ABSTRACT

A pavement breaker having a reciprocating piston hammer to pound a work steel, wherein a jacket about the tool provides a reservoir of constantly pressurized oil, which pressurized oil drives the hammer on a work stroke, operates a plunger to return the hammer, operates dampers to dampen excessive movement of the hammer beyond its usual impacting point, operates a dump valve to relieve the pressurized condition of the reservoir when the tool is lifted out of pressed relation to the work, and operates a ram to shift a control valve in one direction to interrupt reservoir oil flow to the hammer, the control valve being mechanically shiftable in the opposite direction by the hammer on a return stroke to reestablish reservoir flow to the hammer.

13 Claims, 7 Drawing Figures
RECIPIROCATING HYDRAULIC HAMMER

BACKGROUND OF THE INVENTION

This application is a division of patent application Ser. No. 165,539, filed July 23, 1971.

This invention is concerned with an hydraulically operable tool having a hammer which is hydraulically reciprocable to pound a work steel against the work.

While the invention is illustrated in a tool designed especially for use as a pavement breaker, it is understood that the invention is subject to other applications.

A feature of the invention lies in the employment of an hydraulically operable piston for driving the hammer on a work stroke, and in an hydraulically operable plunger for automatically returning the hammer and piston to starting position.

Another feature lies in a pressurized oil reservoir defined by a jacket in surrounding relation to an end portion of the tool, whereby the paths of fluid flow to effect operation of various elements of the tool are shortened to a minimum with consequent reduction of energy losses that would otherwise arise from leakage and friction.

Another feature of the invention lies in a slide valve incorporated in the tool to control flow of reservoir oil to and from one end of the driving piston. The valve is shifted mechanically near the end of the return stroke by means of the returning piston; and is shifted under hydraulic pressure from the reservoir during the work stroke.

A further feature lies in the use of plungers hydraulically damped by reservoir oil to absorb energy of the moving hammer beyond its usual impacting position.

Another feature lies in a dumping plunger valve which is responsive to pressure of reservoir oil to cause dumping of fluid from the reservoir and dissipation of its energy, when the hammer has moved to a predetermined low position as when the tool is removed clear of the work or when the work steel has suddenly dropped into a void area.

A still further feature of the invention lies in the organized arrangement of the return plunger, the dumping plungers, the dumping valve, and an hydraulically operable ram for shifting the control valve in one direction whereby the arrangement they are all directly subject to constant pressure of oil in the reservoir for their operation.

Other advantages and features will become apparent as the description of the invention proceeds in greater detail.

BRIEF DESCRIPTION OF DRAWING

In the accompanying drawing;

FIG. 1 is a longitudinal section of an hydraulic hammer illustrating the invention, which view is taken on line 1—1 of FIG. 2;

FIG. 2 is a plan view of the top end of FIG. 1;

FIG. 3 is a section taken on line 3—3 of FIG. 1;

FIG. 4 is a section taken on line 4—4 of FIG. 1;

FIG. 5 is a section taken on line 5—5 of FIG. 1;

FIG. 6 is a longitudinal section taken on line 6—6 of FIG. 5; and

FIG. 7 is an enlarged detail of the valve mechanism shown in FIG. 6.

DESCRIPTION OF PREFERRED EMBODIMENT

The hydraulically operable hammer illustrating the invention is designed primarily for use as a pavement breaker. The tool is mountable to a boom (not shown) on a motor vehicle by means of brackets 10 (FIG. 5) fixed to a side area of the tool's housing 11. The boom is hydraulically operable to selectively raise or lower the tool so as to bring a work steel 12 into or out of pressed relation with the work.

