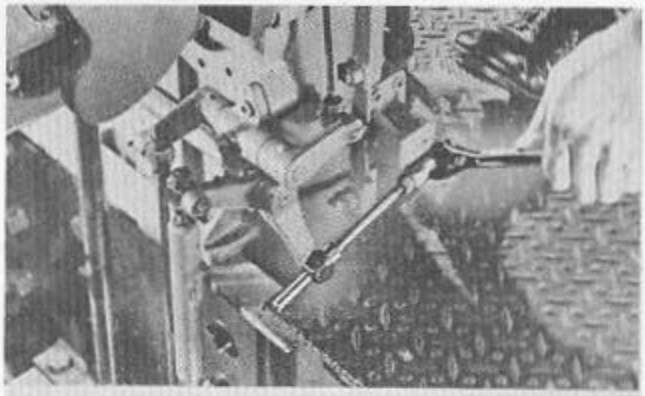


Then, completely depress the foot pedal and note the movement of the interlock shaft crank at the control unit.

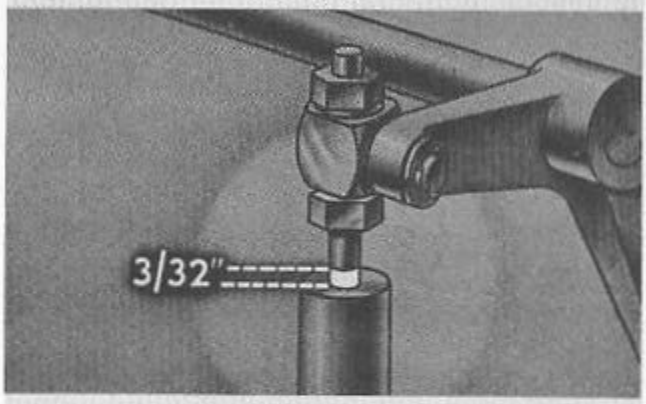


The crank should have moved from the left stop pin to the right stop pin. If this full movement is not obtained, . . .

. . .shorten or lengthen the rod connecting the foot pedal to the bell crank until full movement from stop pin to stop pin is obtained. Continue adjusting the rod. . .



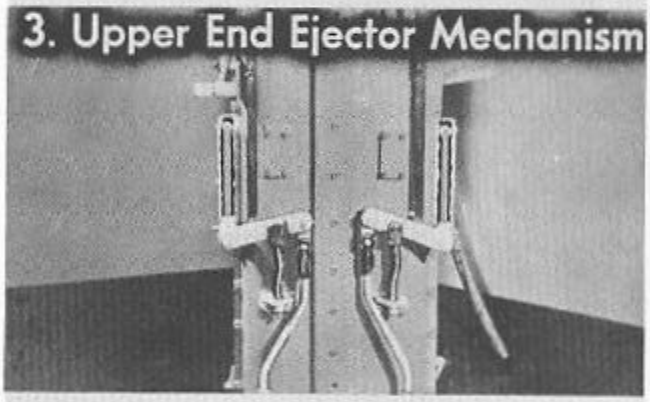
. . .until you get three thirty-seconds of an inch overtravel in the interlock linkage spring cage, just as you did when adjusting the interlock cam linkage. Adjust the inboard foot pedal linkage in the same way.



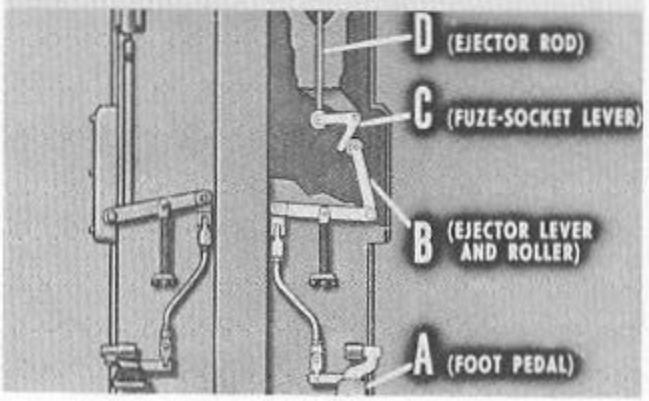
3. Upper End Ejector Mechanism

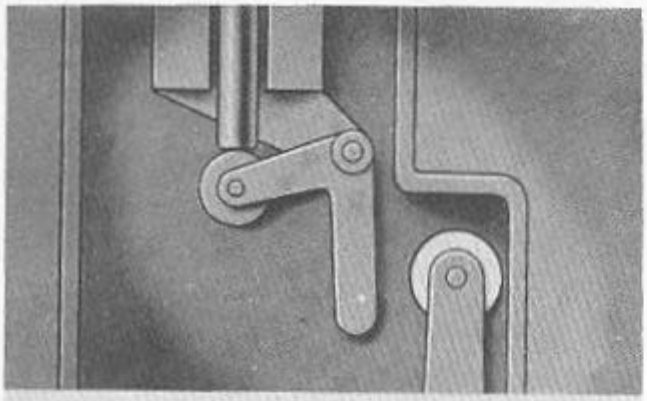
STEP 3

The third adjustment (that of the upper end ejector mechanism) may also be required occasionally. To understand this adjustment we'll review briefly how the mechanism functions, using the inboard side as an example.

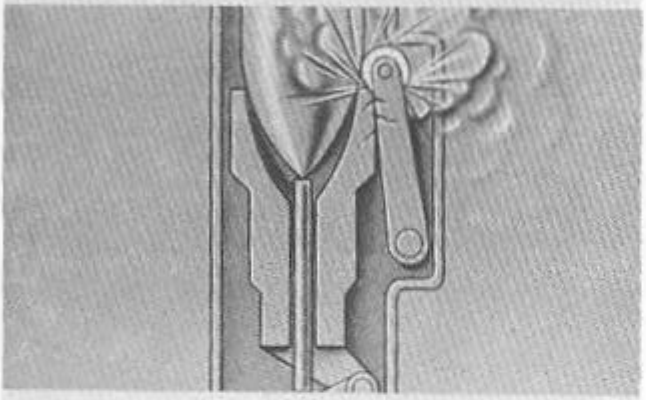


Depressing A, the foot pedal, moves B, the ejector lever and roller. This contacts C, the fuze-socket lever, raising D, the ejector rod in the fuze pot.

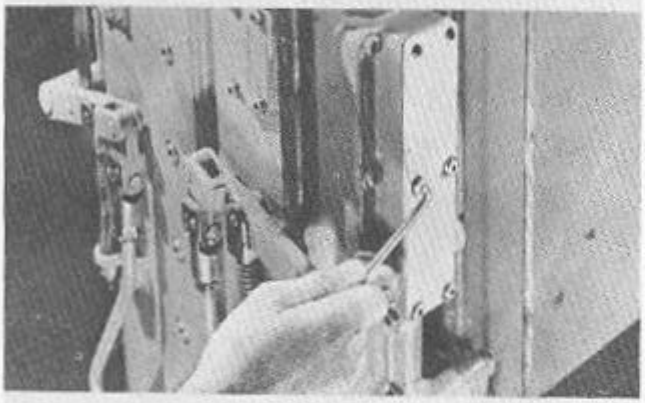




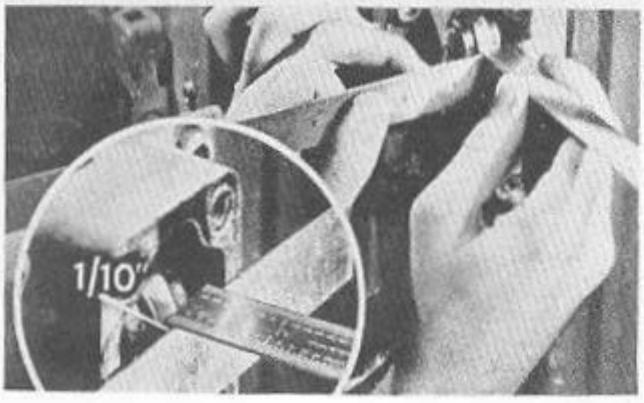
If the roller is too far away from the fuze-socket lever the ejector rod will not be raised sufficiently to permit unloading the projectile. On the other hand, if the roller is too close to the lever. . .



. . .look what happens when the fuze pot comes up. To be sure that the roller is in the correct position. . .

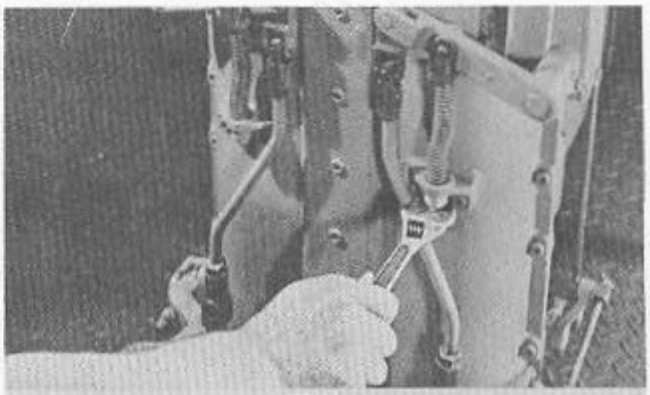


. . .first, remove the cover from the ejector roller housing.



Then, place a straight edge horizontally across the opening and measure the distance from the inner surface of the straight edge to the ejector roller. With the foot pedal released, this should measure one-tenth of an inch. If adjustment is required, . . .

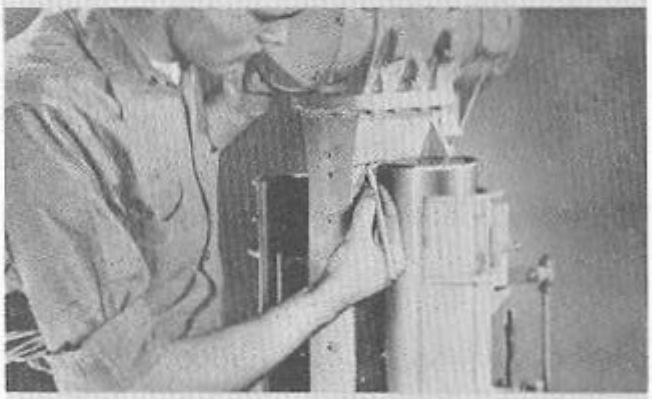
. . .adjust the nut on the ejector spring rod. Adjust the outboard roller in the same way. These adjustments were made and pinned when the hoist was assembled, and should not require attention unless the ejector mechanism has become bent or damaged.



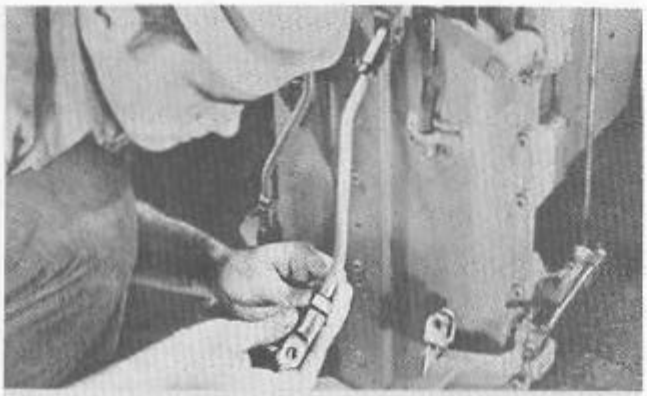
STEP 4

A fourth adjustment may be needed to regulate the amount of ejector lift to make sure that the projectile will be raised sufficiently to disengage the fuze lugs from the pot when the foot pedal is depressed. We'll start on the inboard side.

The first step is to measure the actual distance the projectile is raised. With the foot pedal released and with a projectile in the inboard flight, put a pencil mark on the hoist tube at the base of the projectile. Now, depress the foot pedal all the way. . .



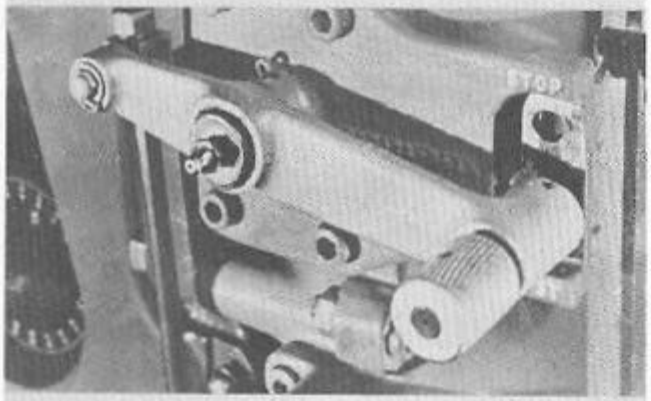
. . .and mark off the new position of the projectile base. The distance between these 2 marks should be one and three-eights inches representing the ejector lift. To adjust the ejector lift, . . .



