Jan. 5, 1960 I. SUBLETT ET AL 2,919,678

HYDRAULIC DRIVING APPARATUS

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Fig. 2.

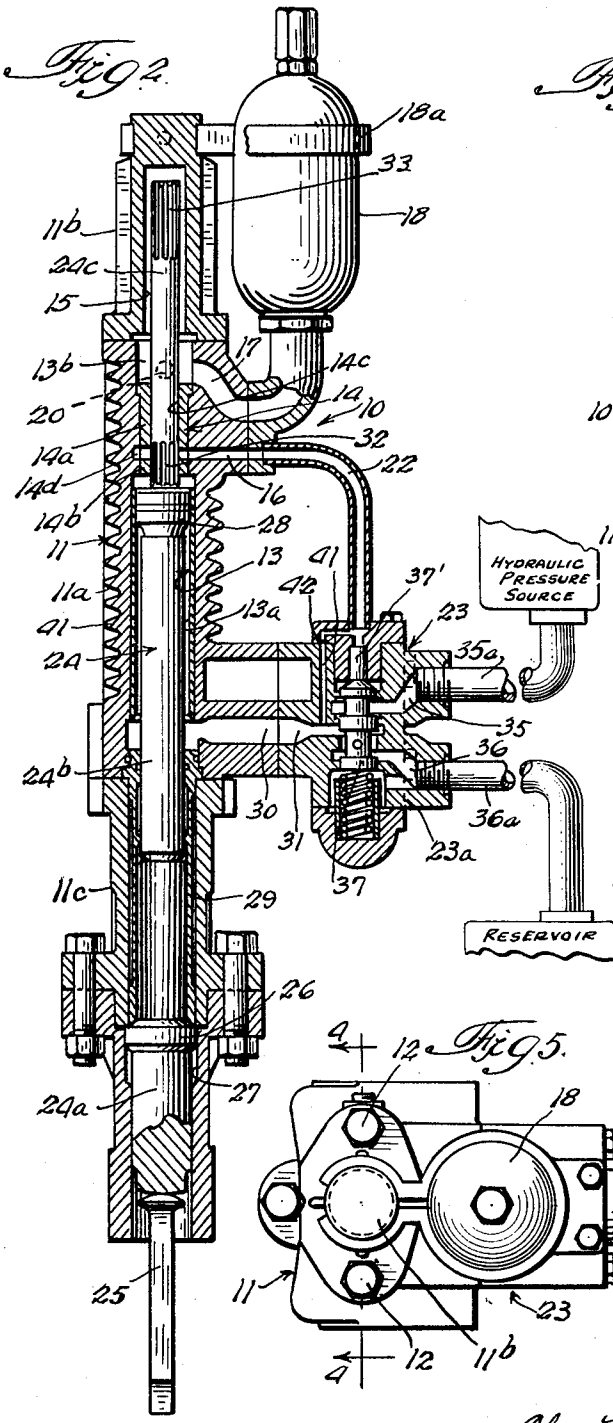


Fig. 1.

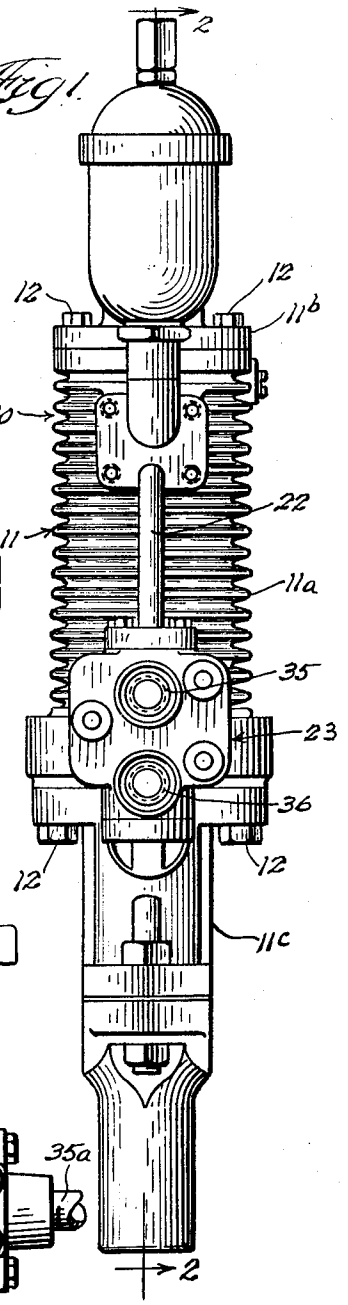


Fig. 5.

