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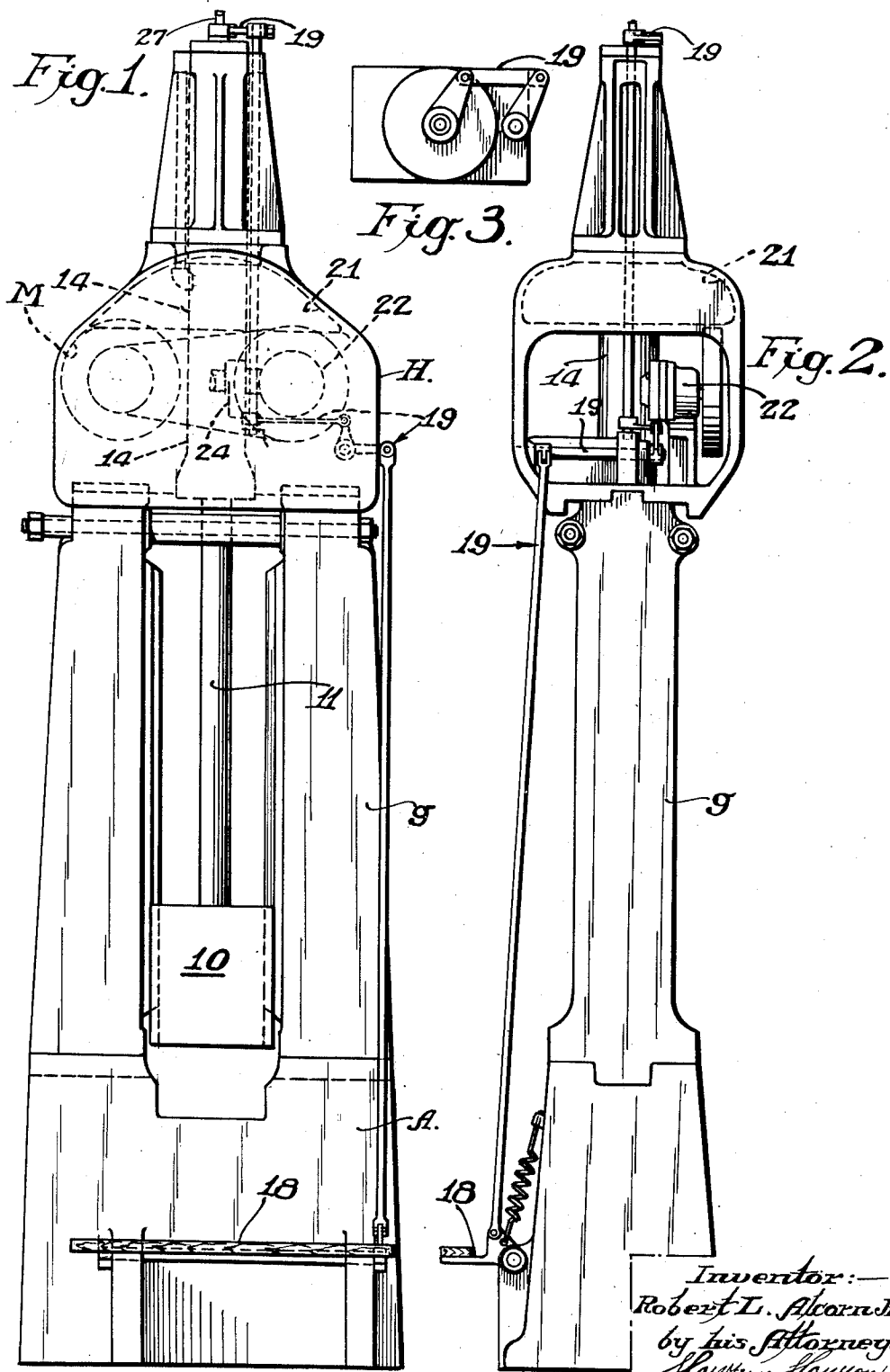
R. L. ALCORN, JR

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HYDRAULICALLY OPERATED DROP HAMMER