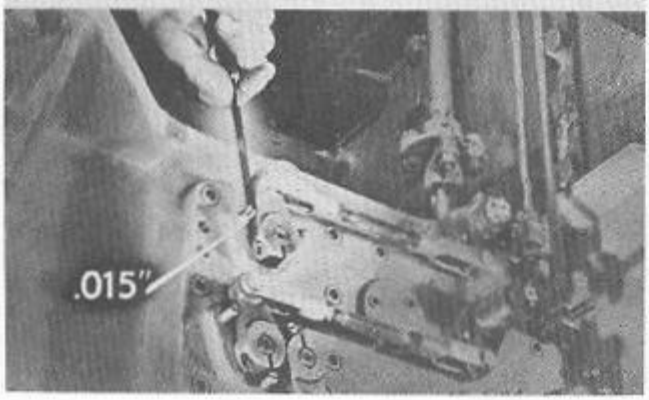
. . .shorten or lengthen the rod connecting the inboard foot pedal to the ejector mechanism bell crank. Adjust the outboard ejector lift in the same way.

STEP 5

The fifth point concerns the linkage connecting the stop-hoist lever with the unloading valve in the control unit. This is another item that may get out of adjustment. If it does, the unloading valve will not move its full distance.

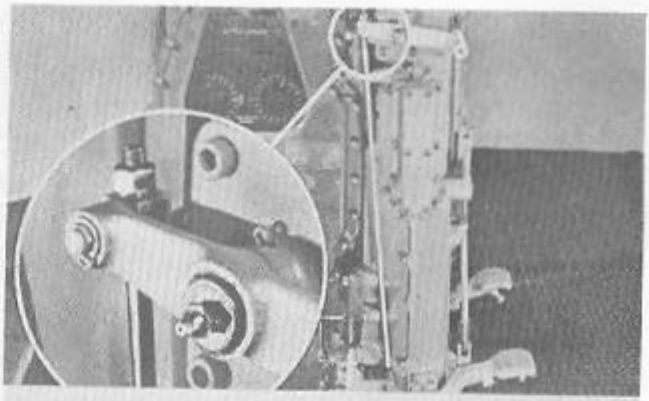


To make this adjustment set the stop-hoist lever in the HOIST position. In this position. . .



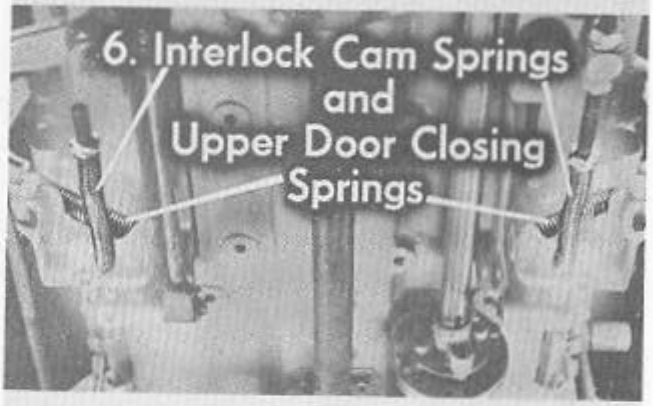
. . .there should be a clearance of fifteen-thousandths of an inch between the unloading valve bell crank and its left stop pin. To obtain this amount of clearance, . . .

. . .adjust the rod connecting the unloading valve bell crank and the stop-hoist lever. This will ensure full movement of the unloading valve.

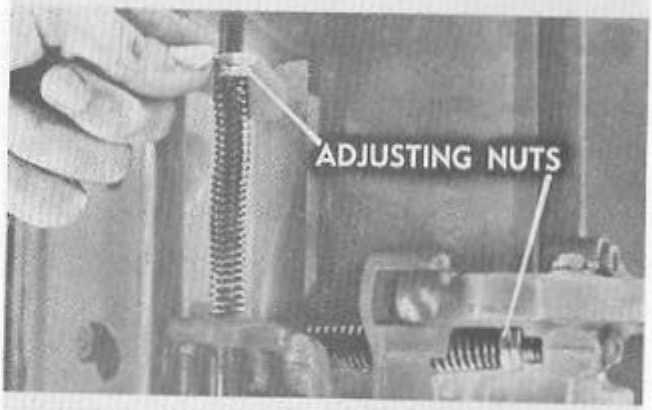


STEP 6

The sixth point concerns adjustments that may also be needed on the interlock cam springs and the upper door closing springs. To start each new cycle properly, the springs should return the doors and cams smartly to their normal positions when the projectile is removed.

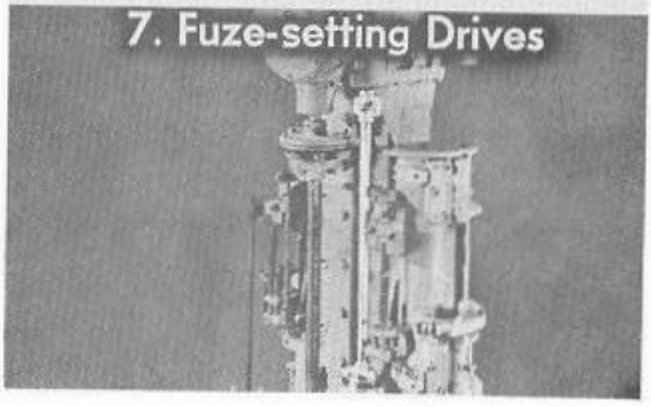


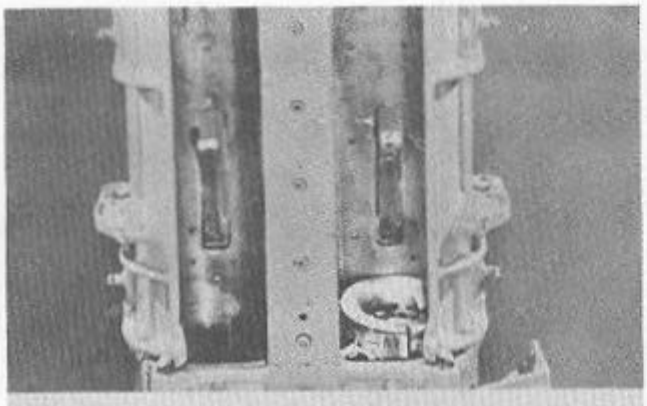
There is an adjusting nut for each spring. By adjusting these nuts, the desired spring action can be obtained.



STEP 7

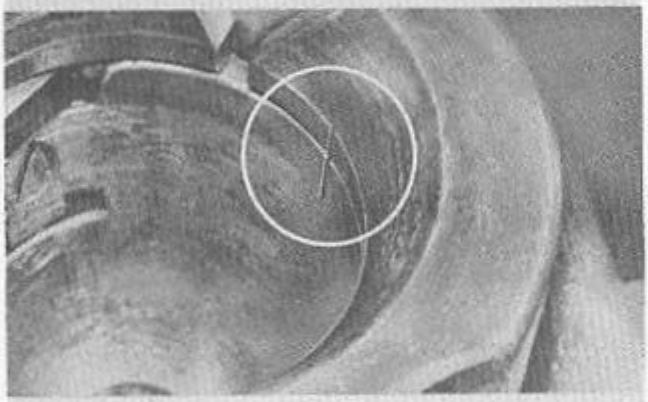
The seventh point concerns the fuze-setting drives. If these do not work properly, the actual fuze setting will not agree with the dial indications of the indicator regulator. To check whether the fuze-setting drives function properly, . . .



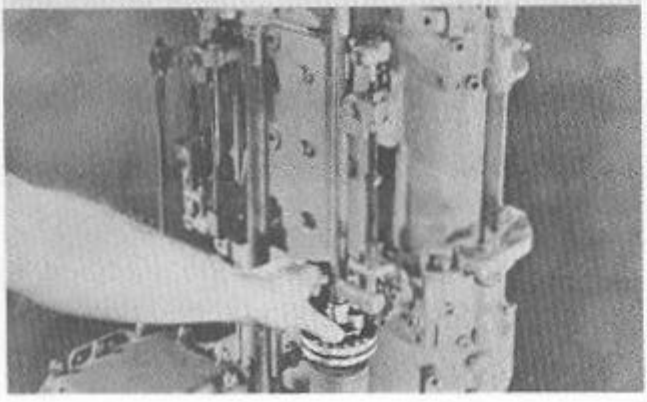


. . .bring the inboard fuze pot to the upper end of the hoist.

And, set the indicator regulator at 10 seconds. At this setting, . . .



. . .these scribe marks on the outer and inner sockets of the fuze pots should be lined up. If they are not, . . .



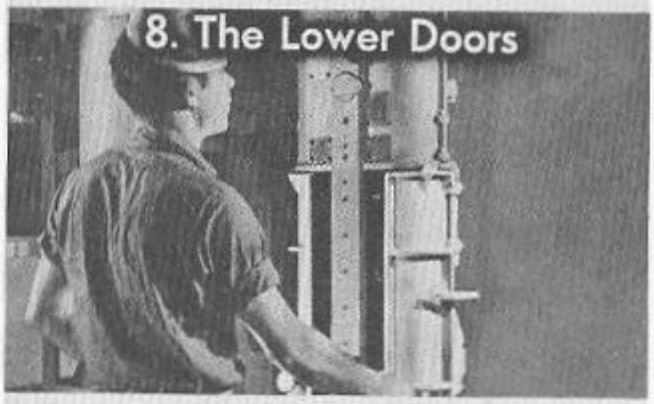
. . .disconnect the adjustable coupling in the vertical fuze-setting drive shaft. Then, rotate the upper half of the coupling until the scribe marks in the fuze pot are lined up.

Make sure that the indicator regulator is still at 10 seconds. Then, reconnect the coupling. To adjust the outboard fuze-setting drive the procedure is the same except that. . .

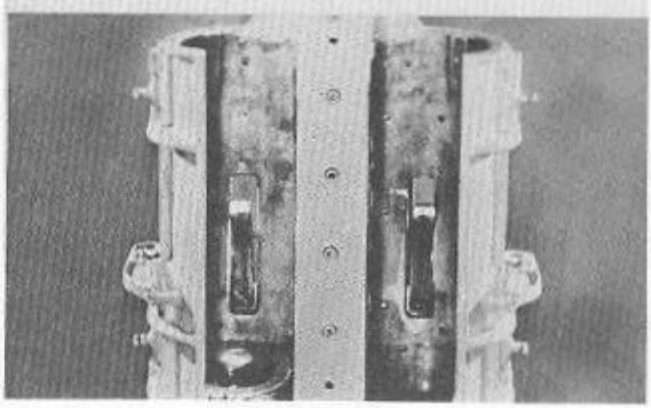
. . .the adjustable coupling over the drive sprocket housing is used.

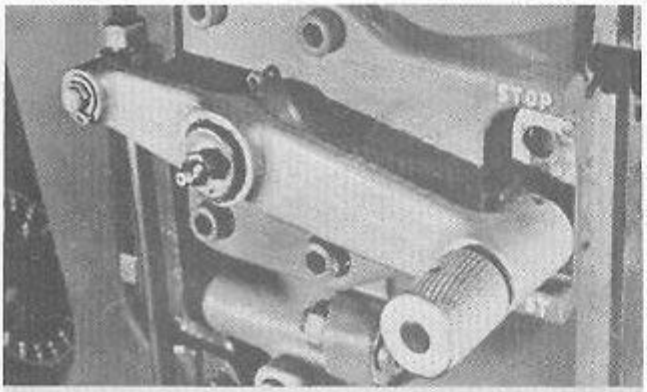
STEP 8

Now, we are ready for step 8—adjusting the lower doors. This is the final adjustment. Remember, a preliminary adjustment was made earlier. To avoid starting a cycle prematurely which might jam or damage the hoist, do not start the motor until after the following steps are taken.

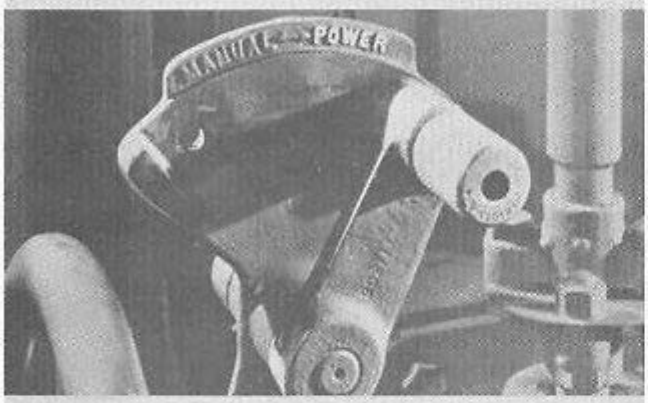


Be sure that the upper end of the hoist is empty.





Place the stop hoist lever in the HOIST position.

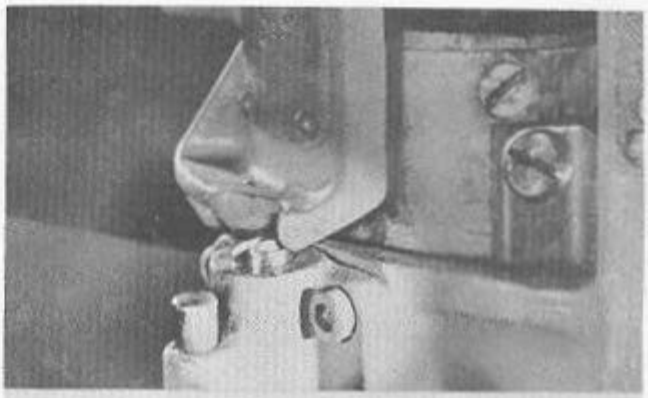


Place the manual control lever in the POWER position.