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HYDRAULIC DRIVING APPARATUS

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Fig 3.

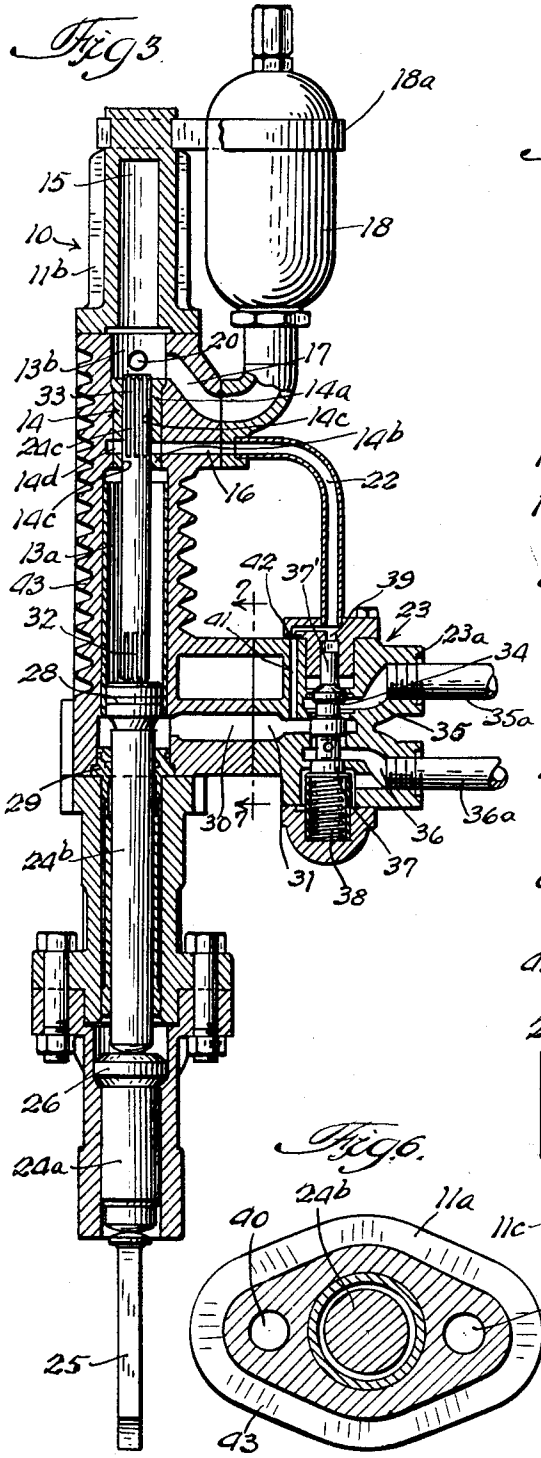


Fig 4.