Filed June 27, 1941

3 Sheets-Sheet 1



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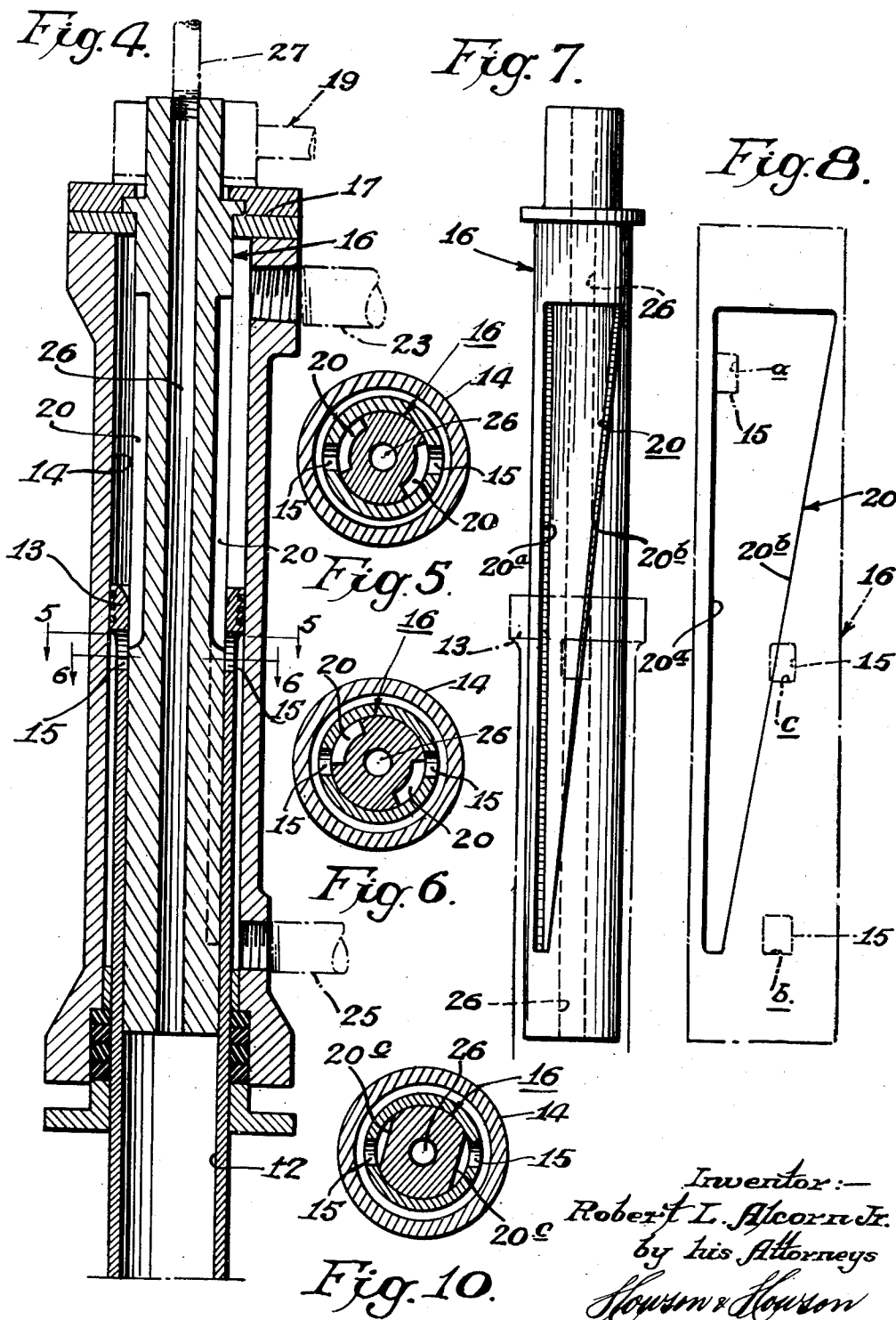
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3 Sheets-Sheet 2