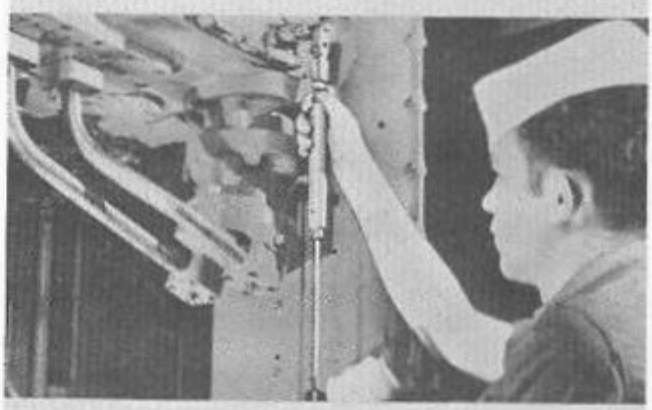
Place a projectile in the inboard flight at the lower end of the hoist. Now we are ready for a test that will tell us whether or not the cycle will start too soon.

Close the inboard door very carefully until it is held by the step of the door latch. Be sure that the door is not tightly closed and latched.

When you are sure that the door is resting on the step of the latch, start the motor. The hoist should not start. If it does start, an adjustment is necessary. Stop the motor. . .

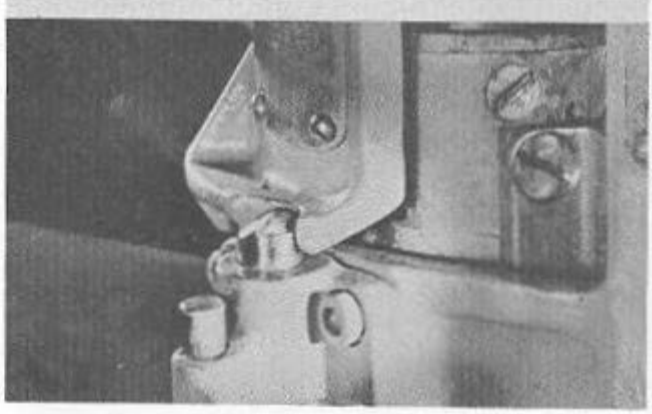


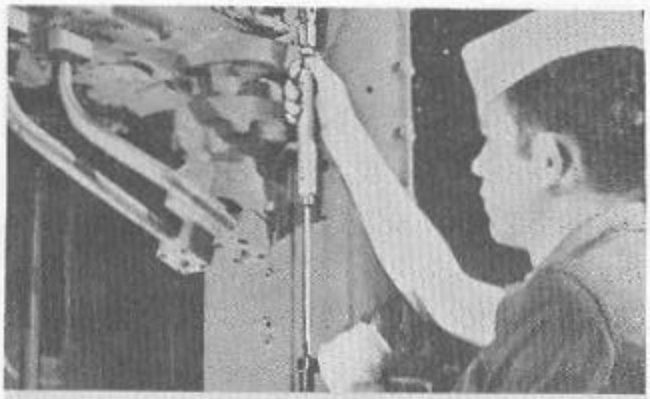
. . .and do this. Lengthen the rod leading to the starting valve until the hoist will not start with the door on the step of the door latch. Several cycles of the same flight will be necessary to check this adjustment thoroughly.



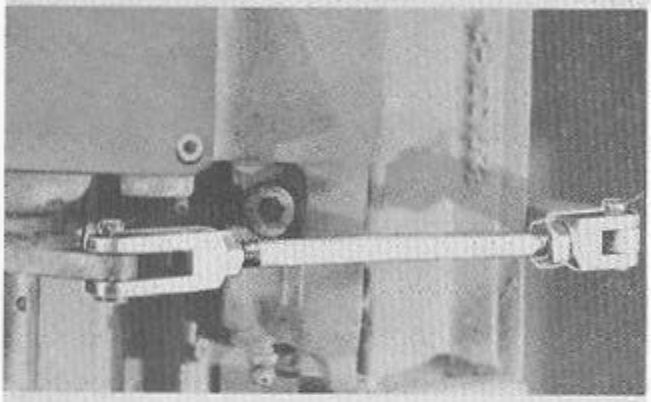
After this adjustment has been made and the motor again turned on, slowly ease the door to the fully latched position.

When the door reaches this position a cycle should begin. If not, . . .

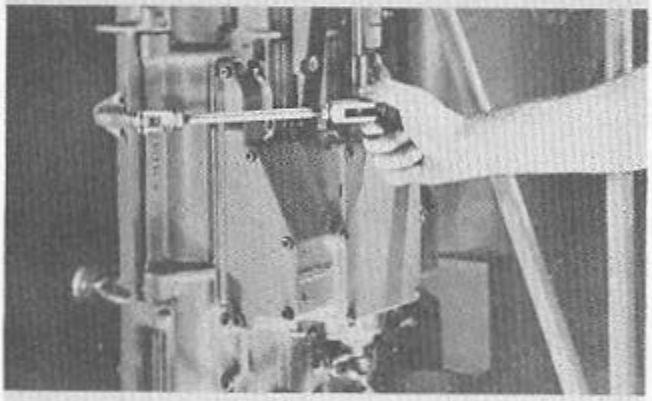




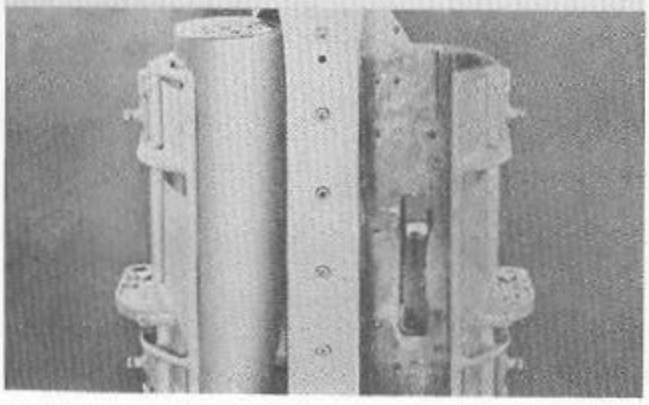
. . .shorten the starting handle rod until the hoist does make a cycle. Let's stop here a moment to clear up a point.



Why didn't we make this adjustment at the door connection rod where the preliminary adjustment was made? Well, we want to disturb this preliminary adjustment as little as possible. So, in this final adjustment, we start with the manual starting handle. However,—



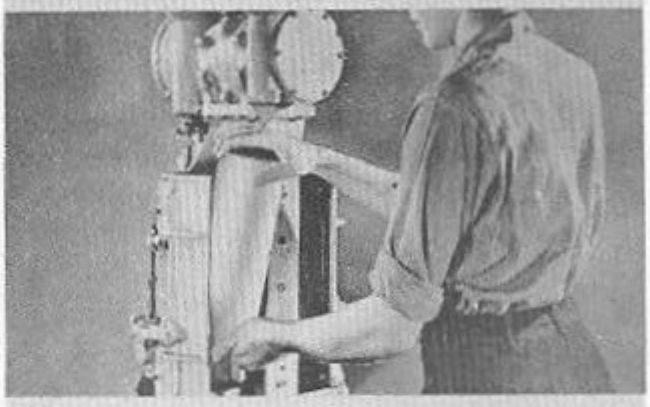
. . .the final adjustment of the second lower door is made at the door connecting rod. This is because we would disturb the first adjustment if we made them both at the manual starting handle. Just remember, no matter which side you adjust first in making the final lower door adjustment, adjust the first door at the manual starting handle, and adjust the second door at the door connecting rod. Since we have adjusted the inboard side first at the manual starting handle, we adjust the outboard side at the door connecting rod. Now, that all adjustments have been made, we are ready for a final test of the hoist.



With the power on, run up a drill projectile and leave it at the upper end.

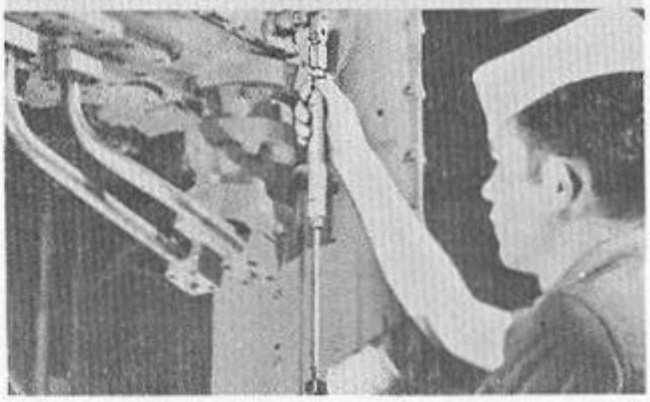
Now, place another drill projectile in the opposite flight at the lower end and fully close the door. The hoist should not make a cycle with projectiles at top and bottom.

Now, remove the drill projectile from the upper end allowing the door to close completely.

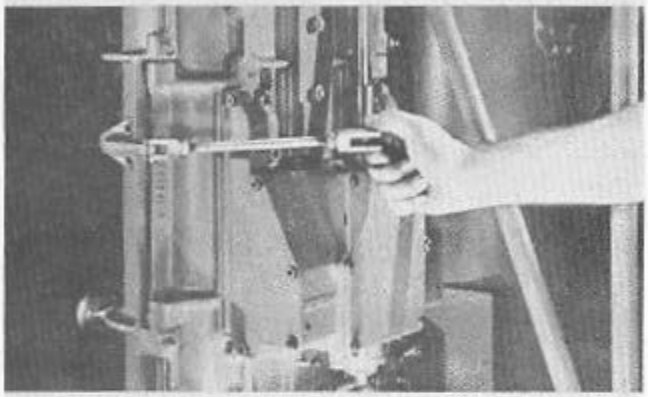


Release the foot pedal. The hoist should now make a complete cycle. If the hoist does not make a complete cycle, . . .

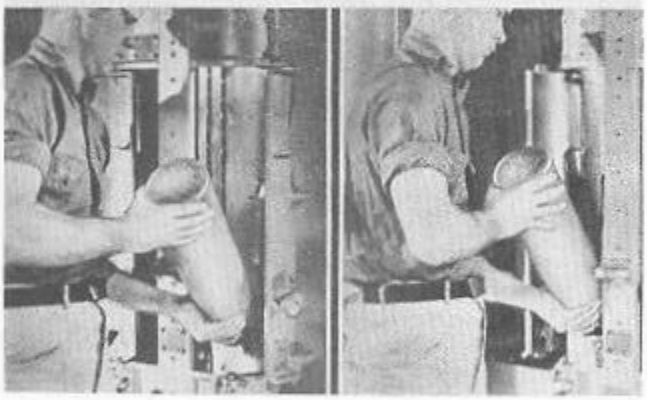
. . .it may usually be corrected by shortening the manual starting handle a very small amount.



Now make the same test for the other side of the hoist. If it does not make a cycle, . . .

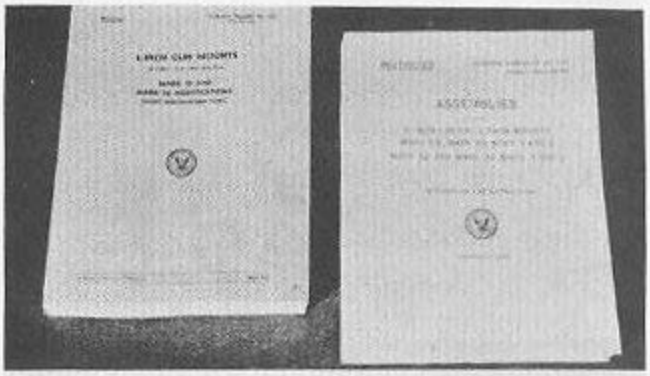


. . .it usually may be corrected by adjusting the door connecting rod a small amount.



When the hoist makes a complete cycle on both sides in the usual way, adjustments have been properly made.

CHAPTER 29—MAINTENANCE



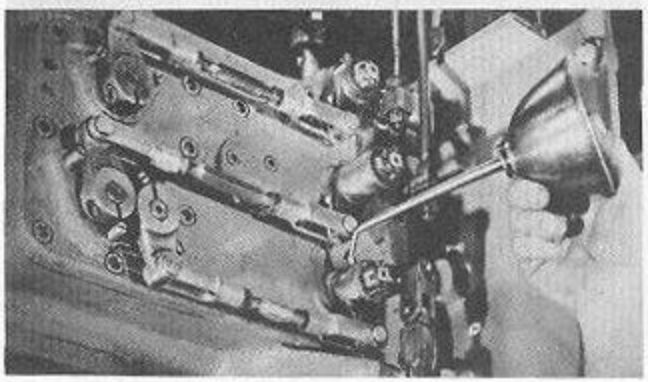
PURPOSE

Instructions for the maintenance of the 5"/38 projectile hoist Mk 2 are given in OP 735, and for the Mk 4 hoist, in OP 805. The purpose of this chapter will be to describe more fully the most important of these maintenance procedures.