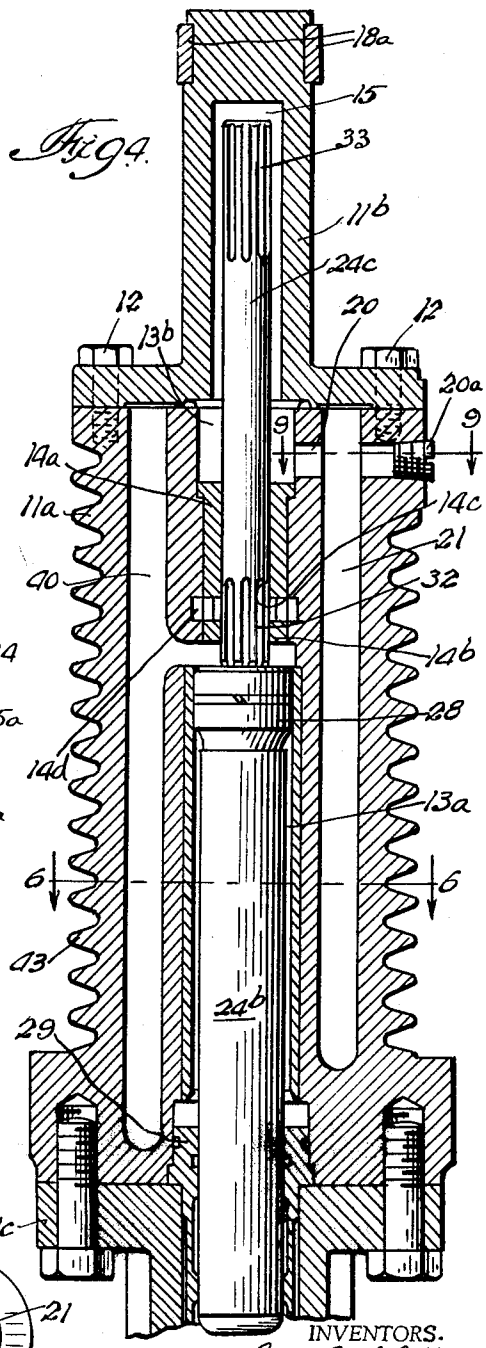


Fig 6.

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HYDRAULIC DRIVING APPARATUS

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Fig. 7.

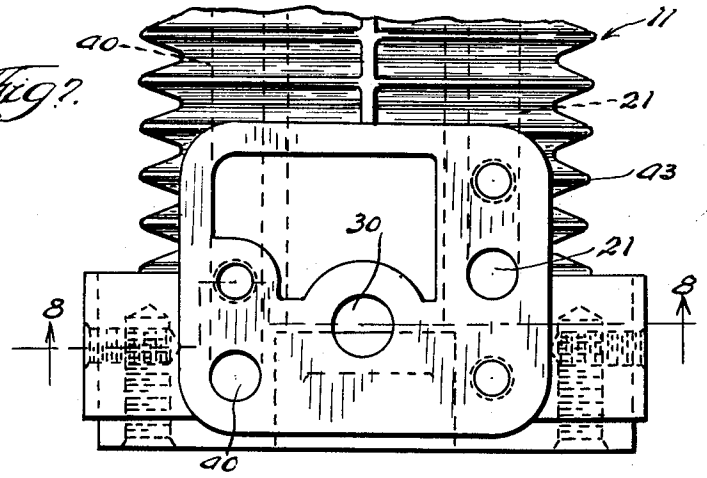


Fig. 8.

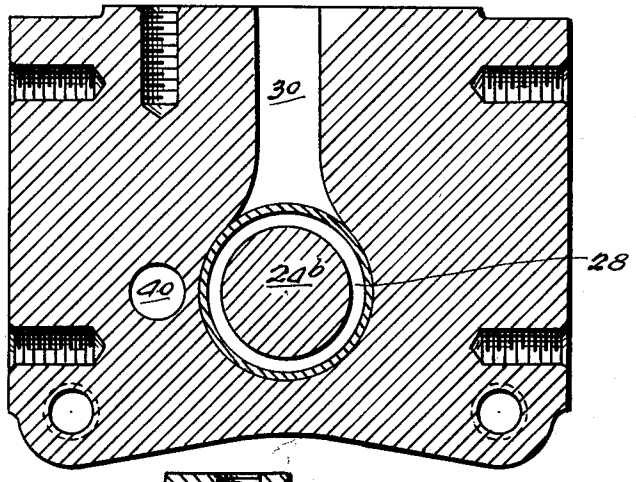
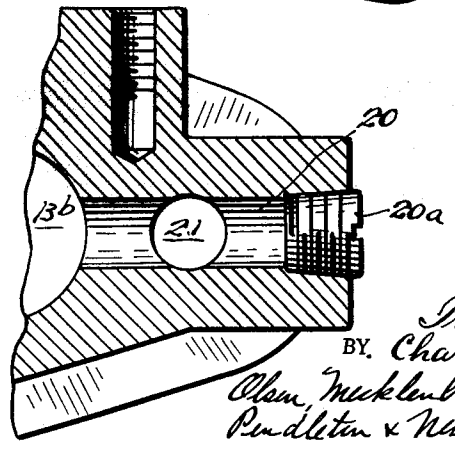


Fig. 9.



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2,919,678

HYDRAULIC DRIVING APPARATUS

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Application August 13, 1957, Serial No. 677,902

12 Claims. (Cl. 121—25)

This invention relates to a hydraulic driving apparatus and, more particularly, to an improvement of the apparatus disclosed in United States Patent No. 2,731,796.

In apparatus of this type it has been found that a real problem of maintenance exists in instances where the apparatus, in the course of its operation, is subjected to an excessive amount of shock and wear, such as in the case when it is used as a spike driver or paving breaker.

Thus, it is one of the objects of this invention to provide an improved apparatus wherein the problem of maintenance, involving replacement and adjustment of parts thereof, is materially reduced.