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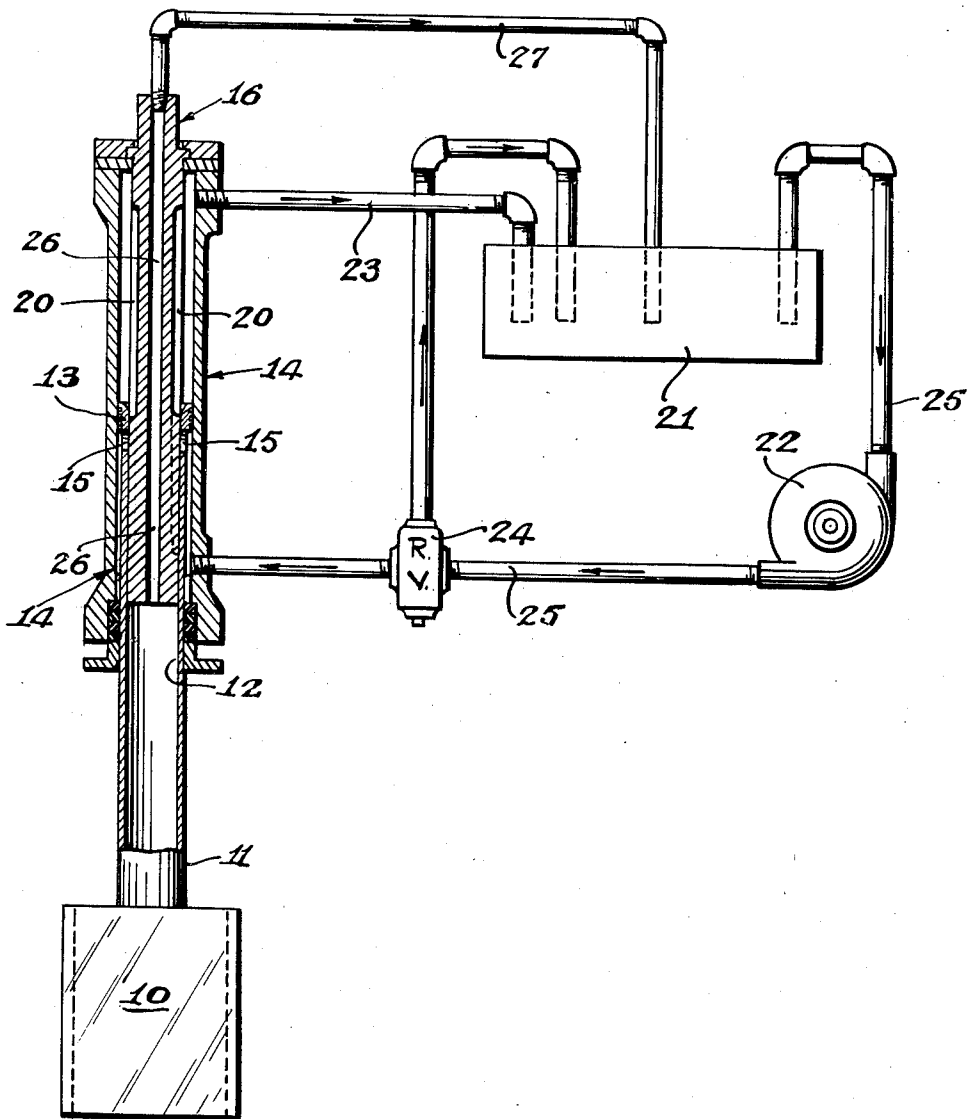
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HYDRAULICALLY OPERATED DROP HAMMER

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Fig. 9



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UNITED STATES PATENT OFFICE

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HYDRAULICALLY OPERATED DROP
HAMMER

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10 Claims. (Cl. 78—42)

This invention relates to hydraulically operated drop hammers and, more specifically, to a hydraulic operating system therefor.

An important object of the invention is to provide a construction which will permit the hammer to have a substantially free fall, but which, due to its construction, eliminates the shocks ordinarily occurring in such hydraulic systems at the moment of impact.

Another object of the invention is the provision of a control mechanism for hammers of this type which will allow the use of a continuously circulated hydraulic power application while at the same time providing a means whereby the ram may be idled at any desired point at the will of the operator.

A further object of the invention is to provide a control mechanism of this character which is extremely simple in its construction and operation.

Another object of the invention is to provide a control of this type which is of general application.