The general housing 11 includes a fronthead 13 bolted at 14 in end relation to an elongated cylinder or jacket section 15. The cylinder provides a chamber 16 which serves as a pressure oil reservoir. The reservoir is sealed at its rear by means of an end wall 17 and is sealed at its opposite end by means of an annular shoul-der 18 provided by the fronthead 13. An inlet 19 to the reservoir is connected by means of a hose line 21 with an hydraulic pressure supply system 20 mounted upon the motor vehicle. The supply system is equipped with suitable controls which enable it to be employed, not only for hydraulically filling and pressurizing the reservoir, but also for hydraulically operating the boom.

Axially arranged within the reservoir in spaced relation to the end wall 17 and to the surrounding wall of the reservoir is an internal or second housing 22. The latter includes a lower section 23 having an annular wall, the bottom end of which is seated upon the shoul-der 24. Housing section 23 defines a cylindrical air or hammer chamber 24 which connects directly with a coaxial bore 25 extending through the fronthead. A heavy cy-lindrical hammer portion 26 of a combined piston and hammer, or piston hammer, is reciprocable in chamber 24 to pound a tail end 27 of the work steel. The work steel is slidably received in the front head and it projects at its tail end into the hammer chamber where it is subject to being pounded by the hammer.

A retaining cap 28 threadedly engaged over the forward end of the fronthead has an internal shoulder 29 which is cooperating with a flange or collar 31 located intermediate of the ends of the work steel to retain the latter within the tool against endwise escape. The collar 31 is also cooperating with a second shoulder 32 within the fronthead to limit the extent of projection of the work steel into the hammer chamber.

There is a slight clearance 33 spacing the hammer from the surrounding wall of the hammer chamber. This is of advantage in that whatever ambient air enters the hammer chamber through the fronthead will freely circulate about the hammer and escape around the drill steel back to atmosphere. Accordingly, neither a vacuum nor trapped air can develop in the hammer chamber to impede reciprocation of the hammer.

The hammer is caused to be driven on a work stroke under pressure of reservoir hydraulic fluid applied to an integral piston portion 34 of the hammer and it is adapted to be mechanically returned under pressure of the reservoir fluid applied to an end of a return plunger 35.

The piston 34 is defined by means of an elongated stem that is fixed axially to the hammer but is of relatively reduced diameter. The piston is slidably received in a bushing 36 fixed by bolting in a backhead section 37 of the internal housing. The backhead 37 seals over the rear end of the hammer chamber 24 and it is rigidly seated upon an annular rear end wall 38 of the lower housing section 23 by means of a group of bolts 39. The bolts pass through side ears 41 of the backhead and are threadedly tightened in the annular shoulder 38. The
3 bolts not only secure the backhead to section 23, but also the latter seated upon the shoulder 18. The backhead defines a piston chamber 42 rearwardly of the piston.

A shuttle valve 43 (FIGS. 1, 6, 7) axially slideable in the piston chamber rearwardly of the piston, controls the application to and relief of reservoir hydraulic pressure fluid from the piston. The valve is slideable between a pair of axially spaced annular shoulders 44 and 45 of the piston chamber to open and closed positions relative to a ring of oil feed ports 46 and a ring of oil discharge ports 47 formed in a valve bushing 48. The rearwardly disposed shoulder 45 is defined by the inner face of a plug 49 bolted to the upper end of the backhead over the piston chamber.

The feed ports 46 connect through an annulus with a group of larger feed ports 51 communicating with the reservoir 16. The discharge ports 47 connect through an annulus with a larger discharge port 52 that opens laterally into a return line passage 53. The latter leads to an outlet 54 provided by an adapter 55. The adapter is bolted to the external face of the end wall 17. The outlet connects by means of a hose line 56 with a sump (not shown) in the external hydraulic pressure supply system.