It is a further object of this invention to provide an improved apparatus which is simple and compact in construction, efficient in operation, and is capable of being utilized in a variety of different ways.

Further and additional objects will appear from the description, accompanying drawings, and appended claims.

In accordance with one embodiment of this invention, an improved driving apparatus is provided comprising a source of hydraulic pressure, a reservoir for hydraulic fluid, and a housing provided with an elongated chamber. The chamber is divided into first and second compartments by an apertured partition. The first chamber is in continuous communication with the source of hydraulic pressure. Slidably mounted within the aperture of the partition is an elongated reciprocating element which is adapted to effect isolating of one compartment from the other. Cooperating with said housing chamber and operatively connected to the source, the second compartment, and the reservoir, is an adjustable unit for controlling the direction of movement of said element within said chamber. The control unit, when in one position of adjustment, interconnects the source and the second compartment whereby the reciprocating element is actuated in a direction toward one end of the chamber and, when in a second position of adjustment, interconnects the reservoir and the second compartment whereby the reciprocating element is actuated in a direction toward the opposite end of the chamber.

For a more complete understanding of this invention, reference should be made to the drawings, wherein:

Figure 1 is a right side elevational view of the apparatus shown in Fig. 2.

Fig. 2 is a vertical sectional view taken along line 2—2 of Fig. 1 and with the reciprocating element shown in its uppermost position with respect to the housing.

Fig. 3 is similar to Fig. 2, but showing the reciprocating element in its lowermost position with respect to the housing.

Fig. 4 is an enlarged fragmentary sectional view taken along line 4—4 of Fig. 5.

Fig. 5 is a top plan view of Fig. 2.

Fig. 6 is a sectional view taken along line 6—6 of Fig. 4.

Fig. 7 is an enlarged fragmentary sectional view taken along line 7—7 of Fig. 3.

Fig. 8 is a sectional view taken along line 8—8 of Fig. 7.

Fig. 9 is an enlarged fragmentary sectional view taken along line 9—9 of Fig. 4.

Referring now to the drawings, a hydraulic driving apparatus is shown which is an improvement over the apparatus described in Patent No. 2,731,796. The apparatus is adapted for a wide variety of uses, such as a spike driver, spike puller, paving breaker, or the like, wherein a reciprocatory movement may be employed to impart a driving force.

The apparatus **10** is shown as applied to a spike driver; however, it is to be understood, of course, that this is done merely by way of example and the invention is not intended to be limited to this particular application.

The apparatus **10** comprises an elongated housing **11** which, in this instance, is formed into at least three sections: a central section **11***a*; a top section **11***b*, which is secured by any suitable means, such as bolts **12**, to the upper end of central section **11***a*; and a lower section **11***c*, which is also secured by means of bolts **12** to the lower end of section **11***a*. Housing section **11***a* is provided with an elongated chamber **13**, in which is disposed a stationary apertured unit **14** which is adapted to effect division of chamber **13** into two aligned compartments **13***a* and **13***b*. Upper housing section **11***b* is also provided with an elongated chamber **15** which is coaxially disposed and communicates with compartment **13***b* of the central housing section **11***a*. Apertured unit **14**, in this instance, is shown as comprising a pair of axially spaced bearing elements **14***a* and **14***b*, which are disposed in fixed relation within section chamber **13**. Both elements are provided with central openings **14***c* which are in coincident relation with respect to one another. Both openings communicate at one end with the space **14***d* between the elements. Space **14***d* communicates with a port **16** formed in housing section **11***a*, for a purpose to be hereinafter discussed. Housing section **11***a* is provided with a second port **17** communicating with compartment **13***b* which is adjacent to chamber **15** of housing section **11***b*, as shown more clearly in Fig. 2.

Port **17** functions as a connection between compartment **13***b*, section chamber **15**, and hydraulic pressure accumulator **18**, the latter being secured to housing section **11***b* by means of a suitable bracket **18***a*. Also formed in housing section **11***a* and communicating with chambers **13***b* and **15** is a port **20**, which serves to connect compartment **13***b* with an elongated passageway **21**, see Fig. 4, formed in section **11***a* and disposed substantially parallel to chamber **13**. Passageway **21** is in continuous communication with a source of hydraulic pressure, and thus, a positive hydraulic pressure is maintained at all times in compartment **13***b* and is adapted to replenish the hydraulic pressure spent by the accumulator **18** during certain periods of operation of the apparatus, as will be more clearly described hereinafter.