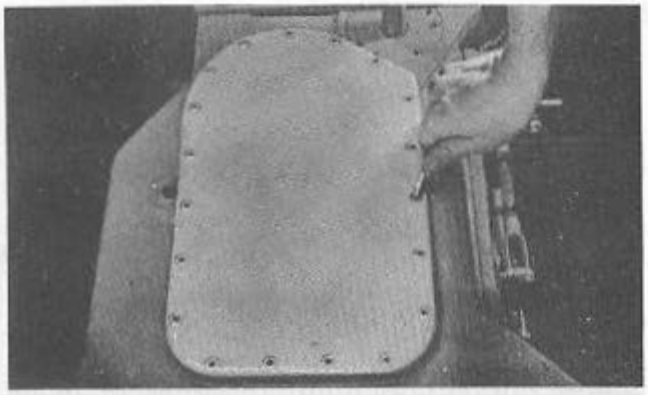
MAINTENANCE

When you get right down to it, most of the grief on hydraulic equipment is caused by improper maintenance. For example, . . .

. . .parts exposed to salt spray will corrode rapidly. Unless this corrosion is checked, the unit will soon become unserviceable.

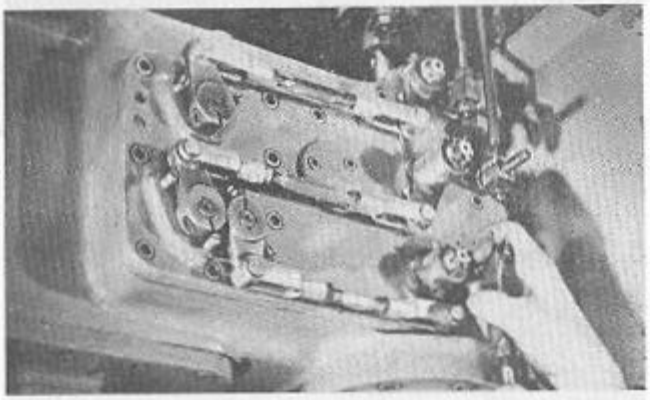


Daily inspection, cleaning, and lubrication of exposed parts and daily workouts of the hoist will help reduce casualties to a minimum.



All covers should be checked daily and kept tightly secured. This will prevent leaks of the introduction of foreign matter into the unit. Fluid leakage should be noted and corrected immediately.

The hydraulic system should be exercised every day. This keeps the moving parts in working condition and helps prevent the valves from sticking.



Daily tests also help to determine those parts which get out of adjustment most frequently. And these troubles can then be corrected before they cause a serious casualty.

CHECKOFF LISTS

The checkoff lists, if carried out carefully, will help to prevent many hoist casualties. Trouble points will be revealed and they can be lubricated or adjusted as necessary.

DAILY CHECKOFF LIST

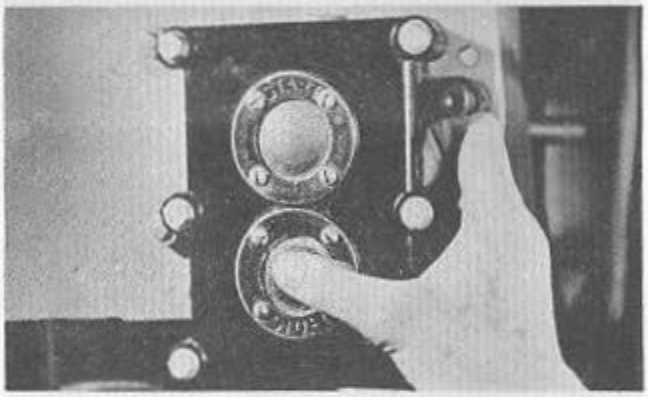
The daily checkoff consists of 3 major phases:

1. Check of all potential trouble points,
2. check of system for proper fluid level, and
3. test operation of the hoist.

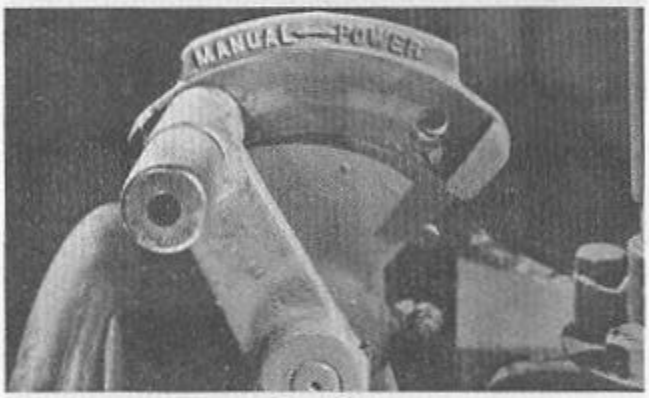
DAILY PHASE 1

Let's discuss the first item—check all potential trouble points. These are the points that are most likely to cause trouble under operating conditions.

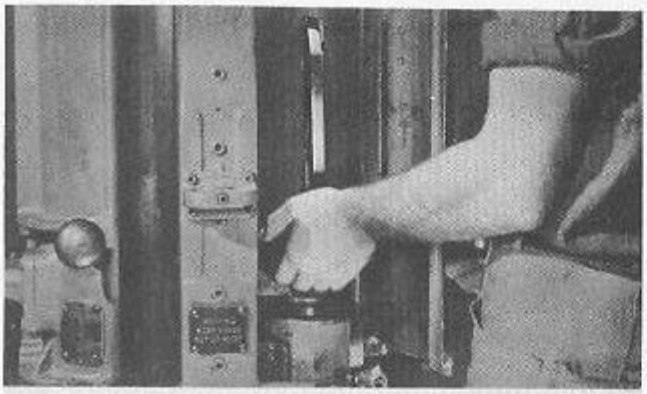
Before beginning these operations, the power should be turned off, . . .



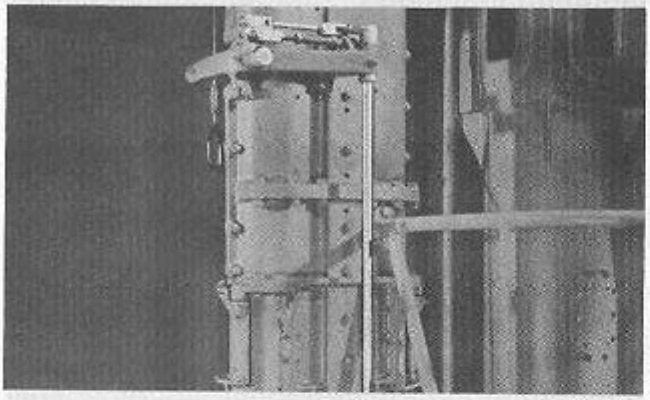
. . .and, the manual control lever placed in its MANUAL position.



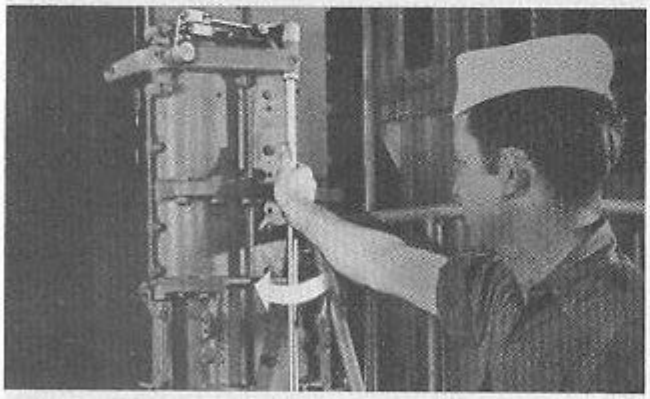
Let's first inspect the control cam. To check the action, push against the cam until it rests against the stop.



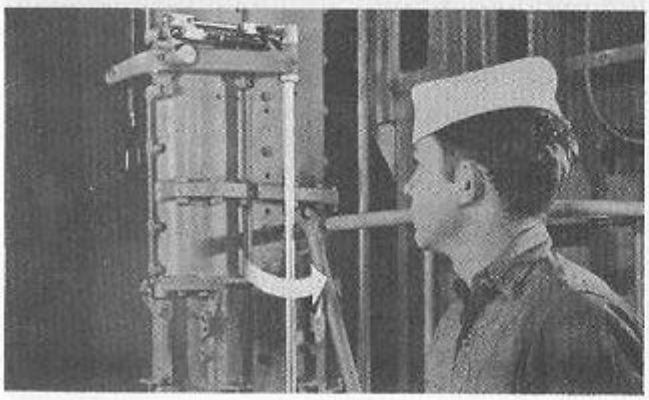
Then release it. It should snap back to normal position. If the action is sluggish, maybe you are using too heavy a lubricant. Or, perhaps the cam is binding. So, flush out the old lubricant with a lighter one, and correct any binding action if necessary. Be sure you check the other control cam, also.



The vertical control shaft and linkage is another potential trouble point that should be checked. If these parts do not function properly, the starting valve will also fail to function properly. To check, . . .

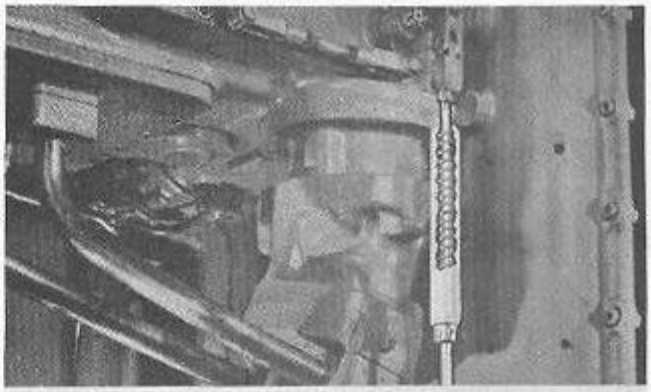


. . .rotate the vertical control shaft until it stops. Then. . .

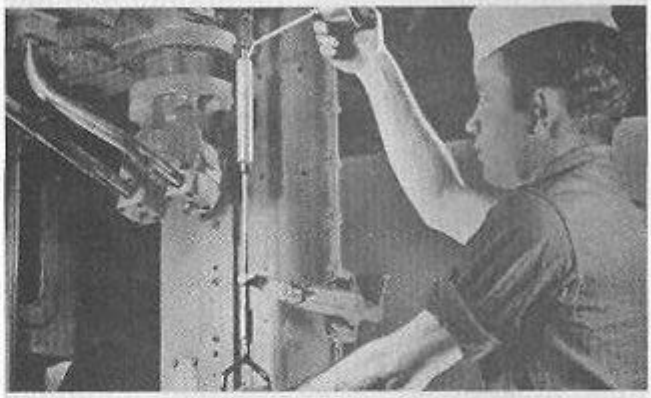


. . .release it. It should snap back to normal. If it is slow to return, lubricate and free the bearings and linkages, and adjust for proper spring tension if necessary. Repeat this test several times before you decide the action is satisfactory.

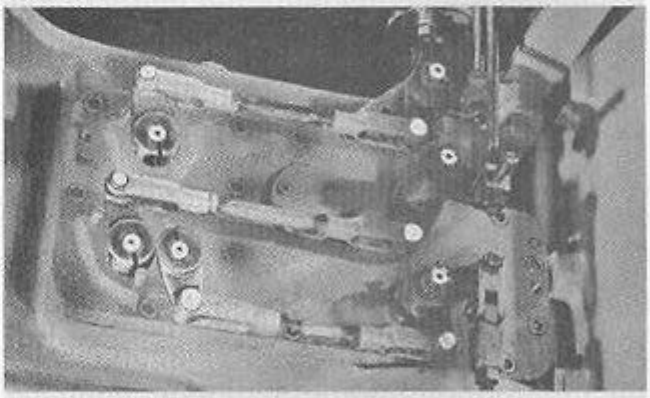
Also, check the relief spring in the vertical connecting rod to the starting valve. If its action is sluggish or weak, the starting valve will not function properly. If necessary, . . .



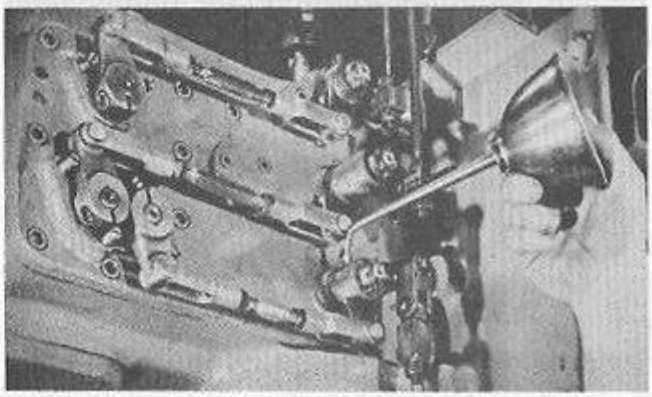
. . .work lubricant into the spring cage around the vertical connecting rod while you move the manual starting handle up and down several times. Be sure to pull the handle all the way down so that the spring is fully compressed.

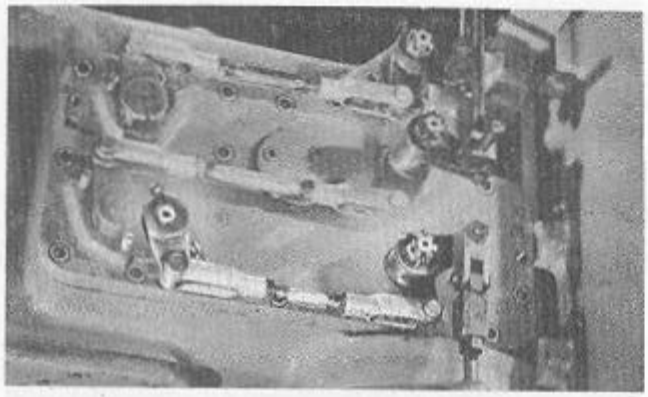


The pivot points for the valve cranks are also sources of trouble, particularly when lubrication is neglected.