The return passage 53 is defined in part by means of a tube 57 (FIG. 1) that is fixed at its lower end in an offset portion of the backhead 37 (FIG. 4), extends through the back wall 17 and is fixed in the adapter 55. The return passage also connects by means of a second large discharge port 58 with an annulus 59 surrounding the piston bushing 36. A group of relief ports 61 in the piston are registrable during a work stroke of the piston with a group of drain ports 62 in the piston bushing 36 to relieve pressure oil from a cavity 63 in the piston through the annulus 59 to the return passage 53, as in FIG. 1. During a return stroke of the piston, the relief ports 61 are blocked off and a group of feed ports 64 in the piston become connected with the piston chamber 42 to admit reservoir pressure oil to the piston cavity 63, as in FIGS. 6 and 7.

The shuttle valve 43 is defined by an open ended cylindrical body or skirt which is slideable to cover and uncover the several feed and discharge ports 46 and 47. The body of the valve is joined by means of a group of radial spokes 65 (FIG. 4, 7) with an axially extending valve operating rod 66. As the valve is shifted from one position to the other, pressure oil within the piston chamber 42 freely passes through the spaces between the spokes. An upper section of the valve rod rearwardly of the spokes extends slidably into an axial bore 67 of the plug 49. The bore is extended by means of a relatively reduced counterbore 68 through a terminal stem 69 of the plug. A ram 71 slideable in this counterbore 68 constantly abuts the upper end of the valve rod under ambient pressure of reservoir fluid. During the progress of a work stroke of the piston, the ram 71 functions under pressure of reservoir fluid to slide the valve forwardly or donwardly so as to uncover the discharge ports 47 and to cover the feed ports 46 preparatory to a subsequent return stroke, as appears in FIG. 1.

A longer oppositely lower extending section of the valve rod extends slidably through a bushing or adapter 72 into the piston cavity 63. The valve rod is of reduced diameter relative to that of the cavity so as to provide a surrounding clearance allowing communication of the cavity with the piston feed ports 64. The adapter 72 includes a flange which is bolted over the end of the piston. The adapter has a lower sleeve or stem portion which guides the valve rod and extends into the piston cavity. This stem is of reduced diameter relative to the piston cavity so as not to block communication of the piston cavity with the ports 64.

The adapter 72 has an oppositely upper extending sleeve or stem 72 which also guides the valve rod and projects with a substantial surrounding clearance into the piston chamber 42 rearwardly of the piston. On a return stroke of the piston, the stem 73 is carried freely into the interior of the valve 43 so as to abut the spokes 65 and slide the valve to a partially shifted condition, as appears in FIGS. 6 and 7. In this partially shifted condition of the valve, the drain or return ports 47 are covered and the feed ports 46 are uncovered.

As the piston is returning and shifting the valve, the side ports 64 of the piston are brough to communication with chamber 42; and the valve is being shifted pressure fluid enters through ports 46 to chamber 42 from where it enters ports 64 to fill and pressurize the piston cavity 63. The pressure developing in chamber 42 and the cavity 63 decelerates the returning piston and causes its return movement to stop slightly short of and before the face 75 of the hammer can bottom against the stationary flange 74. The pressurization of cavity 63 exerts a bias over the lower end of the valve rod to shift the valve away from the piston for a slightly further distance until the valve abuts the upper shoulder 45. Reservoir pressure acting over the smaller diameter end of the ram 71 is insufficient to resist this further shifting action. The hydraulic bias in cavity 63 acting on the valve rod serves to hold the valve in its open and fully shifted condition until the pressure in the cavity 63 is subsequently relaxed which occurs at about the time of impacting action of the hammer during a work stroke. Following shifting of the valve to its open condition, rapid pressurization of chamber 42 acts upon the piston to drive it over a forceful work stroke.

The manner in which the piston hammer is returned and in which the valve is shifted to its open condition is of decided advantage. The hydraulic deceleration and stopping of the returning piston before the hammer can contact the stationary flange 74 avoids undesirable forces being imparted by the hammer to the internal housing 22. The hydraulic stopping of the piston before it can shift the valve into abutment with the end shoulder 45 also is of decided advantage in that undesirable compressive forces of the piston upon the valve are avoided.