Port **16**, which has previously been mentioned as being formed in the upper portion of housing section **11***a*, see Fig. 2, communicates with a conduit **22**, which serves to connect port **16** with a control unit **23**, the latter to be described more fully hereinafter as controlling the direction of movement of a plunger **14**.

Plunger **14** is mounted within the housing **11** for reciprocatory movement with respect thereto and, in this instance, is formed of a plurality of independent aligned sections **24***a*, **24***b*, and **24***c*. Plunger **24** serves, in this instance, to impart a hammering blow on a spike **25**, for the purpose of driving the latter into a suitable tie or the like (not shown). The bottom section **24***a* of plunger

24 is disposed in the lower housing section 11c and contacts directly the head of the spike 25. The lower end of housing section 11c is open to accommodate the head of the spike. The housing section 11c is also provided with an axially extending annular pocket 27 formed in the interior surface of the section and in which is disposed for slidable movement with respect thereto, a shoulder 26 provided on plunger section 24a. The axial length of pocket 27 determines the extent to which the plunger section 24a is capable of moving relative to the housing section interior.

Plunger section 24b is the central section and is completely disposed within housing section 11a. The upper end of plunger section 24b is provided with an enlarged head 28 which is adapted to slidably contact the compartment wall 13a. The remaining depending portion of plunger section 24b is reduced in diameter, as shown in Figs. 2 and 3. The depending portion of plunger section 24b is embraced by a sealing sleeve 29, which serves a dual function, namely, to prevent leakage of the hydraulic fluid through the bottom of compartment 13a and, also, to function as a bearing guide for the plunger section 24b. Communicating with the lower end of compartment 13a is a passageway 30 formed in housing section 11a which, in turn, is in communication with a passageway 31, the latter being formed in the housing 23a of control unit 23. Unit 23 will be described more fully hereinafter.

Plunger section 24c is the upper section and is in continuous abutting engagement with the head 28 of plunger section 24b. Section 24c is of a smaller diameter than head 28, as seen in Figs. 2 and 3. Plunger section 24c is slidably disposed within the coincident openings 14c of bearing elements 14a and 14b and is adapted to effect isolation between chambers 13a and 13b. Plunger section 24c has the lower end 32 thereof provided with a plurality of symmetrically arranged axially extending splines of equal length. The upper or opposite end 33 of section 24c is also provided with a plurality of symmetrically arranged, axially extending splines which are of equal length but of a length considerably greater than the length of the first mentioned splines.

Upon plunger 24c reaching the uppermost terminus of its reciprocating motion, as shown in Fig. 2, the grooves formed in splined end 32 cooperate with the perimeter of openings 14c of element 14b and effects communication between space 14d formed between bearing elements 14a and 14b and compartment 13a formed in housing section 11a. When, however, the plunger section 24c is at the lowermost terminus of reciprocating movement, as shown more clearly in Fig. 3, the grooves formed in splined end 33 cooperate with the perimeter of opening 14c in element 14a and effects communication between compartment 13b and space 14d. The effect of these alternate communications with space 14d is to automatically produce change in direction of movement of the plunger 14.

Control unit 23, as shown in Fig. 2, is provided with housing 23a having formed therein a central elongated cavity 34, a first port 35 communicating with cavity 34 and connected by suitable conduit 35a to a source of hydraulic pressure, and a second port 36 communicating with cavity 34 and spaced, in this instance, beneath port 35 and connected by suitable conduit 36a to a reservoir for hydraulic fluid. Housing 23a is also provided with a passageway, not shown, which connects first port 35 with the lower end of passageway 21 formed in house section 11a, and thus, as heretofore mentioned, there is continuous communication between passageway 21 and the source of hydraulic pressure.

Mounted for reciprocatory movement within elongated cavity 34 is a spool 37 which is biased by a coil spring 38 to assume a normal upwardly disposed position, as shown more clearly in Fig. 2. The spool 37 is provided with a plurality of relatively spaced shoulders which coact

with the annular protuberances formed in the contour of cavity 34 and effect either communication of port 35 with passageway 31 or communication of port 36 with passageway 31. The upper end of cavity 34 terminates in a restricted passageway 39 which, in turn, is in communication with conduit 22. Thus, the function of port 16 in housing section 11a, conduit 22, and restricted passageway 39 is to permit high pressure hydraulic fluid to react on a small piston 37' which, in turn, engages the upper end of spool 37, when the plunger section 24c is in its lowermost terminus, and effect overcoming of upward biasing force exerted by spring 38 on spool 37 and thereby cause downward movement of spool 37 until there is interconnection between port 35 and passageway 31. Upon this interconnection being established, the high pressure hydraulic fluid reacts on the underside of head 28 formed on plunger section 24b, and cause the latter to move in an upward direction within housing section chamber 13a. The diameter of head 28, as compared to the diameter of the upper end of plunger section 24c, is such that the resultant force exerted by the hydraulic fluid on the head 28 in an upward direction is greater than the resultant force exerted on the upper end of plunger section 24c. The differential between these resultant forces determines the speed with which the plunger will move upwardly.