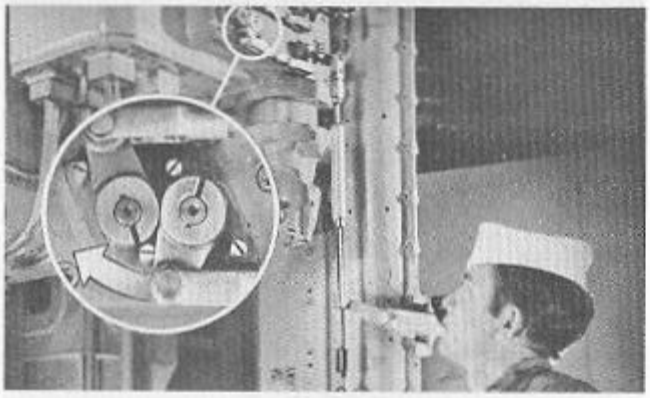


Make certain that these points are lubricated and exercised every day. Use only the prescribed lubricant, usually a medium mineral oil.

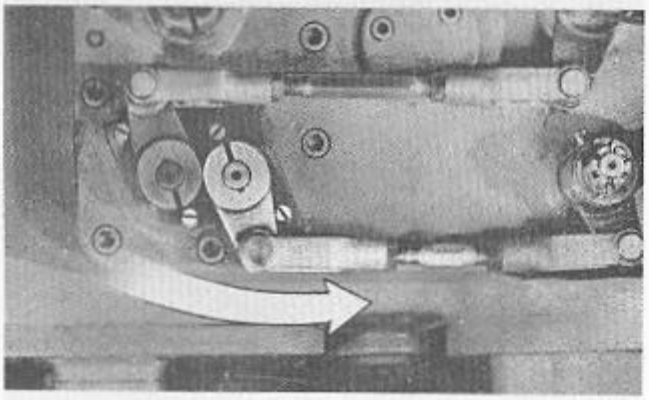




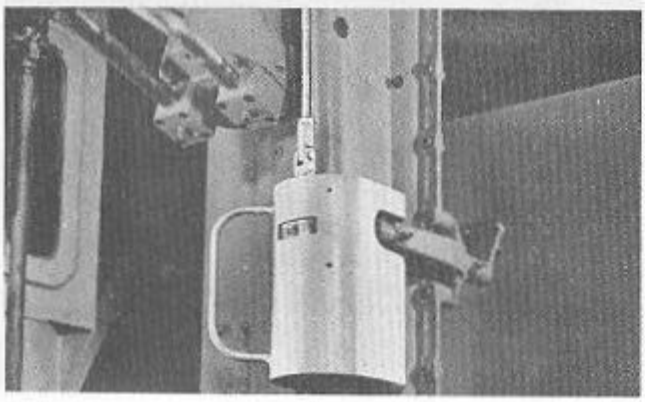
The pivot points for the starting valve linkage are particularly important. They must be kept lubricated and free from salt water if the starting valve is to function with exact precision. To check for proper operation, . . .



. . .depress the manual starting handle until the starting valve crank rests against the left stop pin. Slowly ease up on the starting handle. . .

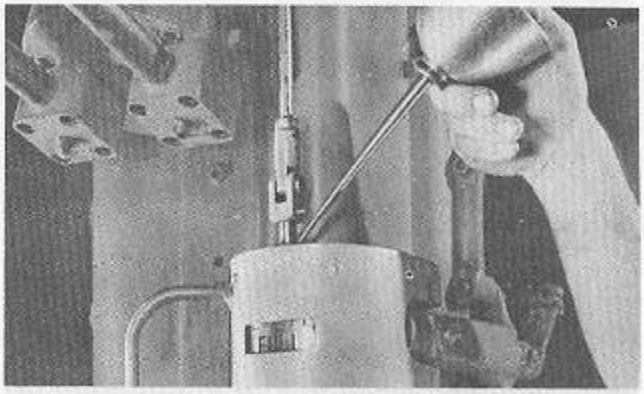


. . .until the crank moves back against the right-stop pin.

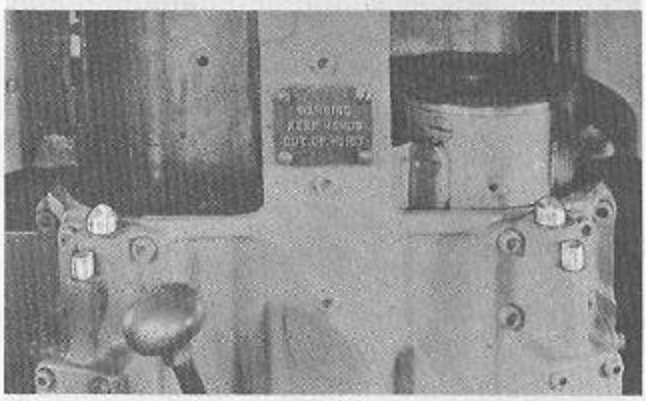


The FULL/EMPTY indicator mechanism in the cover of the manual starting handle is another potential trouble point. It is linked to the interlock mechanism and must function without putting a drag on the interlock linkage. If there is a drag, the interlock mechanism might not lock the starting valve in neutral.

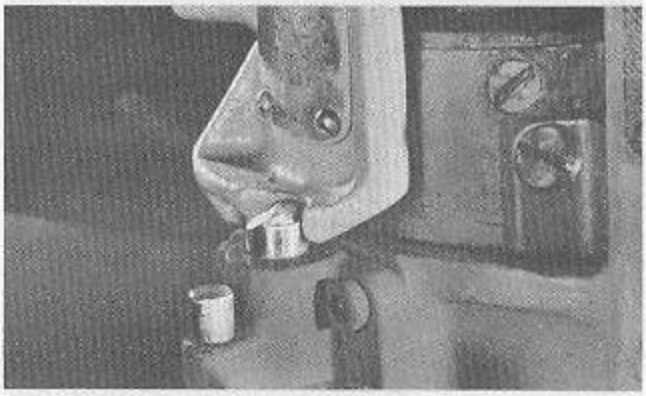
So, it is important that the moving parts of the indicator mechanism be kept free and well lubricated.



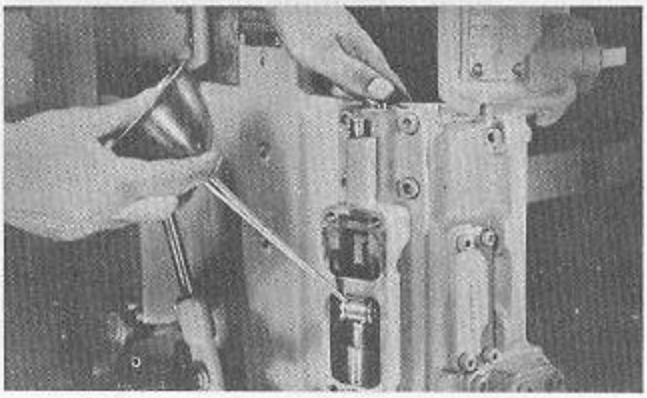
There are also several points on the lower doors that need daily checking. The lower door latches and the latch release plungers on both sides must be kept free.

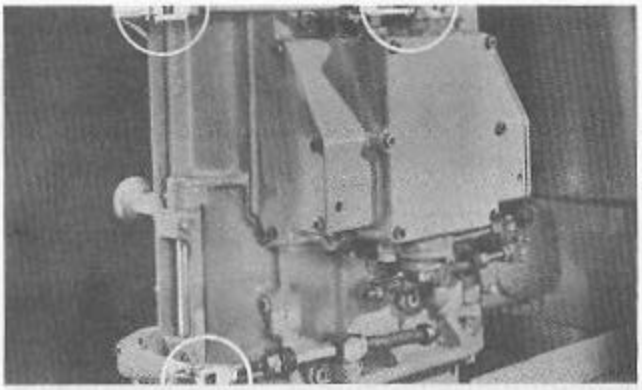


When the door is eased over the latch, the latch should snap up into position and lock the door closed. Depress and release the latch release plunger. It should move freely. If these actions are sluggish,. . .

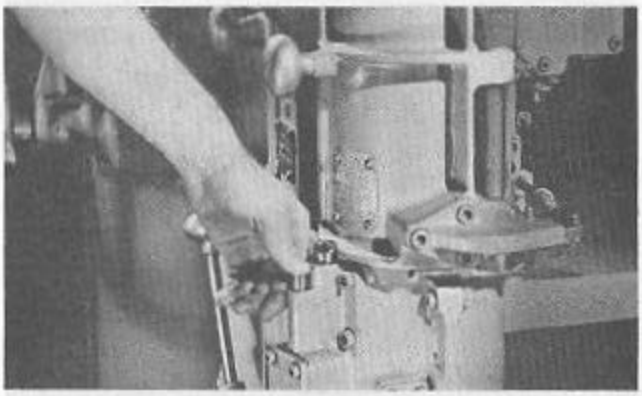


. . .remove the cover and lubricate the moving parts.

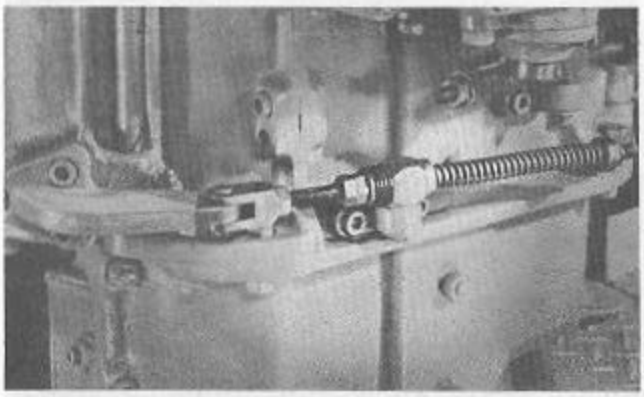




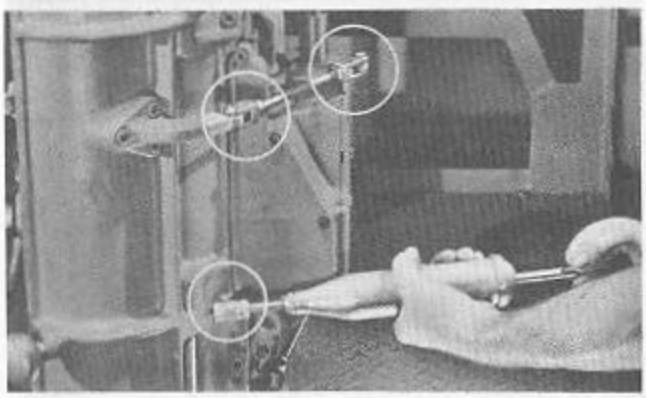
The bearings and hinge pins on both lower doors must also be kept free and well lubricated so there is no drag on the door springs. Test them for proper operation like this.



With the door closed, depress the latch release plunger. The door should open smartly...



...and rest against the stop on the spring rod. If this operation is sluggish or incomplete,...

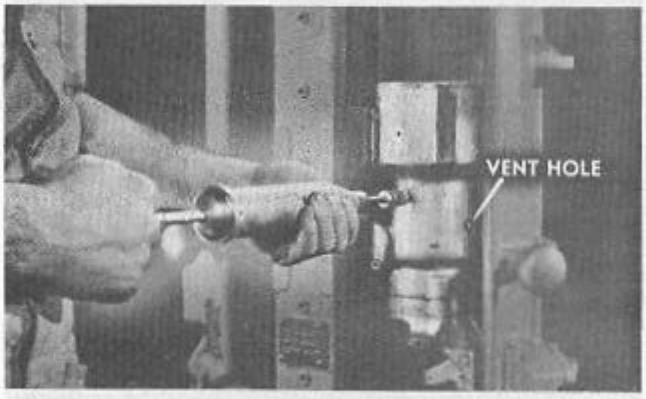


...lubricate the hinge pins. If necessary, increase the tension on the door springs.

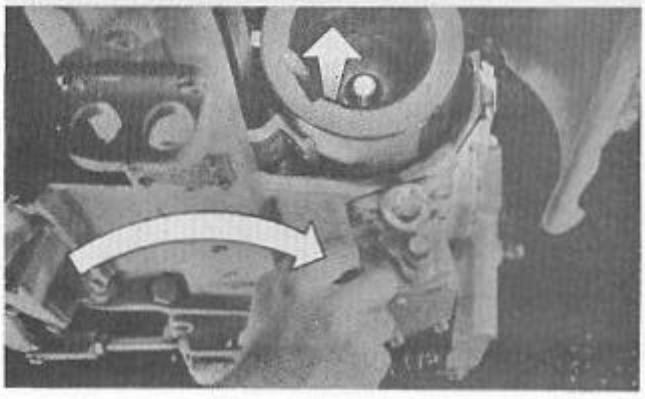
Now, let's check up on the fuze pots.