While the hammer and piston are shown in a preferred form as an integral unit, they may be incorporated in the tool as separate elements.

MEANS FOR DAMPING HAMMER MOVEMENT WHEN THE WORK STEEL IS NOT IN IMPACTING POSITION

Damping means is provided to absorb the energy of the hammer on a work stroke when the work steel is not in its impacting position. This means is provided by a pair of diametrically spaced damping plungers 76 (FIGS. 3, 6). Each is slideable in a separate borer 77 formed in a housing 78 fitted in the wall 18 of the front-head. Each projects in parallel relation to the axis of the hammer part way into the hammer chamber 24
under bias of reservoir oil pressure. To this end, the reservoir connects separately with each plunger bore by means of a restricted passage 79 in the wall of the fronthead with ports 82 that are located a short distance above the bottom of the plunger bore. Reservoir pressure fluid entering the plunger bore biases the plunger upwardly until a tapered upper shoulder abuts a complementary shoulder of the bore. In this condition, a reduced diameter stem 81 of the plunger projects into the hammer chamber. The upper end of the stem 81 of each plunger will normally be cooperative with the opposed underface of the hammer during a work stroke after the work steel has dropped to a position below the level of the plungers. This dropped condition will be obtained when the work steel encounters a void or soft area or when the tool is lifted out of pressed relation to the work. The work steel, when pressed against the work, will normally project axially into the hammer chamber above the biased level of the plungers, as in FIG. 6.

The plungers 76 have a slight taper about their lower ends normally positioned opposite the ports 82 so as to restrict flow through the latter back to the reservoir as the plungers are pressed downwardly by the hammer. This flow is further restricted as the plungers are moved further down by the hammer to carry their tapered ends in further restricted relation to the ports 82.

HAMMER RETURN PLUNGER

The hammer 26 is caused to be returned upon completion of its work stroke by means of the hydraulically biased return plunger 35 (FIGS. 6, 3). The plunger is slidable in parallel relation to the axis of the hammer in an eccentrically located bore provided by a bushing 83 fitted in the shoulder 18 of the fronthead. The under side of the bore is connected with the reservoir by a passage 84 opening into the reservoir through the shoulder 18 of the fronthead. Pressure fluid from the reservoir constantly filling the passage 84 continuously pressurizes the plunger into abutment with the underface of the hammer. The passage 84 is sufficiently large enough to allow rapid escape to the reservoir of fluid displaced by the plunger when the hammer is moving downward on a work stroke.

When the shuttle valve 43 is caused to be shifted toward the end of a work stroke by the arm 71 so as to discontinue application of reservoir oil to the piston and to open the piston chamber 42 to the return line 53, the pressure of oil in the reservoir then effectively acts through the passage 84 upon the return plunger 35 to move the hammer on a return stroke. The diameter of the return plunger is relatively small so as to permit a desired easy or slowed return of the hammer.

DUMPING VALVE

A dumping plunger valve 85 (FIGS. 5, 6) is provided to cause the reservoir oil to be dumped and its energy relieved through the return line 53 when the tool is lifted from the work. This dumping action prevents the piston from being returned from a work stroke by the return plunger 35. This is desired to immediately stop further undesirable reciprocation of the hammer. The dumping valve extends parallel to the piston and hammer and is slidable in a bushing 86 fitted in an offset side portion of the backhead 37. The dumping valve has and upper flat end which normally projects into the reservoir 16; its opposite lower end projects through the bushing 86 and is in constant contact with the upper surface of the hammer 26 under bias of reservoir oil pressure. The dumping valve normally blocks communication of the reservoir through the bushing 86 with a dumping port 87. The latter is connected by the annulus 59 with the return passage 53.