These and other objects I attain by the construction shown in the accompanying drawings wherein, for the purpose of illustration, I have shown a preferred embodiment of my invention and wherein:

Fig. 1 is a front elevation of a hydraulically controlled drop hammer embodying my invention;

Fig. 2 is a side elevation thereof;

Fig. 3 is a plan view thereof;

Fig. 4 is a vertical sectional view through the operating cylinder and control mechanism;

Fig. 5 is a section on line 5—5 of Fig. 4;

Fig. 6 is a section on line 6—6 of Fig. 4;

Fig. 7 is a side elevation of the controlling valve element;

Fig. 8 is a diagrammatic view illustrating the coaction between the movable valve element and the cylinder ports;

Fig. 9 is a diagrammatic view showing the hydraulic system employed; and

Fig. 10 is a section similar to that of Fig. 5 illustrating a modified port construction in the valve.

Referring now more particularly to the drawings, A designates the anvil of a hydraulic hammer and G the guide frames thereof. The numeral 10 designates the ram of a hydraulic drop hammer, and 11 the rod thereof, ram 10 being guided by guide frames G. The upper end of this rod is tubular, as indicated at 12, Fig. 4, and is formed as a piston 13 operating in a cylinder 14 supported by head frame H mounted on side guides G. The rod, immediately below the piston

head, is formed with ports 15 at present shown as two in number, and as being diametrically opposed. Axially arranged in the cylinder 14 is a valve element 16, this valve element being mounted in the upper head 17 of the cylinder for oscillatory movement, which movement may be controlled through a pedal 18 and linkage generally designated at 19, such linkage permitting oscillation of the valve through a predetermined angle. The valve has formed in its periphery a fluid passage groove 20 for each of the ports 15 of the rod 11. As shown, these ports are of uniform depth and taper longitudinally of the valve element, each having a side wall 20a longitudinally paralleling the axis of the valve and a side wall 20b converging on the wall 20a. In the present instance, since the apparatus illustrated is a drop hammer and the biasing force exerted on the rod 11 is downward, the ports taper downward and have a length equal to that of the desired stroke. Obviously, the form of port utilized in the valve may be varied considerably. For example, in lieu of the groove described a port may be formed in the valve by producing flats as at 20c, Figure 10. It will be understood that in referring to grooves in the valve any suitable port structure is intended.

The hydraulic system employed with a construction of this character comprises a suitable sump 21 built into head frame H, a pump 22 drawing fluid from the sump and delivering it to the lower end of cylinder 14, a return line 23 leading from the upper end of the cylinder to the sump, and a relief valve 24 discharging excess pressure from the line 25 leading from pump 22 to the cylinder 14. All of these elements as well as the motor M driving the pump 22 may be supported by the head frame, as shown. In order that leakage between the control valve element 16 and the rod 14 may be conveniently returned to the sump, the valve element is made tubular and the bore 26 thereof is provided with a discharge line 27 leading to the sump.

Referring now more particularly to the diagram of Figure 8, if it is assumed that the ram is in elevated position so that the ports thereof occupy a position with relation to the fluid grooves 20 corresponding to that of the position a in elevation and the valve element 16 is oscillated to place the ports in relation to the grooves 20 as indicated by the position a of Figure 8, there is substantially unobstructed passage for fluid delivered by the pump through the ports 15, grooves 20 and return line 23 to the sump. As the position a approximates the vertical wall of the groove

20 the ram will have a substantially unobstructed fall for the full length of its stroke and even after arriving at the end of its stroke there will be no noticeable obstruction of the ports, with the result that there will be no hydraulic hammer or shock as a result of the cessation of movement of the ram. The ports will, at this time, be disposed at the lower ends of grooves 26. If the valve element 16 is now rotated to bring the ports to the position b with relation to the grooves 26, pressure will be applied beneath the piston 13 and will raise the ram until the ports arrive at a position substantially as shown at c, at which time there will be a balance of pressures maintaining the ram at this position. It will be obvious that the use of a port of this type which tapers longitudinally in transverse width from end to end will afford a multitude of zones for coaction with the piston port, these zones being of differing lengths and accordingly providing differing strokes of the ram. It will, of course, be understood that while the apparatus herein illustrated is particularly adapted for use in conjunction with drop hammers, it may be considered that the ram 10 simply comprises a bias element constantly urging the rod 11 in one direction. The control mechanism is, therefore, obviously, capable of a variety of uses and is not necessarily limited to its use in a power hammer mechanism even though it is particularly adapted for use therein.