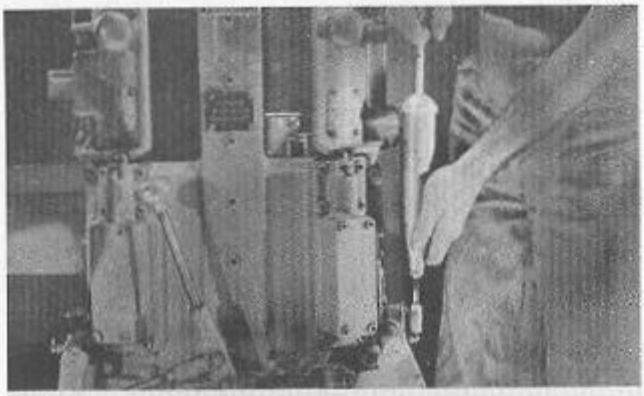
At sea, water may get into the fuze pots even in a closed mount. All traces of water should be removed at once to prevent corrosion.

Be sure to fill the space between the stationary and rotating sockets of the fuze pots with the prescribed lubricants. The proper oil level is up to the vent hole located on the outboard side of each fuze pot.

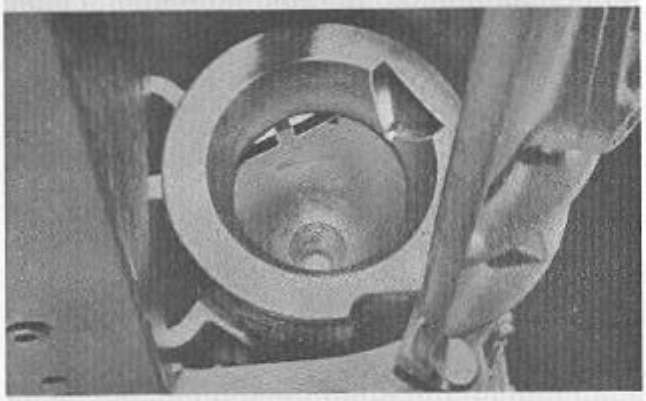


Also, check the action of the ejector rods. With the lower door open, push the ejector lever to the right. This will raise the ejector rod. When the lever is released, both the lever and ejector rod should snap back to normal. If the action is sluggish, . . .

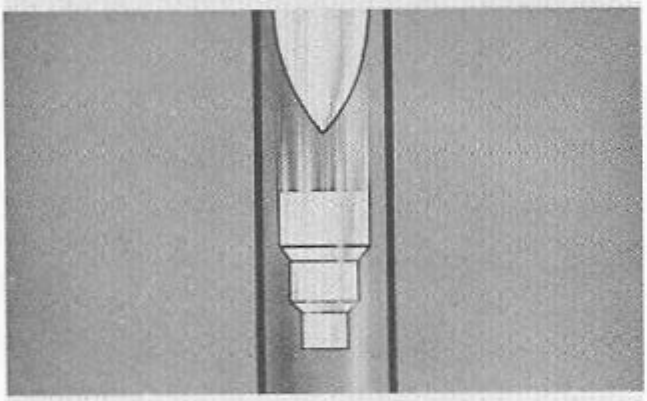




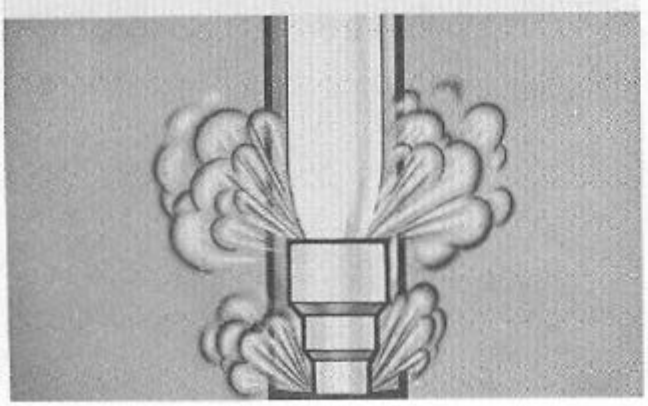
. . .lubricate and free all moving parts in the ejector assembly according to the lubrication chart. Don't forget to check the other ejector rod action, also.



The inner rotating socket and pawls will give trouble occasionally. This usually happens if the hoist should operate with the upper end loaded. When this casualty occurs, . . .

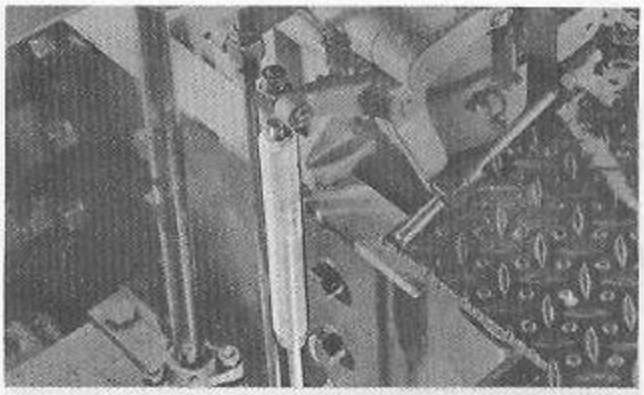


. . .the fuze pot descends faster than the projectile. When they reach the bottom of the hoist, . . .

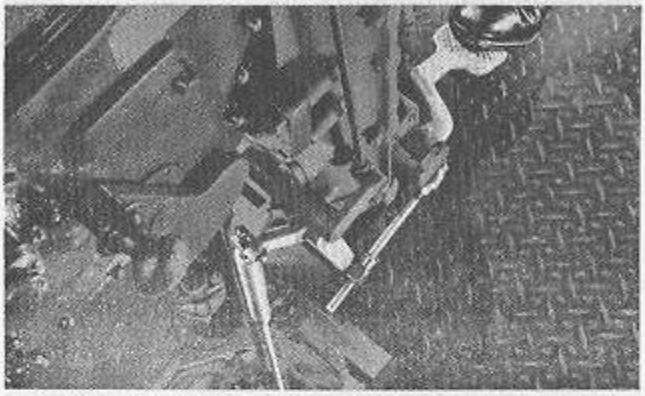


. . .the projectile smashes into the fuze pot, damaging the inner socket and knocking the pawls out of shape. So, inspect the pawls every day and, if necessary, repair or replace any damaged parts.

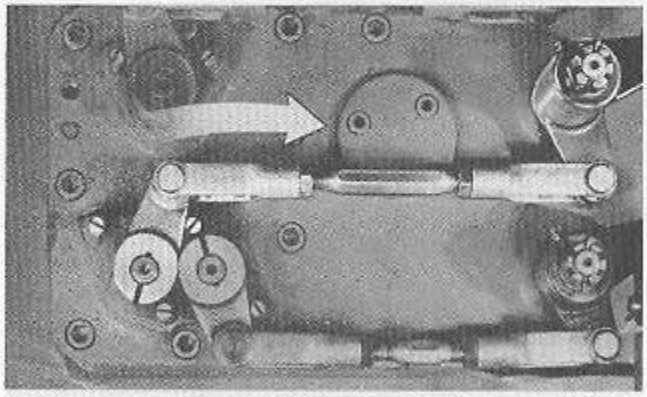
At the upper end of the hoist the daily check includes checking the spring in the connecting rod. Remember, if this spring does not function properly, the starting valve will not be locked in neutral by the interlock mechanism.



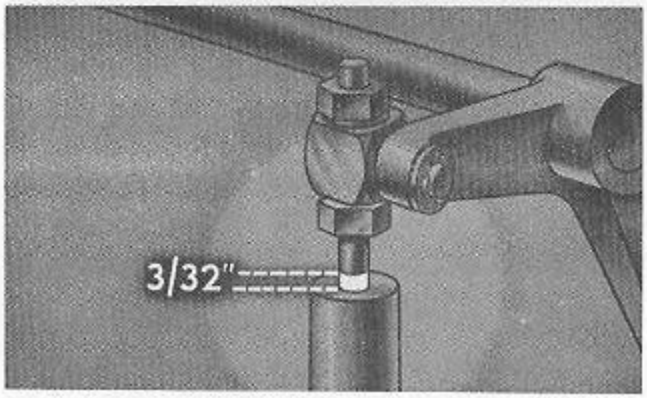
To check its action, depress the foot pedal.

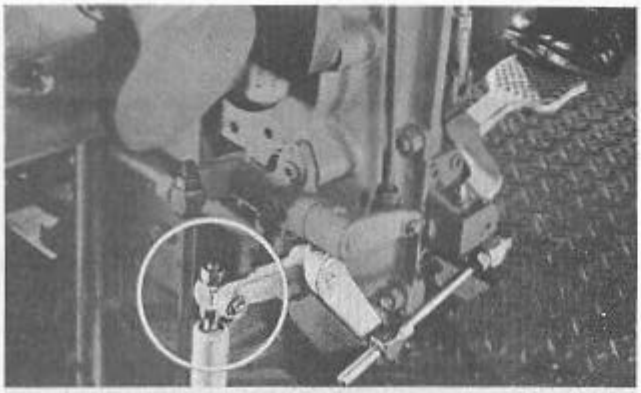


This should cause the interlock crank at the control unit to move all the way over to the right stop pin. At the same time,. . .

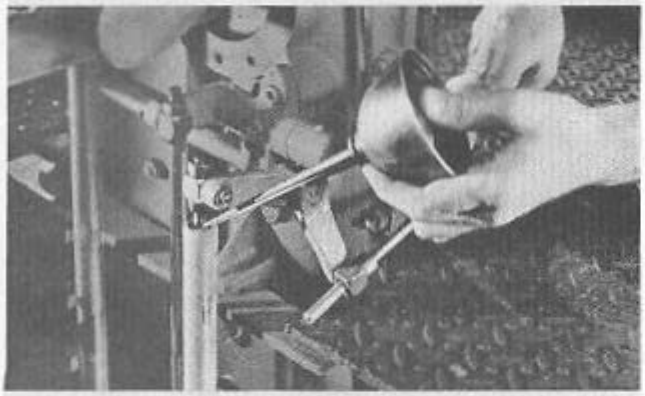


. . .the connecting rod should pull out of the spring cage approximately three thirty-seconds of an inch.

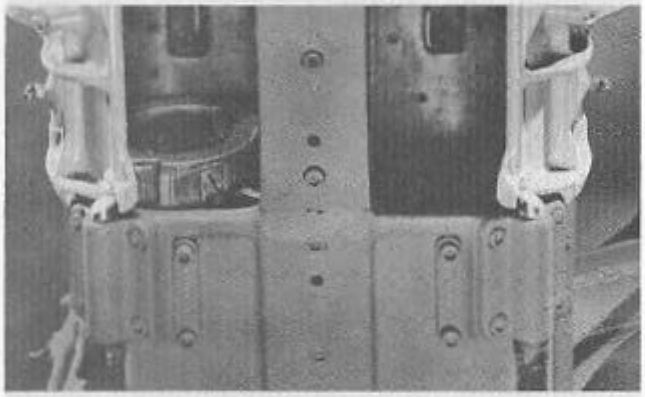




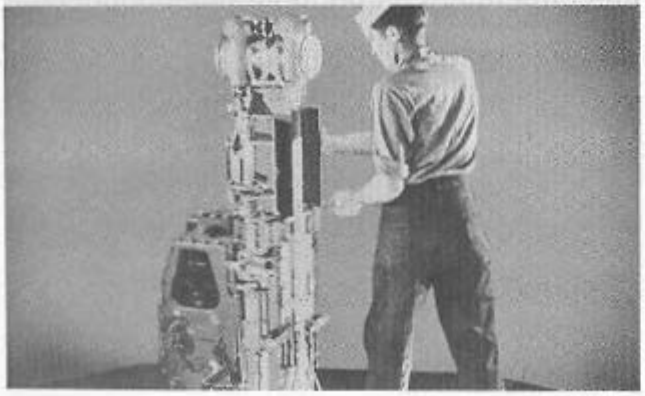
Now, ease up on the foot pedal. This should cause the rod to go back into the spring cage. If the rod sticks, . . .



. . .lubricate the spring cage while you work the rod up and down with the foot pedal. Repeat the operation several times.

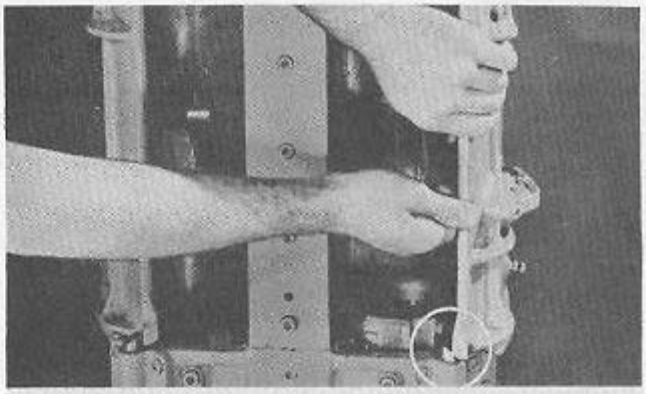


The upper doors and door latches should also be checked for proper operation in the following manner.