It can be seen that, when the tool is lifted from its pressed relation to the work, the work steel will drop to its low position upon the shoulder 29 of the cap 28. Then, as the hammer moves downward on a work stroke below the level of normal impacting relation with the work steel and as it forces the dumping plungers 76 substantially to their limits, the dumping valve under the constant pressure of reservoir oil follows the hammer sufficiently to open or communicate the reservoir with the dumping port 87. The dumping port and return passage 53 are of substantial diameter so as to allow, when the dumping valve is open, rapid escape of reservoir oil to the return passage 53 and the outlet hose line 56 with consequent rapid dissipation of the energy of the pressurized reservoir oil. This condition will prevent return of the piston and hammer from the work stroke.

A conventional pressure surge accumulator 88 (FIGS. 1, 2) is connected with the outlet passage 54 as a protective measure to reduce the pressure of the returning fluid on the return hose 56.

It is to be noted that the inlet feed line 21 is continuously open so that the reservoir 16 in which the internal housing 22 is fully immersed is completely filled and constantly pressurized with fluid continuously being supplied to it from the hydraulic system. This huge volume of reservoir oil serves as an accumulator due to its compressibility. It is of such volume that it will feed one stroke of the piston with a pressure drop of less than 800 p.s.i. in the reservoir. The close proximity of the reservoir to the internal housing and to the piston chamber therein facilitates an extremely high flow rate that occurs when the hammer has attained its maximum velocity just prior to impacting. The annulus style reservoir 16 in surrounding relation to the internal housing provides very convenient access of pressure fluid for obtaining the auxiliary functions of the return plunger 35, the dumping plungers 76, the dumping valve 85, and the ram 71, all of which are directly exposed to reservoir fluid.

In summary of the operation of the tool, let it be assumed that the tool is being held by the boom in pressed relation to the work, that the reservoir 16 is being constantly pressurized with oil from the supply system, and that the tool has obtained the condition shown in FIG. 1 following completion of a work stroke of the piston and hammer. Since both the piston cavity 63 and the piston chamber 42 are at this time connected with the discharge or return passage 53 and are closed by the shuttle valve 43 to reservoir pressure fluid, the reservoir pressure fluid acts upon the return plunger 35 to return the hammer and piston.

On this return stroke, the piston displaces the relief ports 61 to block the piston cavity 63 from drain ports 62; and by means of the stem 73 of the adapter 72, the piston slides the shuttle valve 43 to its open and partially shifted condition, as in FIGS. 6 and 7. As the valve is shifted, fluid trapped at the juncture of the upper end of the valve rod and the ram 71 is drained through a passage 89 to the return line so as to avoid sluggish shifting of the valve.
Reservoir pressure fluid then flows through feed ports 46 to chamber 42 and through the piston feed ports 64 to pressurize the piston cavity 63. The fluid pressure then developing about the returning piston acts to decelerate its movement and brings it to a stop before its end wall 75 can abut against the stationary wall 74 and before its stem portion 73 can shift the valve into abutment with the upper shoulder 45, as earlier explained. The pressure developing in the piston cavity 63 acts to bias the valve to its fully shifted condition and to hold it there until the subsequent work stroke of the piston is substantially completed. The pressure developing over the piston finally drives the piston on a forceful work stroke into impaction relation with the work steel 12.

On the work stroke, the return plunger 35 is moved ahead by the hammer to force the oil below it through passage 84 back into the reservoir. The energy being imparted by the return plunger to the oil forced back to the reservoir is added to the energy of the reservoir fluid acting upon the piston to further increase the drive and impacting force of the hammer.

As the piston moves away from the shuttle valve during the work stroke, the piston registers its relief ports 61 with the drain ports 62 to relieve the pressure fluid from the piston cavity 63 to the return passage 53. As the pressure of fluid in the piston cavity on the lower end of the valve rod relaxes, reservoir fluid pressure acting upon the ram 71 shifts the shuttle valve 43 downward to close the feed ports 46 and to open the discharge ports 47.

The reservoir pressure now acting over the bottom end of the return plunger 35 returns the hammer and piston to starting position. As the piston regains its returned position, as in FIG. 6, it is again driven through a work stroke, as earlier described.