Since the construction herein illustrated is capable of considerable modification without in any manner departing from the spirit of the invention, I do not wish to be understood as limiting myself thereto except as hereinafter claimed.

I claim:

1. In apparatus of the type described, a cylinder, intake and outlet ports at opposite ends thereof, a piston therein, a hollow rod for the piston having a port communicating with said inlet port, means urging the piston in one direction, a member oscillatable in the rod having a fluid discharge groove extending longitudinally thereof and communicating with said outlet port and positionable to communicate with the port of said rod, said groove tapering in transverse width from end to end, whereby to provide zones of differing lengths for coaction with said piston port means to oscillate said member to selectively place said zones in alinement with the piston port, and means to continuously deliver pressure fluid to said inlet.

2. In apparatus of the type described, a cylinder, intake and outlet ports at opposite ends thereof, a piston therein, a hollow rod for the piston having a port communicating with said inlet port, means urging the piston in one direction, a member oscillatable in the rod having a fluid discharge groove extending longitudinally thereof and communicating with said outlet port and positionable to communicate with the port of said rod, said groove tapering in width from end to end and having one longitudinal wall thereof substantially parallel to the axis of the member, whereby to provide zones of differing lengths for coaction with said piston port means to oscillate said member to selectively place said zones in alinement with the piston port, and means to continuously deliver pressure fluid to said inlet.

3. In apparatus of the type described, a cylinder, intake and outlet ports at opposite ends thereof, a piston therein, a hollow rod for the piston having a port communicating with said inlet port, means urging the piston in one direction, a member oscillatable in the rod having a fluid discharge groove extending longitudinally there-

of and communicating with said outlet port and positionable to communicate with the port of said rod, said groove tapering in transverse width from end to end, whereby to provide zones of differing lengths for coaction with said piston port means to oscillate said member to selectively place said zones in alinement with the piston port, means to continuously deliver pressure fluid to said inlet comprising a sump, a continuously operating pump withdrawing liquid from the sump and delivering the same to said inlet, a discharge line leading from the outlet port to the sump, and a discharge line leading from the interior of the rod to the sump.

4. In apparatus of the type described, a cylinder, intake and outlet ports at opposite ends thereof, a piston therein, a hollow rod for the piston having a port communicating with said inlet port, means urging the piston in one direction, a member oscillatable in the rod having a fluid discharge groove extending longitudinally thereof and communicating with said outlet port and positionable to communicate with the port of said rod, said groove tapering in transverse width from end to end, whereby to provide zones of differing lengths for coaction with said piston port means to oscillate said member to selectively place said zones in alinement with the piston port, means to continuously deliver pressure fluid to said inlet comprising a sump, a continuously operating pump withdrawing liquid from the sump and delivering the same to said inlet, a discharge line leading from the outlet port to the sump, and a discharge line leading from the interior of the rod to the sump and comprising an axial port in said oscillatable member.

5. In apparatus of the type described, a cylinder, intake and outlet ports at opposite ends thereof, a piston therein, a hollow rod for the piston having a port communicating with said inlet port, means urging the piston in one direction, a member oscillatable in the rod having a fluid discharge groove extending longitudinally thereof and communicating with said outlet port and positionable to communicate with the port of said rod, said groove tapering in width from end to end and having one longitudinal wall thereof substantially parallel to the axis of the member, whereby to provide zones of differing lengths for coaction with said piston port means to oscillate said member to selectively place said zones in alinement with the piston port, means to continuously deliver pressure fluid to said inlet comprising a sump, a continuously operating pump withdrawing liquid from the sump and delivering the same to said inlet, a discharge line leading from the outlet port to the sump, and a discharge line leading from the interior of the rod to the sump.