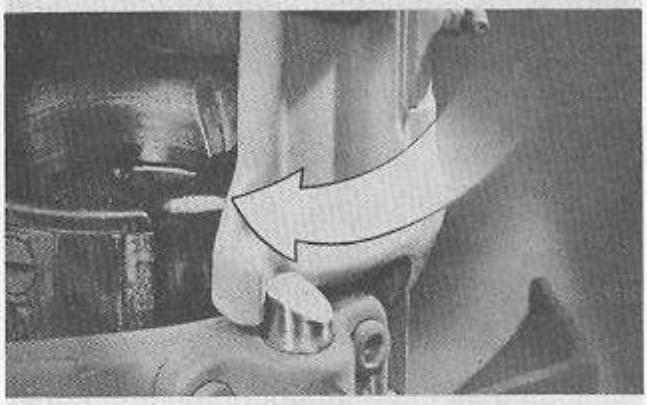


Depress the foot pedal and open the door. when released, the door should close smartly.

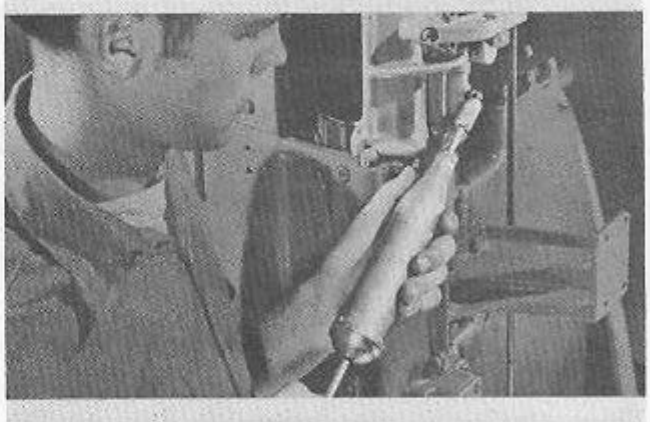
Now, to test the latches, depress the foot pedal and open the door. Then, release the foot pedal and ease the door closed until it rests against the door latch. Now, if you release the door. . .



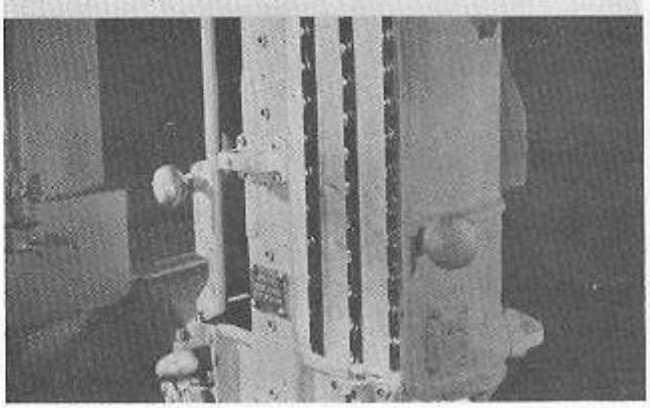
. . .it should overcome the resistance of the latch and close completely.



If the action is sluggish, lubricate the necessary points at the door hinges and latches according to the lubrication chart. Of course, check both the inboard and outboard doors and door latches.



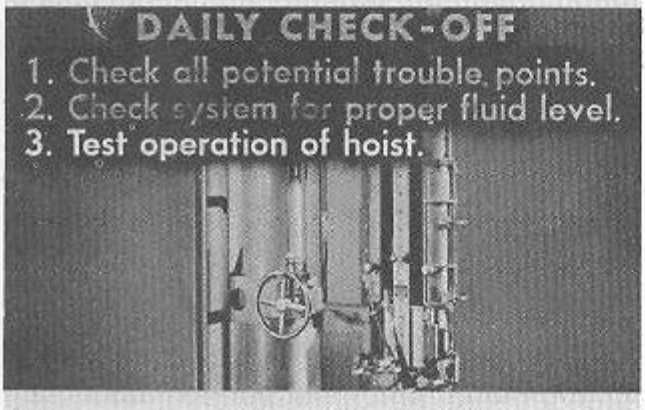
The rollers for the power and fuze-setting chains should be checked every day and kept well lubricated. To do this, . . .



. . .operate the chains in manual and apply the lubricant with a brush as the chains move. Be sure to lubricate the entire length of the chain.

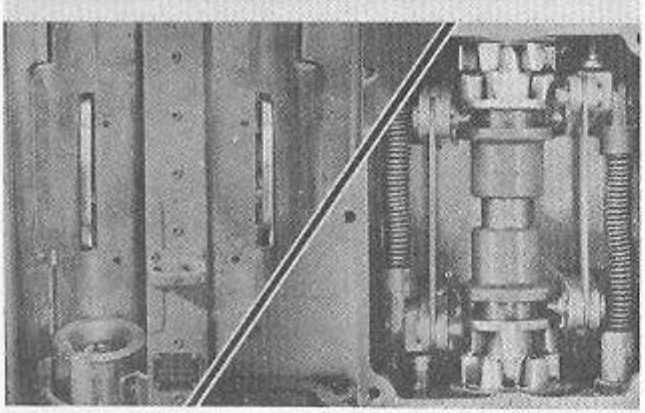
DAILY PHASE 2

Now let's consider the second item on the daily checkoff—check system for proper fluid level. The correct level is anywhere between the two petcocks on the right-hand side of the tank. Open the two petcocks to check for the correct level.



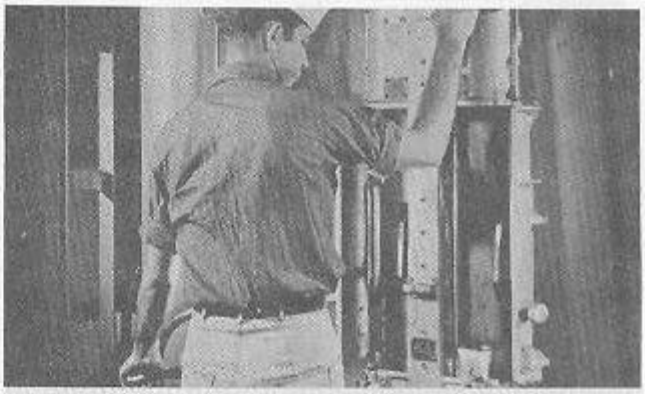
DAILY PHASE 3

Now for number three—test operation of the hoist. Make the test in manual operation first, . . .

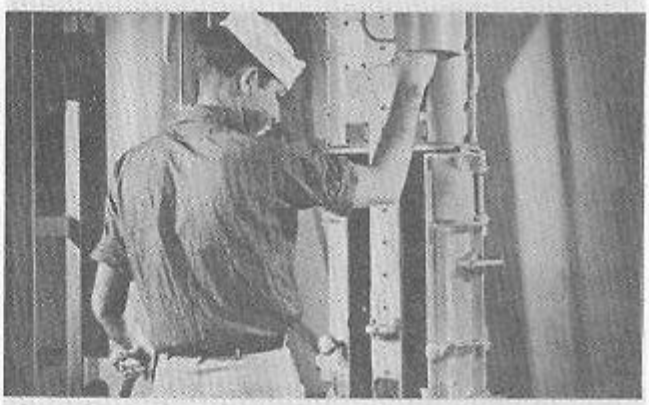


. . .because, the control cams and clutches sometimes jam due to insufficient clearances. So, they should be checked in manual before operating the hoist in power. Here's how.

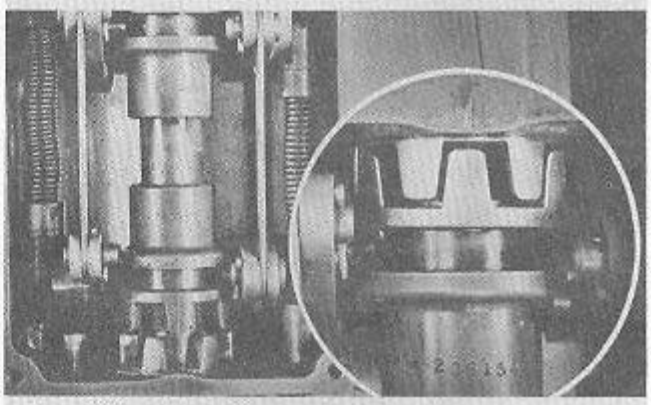
With the hoist empty and with both lower doors fully open, operate the hoist through two cycles in manual.



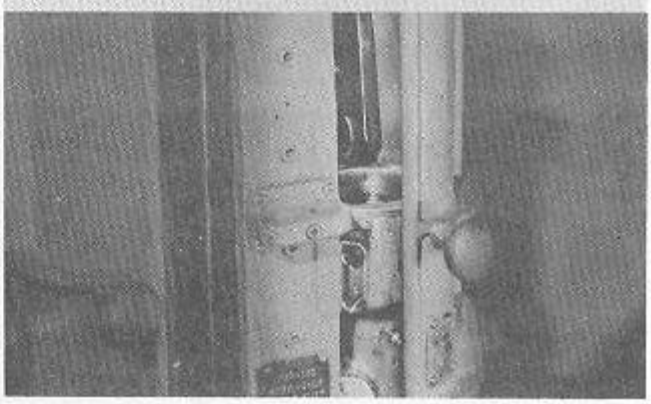
Then, close and latch both lower doors and repeat two cycles in manual. If the fuze pots pass the cams without an indication of binding, . . .



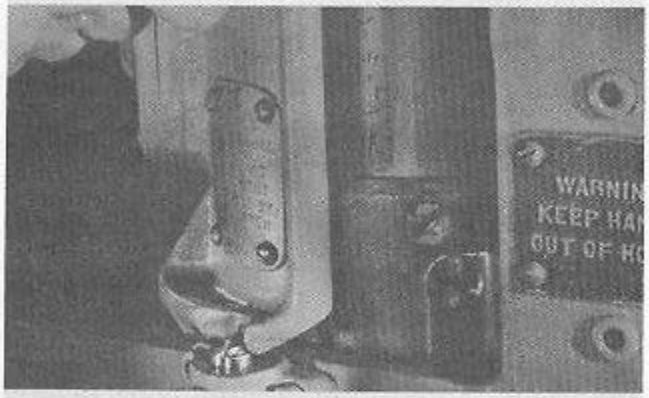
. . .there is adequate clearance on both sides of the clutch teeth and the clutches will not jam if the hoist is operated correctly in power.



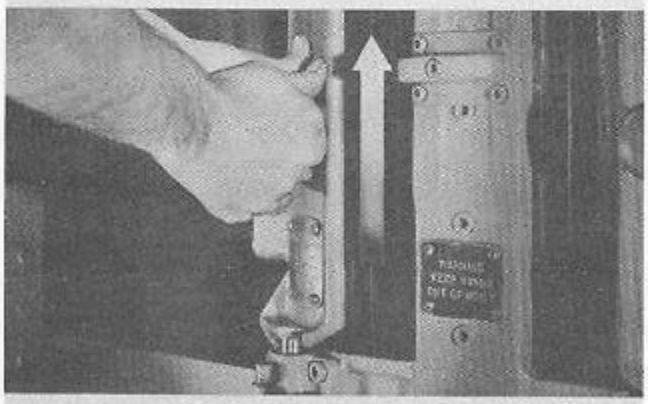
If the fuze pot jams while attempting to ride over the control cam, re-adjust the lower end control gear as explained in the chapter on adjustments (chapter 27).



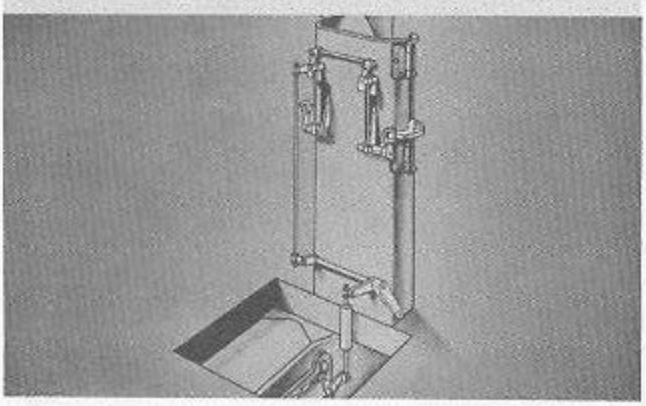
Our next step is to test the hoist in power operation. With the electric motor off, place a projectile in the inboard fuze pot. . .



. . .and ease the door closed so that it rests on the step of the door latch. Now turn on the electric motor. A cycle should not start with the door in this postion.



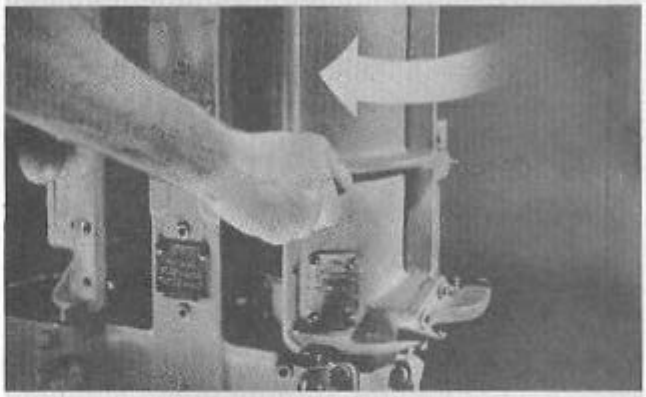
Now, close the door completely and the hoist should make a cycle. Leave the projectile in the upper end, because, . . .