The piston and hammer automatically recycle until the work steel obtains a low condition wherein its collar 31 abuts the shoulder 29 of the retainer cap. The work steel may obtain this low or dropped condition wherein the return plunger is disabled from returning the hammer and piston, not only when the work steel drops into the void or soft ground area, but also which the tool is lifted by the operator out of its pressed relation to the work. As the work steel drops in this action below the level of the damping plungers 76, the hammer is progressively dampened by the plungers 76, as earlier explained. Should the hammer move downward to a point where the damping valve 85, which follows its movement under reservoir pressure, uncovers the dumping port 87, pressure oil in the reservoir and its pressure will be relieved through the dumping port and return passage 53, as earlier explained, to disable the return plunger 35 from returning the hammer and piston.

The hammer will automatically resume its cycling when the operator actuates the boom to carry the tool to a new position in pressed relation of the work steel to the work.

During the time that the hammer is reciprocating, the dumping valve 85 is held in constant abutment with the hammer under pressure of the reservoir fluid and moves in unison with the hammer.

A stop 91 projecting from the side of the internal housing 22 overhangs the upper end of the dumping valve 85 in the normal returned position of the latter, as in FIG. 6. The stop serves to prevent the dumping valve from sliding free of its bushing 86 and dropping into the reservoir should the tool, for some reason, be turned front end up, as may occur during portage of the tool apart from the boom.

Appropriate seals against leakage are provided wherever needed.

What is claimed is:

1. In a reciprocating hydraulic hammer including a housing to which a fronthead is attached adapted to receive a slideable work steel, and including a piston hammer reciprocable in the housing to pound the work steel, an outer jacket within which the housing has a fixed position defines a reservoir in surrounding relation to the housing, an inlet to the reservoir adapted for connection to a pressure oil supply system for filling and maintaining the reservoir constantly pressurized with oil, the piston hammer having a driving end, a first chamber in the housing about the driving end of the piston hammer, valve means in the housing having response to a return stroke of the piston hammer to communicate the reservoir with the chamber, a pressure oil discharge line in the housing adapted for connection with an external sump of the supply system, the valve means having response to movement of the piston hammer on a work stroke to communicate the chamber with the discharge line and to block communication of the chamber with the reservoir, a slideable return plunger constantly subject to pressure of oil in the reservoir so as to constantly abut a bottom face of the piston hammer, the piston hammer having a lower section defining a hammer member providing said bottom face, the housing having a lower section defining an air chamber in which the hammer member reciprocates, and the return plunger having response to pressure of oil in the reservoir following blocking of communication of the said first chamber with the reservoir to move the piston hammer on a return stroke.

2. In a reciprocating hydraulic hammer as in claim 1, wherein the jacket is a cylinder defining the reservoir, and the fronthead has an annular shoulder serving as a supporting base for both the cylinder and the housing.

3. In a reciprocating hydraulic hammer as in claim 1, wherein the fronthead has an axial bore communicating with the air chamber through which bore the work steel is receivable into the air chamber.

4. In a reciprocating hydraulic hammer as in claim 3 wherein the return plunger is slideable in a bore in the fronthead in parallel relation to the axis of the hammer member, which bore opens into the air chamber below the hammer member and is connected below the return plunger with the reservoir.

5. In a reciprocating hydraulic hammer as in claim 3 wherein a damping plunger is slideable in a bore in the fronthead in parallel relation to the axis of the hammer member, which bore connects by a restricted passage with the reservoir, the damping plunger being adapted under pressure of reservoir oil to normally project a predetermined distance from its bore into the air chamber below the hammer member.