6. In apparatus of the type described, a cylinder, intake and outlet ports at opposite ends thereof, a piston therein, a hollow rod for the piston having a port communicating with said inlet port, means urging the piston in one direction, a member oscillatable in the rod having a fluid discharge groove extending longitudinally thereof and communicating with said outlet port and positionable to communicate with the port of said rod, said groove tapering in width from end to end and having one longitudinal wall thereof substantially parallel to the axis of the member, whereby to provide zones of differing lengths for coaction with said piston port means to oscillate said member to selectively place said zones in alinement with the piston port, means to continuously deliver pressure fluid to said inlet com-

prising a sump, a continuously operating pump withdrawing liquid from the sump and delivering the same to said inlet, a discharge line leading from the outlet port to the sump, and a discharge line leading from the interior of the rod to the sump and comprising an axial port in said oscillatable member.

7. In a hydraulic drop hammer, guide frames, a ram vertically movable in the guide frames, a head connecting the upper ends of the guide frames, a cylinder supported by the head frame, a rod for the ram, the upper end of the rod being hollow and being provided with a piston operating in said cylinder, said rod having a port below the piston, the cylinder having an inlet port at its lower end and an outlet port at its upper end, the inlet port being in continual communication with the port of the rod, a member oscillatably mounted in the upper end of the cylinder and fitting in the rod, said member having a fluid discharge groove extending longitudinally thereof and communicating with said outlet port and positionable to communicate with the port of said rod, said groove tapering in width from end to end, whereby to provide zones of differing lengths for coaction with said piston port means to oscillate said member to selectively place said zones in alinement with the piston port, and means to continuously deliver pressure fluid to said inlet.

8. In a hydraulic drop hammer, guide frames, a ram vertically movable in the guide frames, a head connecting the upper ends of the guide frames, a cylinder supported by the head frame, a rod for the ram, the upper end of the rod being hollow and being provided with a piston operating in said cylinder, said rod having a port below the piston, the cylinder having an inlet port at its lower end and an outlet port at its upper end, the inlet port being in continual communication with the port of the rod, a member oscillatably mounted in the upper end of the cylinder and fitting in the rod, said member having a fluid discharge groove extending longitudinally thereof and communicating with said outlet port and positionable to communicate with the port of said rod, said groove tapering in width from end to end and having one longitudinal wall thereof substantially parallel to the axis of the member, whereby to provide zones of differing lengths for coaction with said piston port means to oscillate said member to selectively place said zones in alinement with the piston port, and means to continuously deliver pressure fluid to said inlet.

9. In a hydraulic drop hammer, guide frames,

a ram vertically movable in the guide frames, a head connecting the upper ends of the guide frames and formed with a liquid sump, a cylinder supported by the head frame, a rod for the ram, the upper end of the rod being hollow and being provided with a piston operating in said cylinder, said rod having a port below the piston, the cylinder having an inlet port at its lower end and an outlet port at its upper end, the inlet port being in continual communication with the port of the rod, a member oscillatably mounted in the upper end of the cylinder and fitting in the rod, said member having a fluid discharge groove extending longitudinally thereof and communicating with said outlet port and positionable to communicate with the port of said rod, said groove tapering in width from end to end, whereby to provide zones of differing lengths for coaction with said piston port means to oscillate said member to selectively place said zones in alinement with the piston port, and means to continuously deliver pressure fluid to said inlet comprising a pump mounted on said head frame and adapted to continuously deliver pressure fluid from said sump to the inlet port of the cylinder.

10. In a hydraulic drop hammer, guide frames, a ram vertically movable in the guide frames, a head connecting the upper ends of the guide frames and formed with a liquid sump, a cylinder supported by the head frame, a rod for the ram, the upper end of the rod being hollow and being provided with a piston operating in said cylinder, said rod having a port below the piston, the cylinder having an inlet port at its lower end and an outlet port at its upper end, the inlet port being in continual communication with the port of the rod, a member oscillatably mounted in the upper end of the cylinder and fitting in the rod, said member having a fluid discharge groove extending longitudinally thereof and communicating with said outlet port and positionable to communicate with the port of said rod, said groove tapering in width from end to end and having one longitudinal wall thereof substantially parallel to the axis of the member, whereby to provide zones of differing lengths for coaction with said piston port means to oscillate said member to selectively place said zones in alinement with the piston port, and means to continuously deliver pressure fluid to said inlet comprising a pump mounted on said head frame and adapted to continuously deliver pressure fluid from said sump to the inlet port of the cylinder.

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