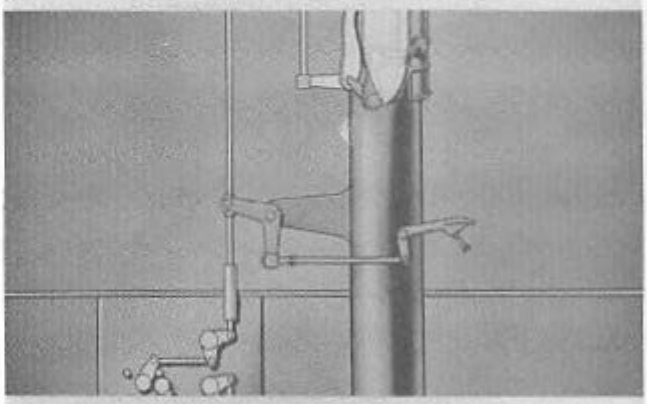
. . .we next check the interlock mechanism which functions when the upper end is loaded. To check this mechanism, . . .

. . .place a projectile in the lower outboard flight. . .

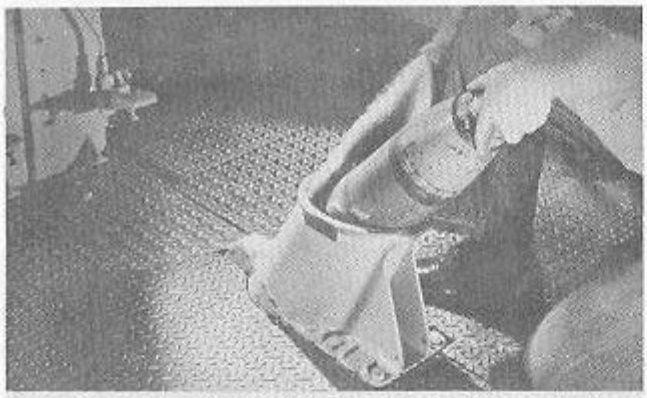
. . .and close the door fully.



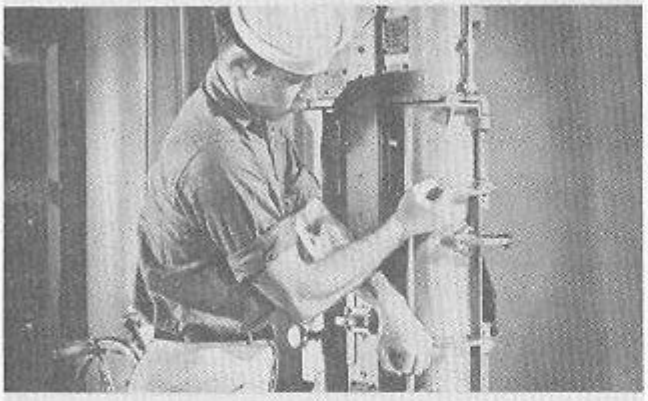
The hoist should not make a cycle, because the first projectile is still in the upper end, and the starting valve is locked in neutral. Next we check fuze setting. Stop the electric motor, . . .



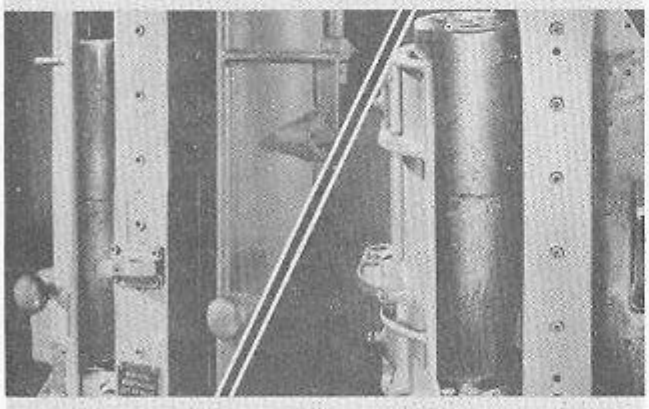
. . .and remove the projectile from the upper end. Check the setting on the fuze with the reading on the fuze-setting indicator regulator dials. They should correspond if the fuzes are being properly set. If not, the fuze-setting mechanism must be adjusted as explained in the chapters on adjustments (chapters 27 and 28).



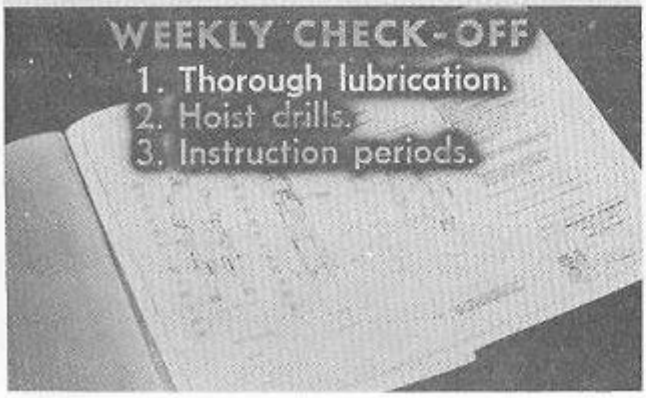
Set the fuze of the projectile at SAFE and return the projectile to the upper handling room through the powder hoist for stowage.



Now, having checked automatic starting and fuze setting on the inboard side, we go through the same steps for the outboard side.



Okay, this completes the daily checkoff. The weekly checkoff is next.



WEEKLY CHECKOFF LIST

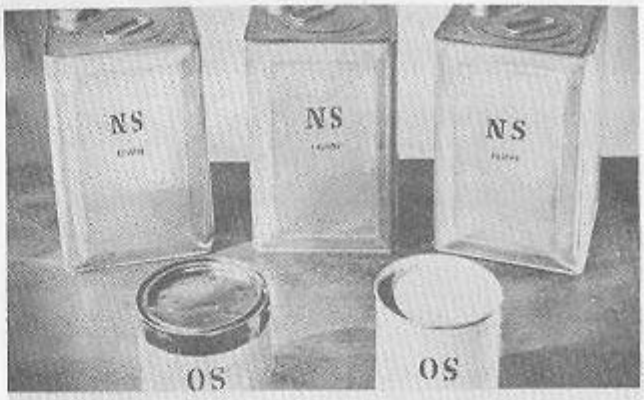
The weekly checkoff includes 3 major phases:

1. Thorough lubrication,
2. hoist drills, and
3. instruction periods.

WEEKLY PHASE 1

In making this thorough weekly lubrication, follow the appropriate charts. These will be found in the back of OP 735, and are also posted near the hoist aboard ship. So, it is not necessary to detail the lubrication procedure here.

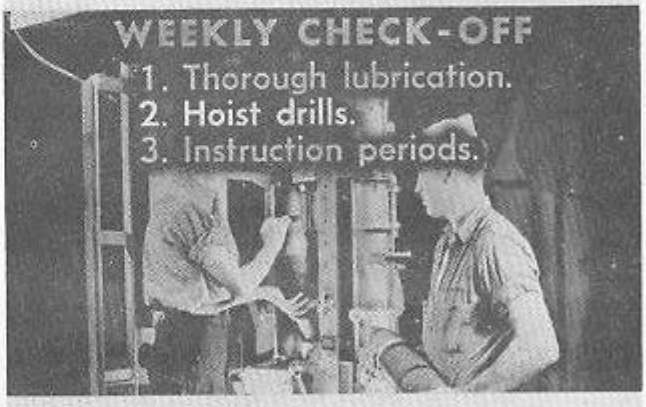
When lubricants recommended by the Navy are not available, use only approved substitutes. These should be replaced with the prescribed lubricant as soon as possible.



When lubricants are changed to meet extreme changes in temperature they should be replaced with the correct lubricant as soon as conditions are normal.

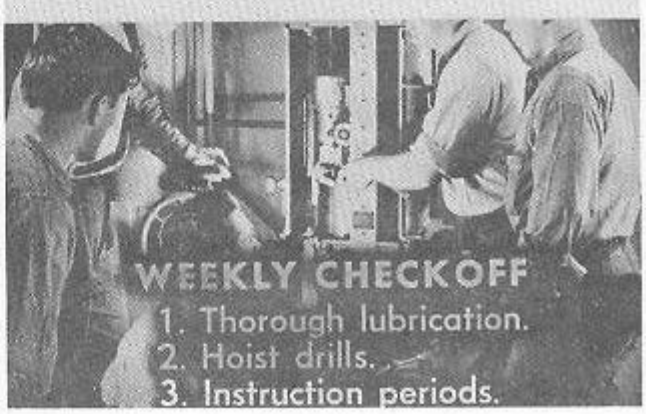
WEEKLY PHASE 2

Hoist drills may be held as often as advisable, but never less frequently than once a week.



WEEKLY PHASE 3

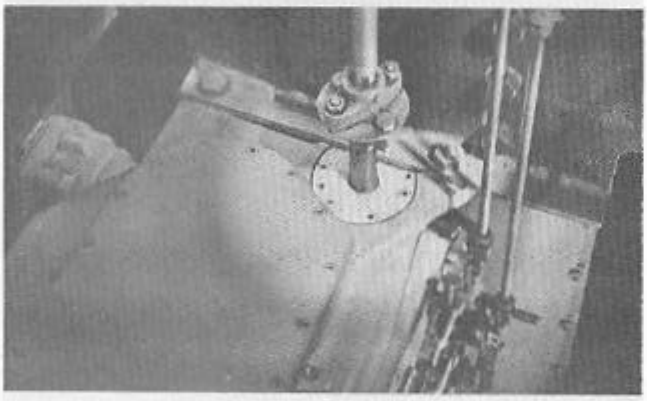
Instruction periods should also be held at least once a week so that each crew member can perform his duties correctly and smartly. Simulate casualties and practice immediate action and remedies.



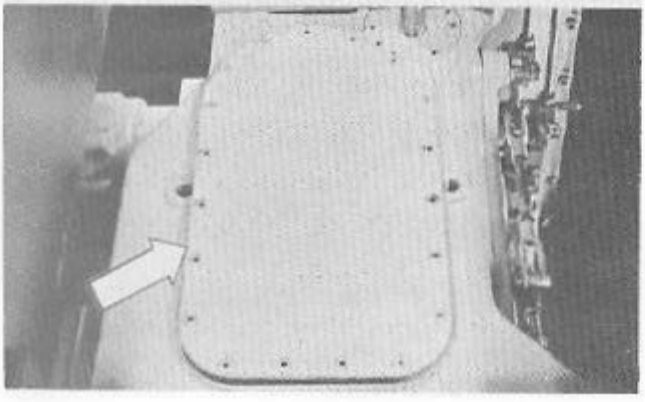
QUARTERLY INSPECTION

A quarterly inspection of the entire hoist mechanism should be made for salt water corrosion. Be sure to inspect the control unit. This is done. . .

. . .by removing the top cover of the control unit and looking for signs of corrosion. If traces of sludge are found, the entire system must be drained, flushed, and refilled. The extent of corrosion will determine whether the unit should be disassembled and overhauled. Every effort should be made to locate and correct the place of entry of salt water.

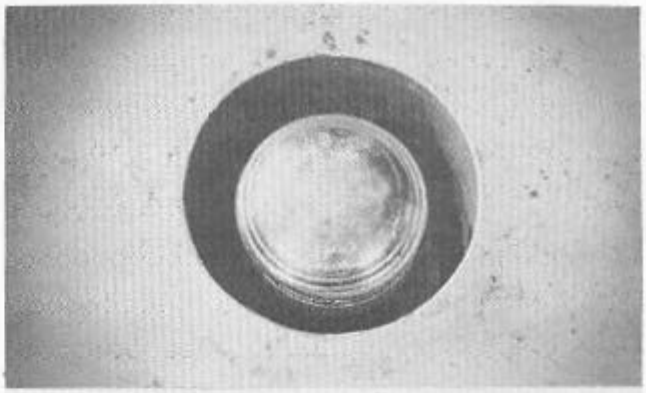


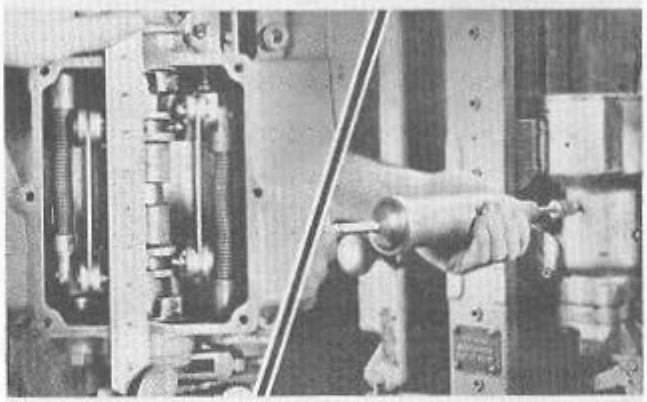
Possible places of entry are: through the seal around the output shaft where it emerges from the control unit; . . .



. . .through the gasket between the top cover of the control unit and the control unit case; . . .

. . .and around the cap on the filler neck of the tank.





SUMMARY

By maintaining all parts in proper adjustment and by frequent and thorough lubrication, the most common troubles can be found and corrected long before they cause casualties.

Don't underestimate the importance of proper maintenance. This is the only way to make absolutely certain that the hoist will be ready to operate when you need it.