6. In a reciprocating hydraulic hammer as in claim 3, wherein the housing has in a backhead section fixed atop the lower section and the piston hammer has a piston section of a reduced diameter relative to the hammer member, which piston section is slideable in the backhead section, the said driving end of the piston hammer being defined by an end of the piston section.
7. In a reciprocating hydraulic hammer as in claim 6, wherein the backhead section has a dump port connected with the discharge line and has a bore intersecting the dump port opening at one end into the reservoir and opening at its opposite end into the air chamber, a plunger valve slideable in the bore in parallel relation to the axis of the hammer member having one end subject to pressure of fluid in the reservoir and having its other end constantly abutting and end face of the hammer member under said pressure, the plunger valve normally blocking communication of the dump port with the reservoir and as a consequence blocking communication of the reservoir with the discharge line, the plunger valve being adapted under said pressure of fluid in the reservoir to follow the hammer member on a work stroke and adapted upon moving over a predetermined distance to uncover the dump port relative to the reservoir.

8. A reciprocating hydraulic hammer including a fronthead having an annular shoulder at a rear end thereof, an outer housing fixed at one end to the shoulder, an inner housing contained within the outer housing and also fixed at one end to the shoulder, the outer housing defining a reservoir surrounding the inner housing and filled with pressurized hydraulic fluid, an inlet through the outer housing connected with an external hydraulic fluid supply system for maintaining the reservoir continuously filled and pressurized with hydraulic fluid, a hammer reciprocable in the inner housing to pound a work steel received in the fronthead, a plunger biased by pressure of the fluid in the reservoir against a bottom end of the hammer urging the hammer on a work stroke, the plunger being reciprocable in an individual cylinder sealed from the inner housing, the hammer having an opposite piston portion of greater diameter than the plunger subject to pressure of hydraulic fluid from the reservoir to drive the hammer on a work stroke, and valve means having response to movement of the piston portion on a work stroke of the hammer to block communication of the reservoir with the said piston portion.

9. A reciprocating hydraulic hammer as in claim 8, wherein said valve means has response to movement of the piston portion on a return stroke to communicate the reservoir with the said piston portion.

10. A reciprocating hydraulic hammer as in claim 8, including a pressure fluid discharge passage in the inner housing connected with an external sump of the supply system, a bore in the housing connecting the reservoir with the discharge passage, and a dump valve slideable in parallel relation to the axis of the hammer in the bore normally blocking communication of the reservoir with the discharge passage.

11. A reciprocating hydraulic hammer as in claim 10, wherein the dump valve has one end subject to pressure of fluid in the reservoir and has its opposite end abutting an upper face of the hammer under pressure of said fluid so as to follow movement of the hammer on a work stroke, the dump valve being adapted upon following movement of the hammer beyond a predetermined distance to communicate the reservoir with the discharge port.

12. A reciprocating hydraulic hammer as in claim 8, wherein plunger means having one end subject to pressure of fluid in the reservoir and having an opposite end projecting a limited distance under said pressure into the path of movement of the hammer on a work stroke is adapted to yieldably resist movement of the hammer on a work stroke beyond a predetermined distance.

13. In a reciprocating hydraulic hammer comprising an outer housing, an inner housing within the outer housing having a hammer chamber, a fronthead having an annular rear shoulder upon which both the outer and inner housing are mounted, the fronthead having an axial bore communicating with the hammer chamber, and a work steel slidably received in the fronthead having a retracted condition projecting at its rear into the hammer chamber into the path of movement of the hammer when in pressed relation to a work surface, the outer housing defining a reservoir in surrounding relation to the inner housing, the reservoir being continuously filled and pressurized with hydraulic fluid, the hammer having a piston end subject to pressure of fluid from the reservoir to drive the hammer on a work stroke against the work steel; a return plunger having a diameter relatively smaller than that of the piston, the plunger constantly abutting an underside of the hammer under pressure of fluid in the reservoir, and valve means for blocking the piston end of the hammer from the pressure of the fluid in the reservoir, the plunger being adapted under the pressure of fluid in the reservoir when the piston end of the hammer is in said blocked condition to move the hammer on a return stroke.