Upon plunger reaching its uppermost terminus, splined end 32 of plunger section 24c effects communication between port 16 and compartment 13a, whereupon the high pressure hydraulic fluid contained within port 16, conduit 22, and restricted passageway 39 is discharged into the reservoir through an elongated cavity 40, formed in housing section 11a, in spaced parallel relation with chamber 13 and passageway 21, as seen more clearly in Fig. 4. Cavity 40 communicates directly with the reservoir through the conduit 36. As soon as this communication is effected by splined end 32, the force of coil spring 38 is sufficient to move the spool 37 and abutting piston 37' to their uppermost positions, as shown in Fig. 2, at which time the compartment 13a disposed to the underside of head 28 of plunger section 24b is vented to the reservoir through passageways 31, 34, 36, and conduit 36a, thereby permitting the hydraulic pressure exerted on the upper end 33 of plunger section 24c to cause the plunger to be swiftly moved in a downward direction relative to the housing 11 into striking engagement with plunger section 24a.

Formed in housing 23a for control unit 23 is a small bypass 41, see Figs. 2 and 3, which has one end thereof terminating in passageway 39 and the other end thereof terminating in passageway 31. Disposed intermediate the ends of by-pass 41 is a restrictor piece 42. The function of by-pass 41 and piece 42 is to replace any leakage which might occur past piston 37' and spool 37 and thus insure that spool 37 piston 37' remain in their down position within the housing 23a until the splined end 33 of the plunger 24 uncovers port 16 to the reservoir, whereupon spool 37 and piston 37' are moved upwardly under the force of spring 38.

In order to effectively dissipate heat which might be created during reciprocatory movement of the plunger 24 in housing 11, a plurality of cooling fins 43 are formed on the outer periphery of housing section 11a. It is to be understood, of course, that if desired, the housing section 11a may be water-jacketed for cooling instead.

The advantages of having separate plunger sections 24b and 24c, rather than an integral construction, is that it facilitates manufacture of the plunger itself and, in addition, enables one section of the plunger to be readily replaced in case of wear or damage. In addition, any inherent structural weaknesses which might be created in an integral plunger have been avoided. Furthermore, the splined ends 32 and 33 of the upper section 24c are of sufficient lengths as to permit the plunger section to be disposed at all times in the coincident openings 14c formed

in bearing elements 14*a* and 14*b*, when the plunger is at its terminal positions and, thus, insures proper alignment betwen the bearing elements and the plunger.

The apparatus may be rendered operative or inoperative by a suitable on-off control, not shown, incorporated in conduit 35*a* leading from the apparatus to the source of hydraulic pressure. The apparatus is of compact, relatively light-weight, construction and may be readily mounted on a suitable support, if desired, or may be provided with suitable handles to enable the operator to readily manipulate the apparatus.

Thus, it will be seen that an improved hydraulic driving apparatus has been provided which is of sturdy, yet simple, construction, fully automatic in operation, and may be readily adapted for a variety of uses.

While a particular embodiment of this invention has been shown, it will be understood, of course, that the invention is not to be limited thereto, since many modifications may be made, and it is contemplated, therefore, by the appended claims, to cover any such modifications as fall within the true spirit and scope of this invention.

We claim:

1. A hydraulic driving apparatus, comprising a housing provided with an elongated chamber, an apertured partition disposed in fixed relation within said chamber and forming a pair of contiguous compartments, an elongated reciprocatory first element mounted for slidable engagement within the partition aperture, an elongated reciprocatory second element disposed within one of said compartments and in aligned, continuous abutting relation with said first element, a movable unit operatively connected to said reciprocating elements for controlling the direction of movement thereof, and means carried by said first element and slidably cooperating with the aperture-forming portion of said partition to effect automatic movement of said unit upon reciprocation of said element.

2. A hydraulic driving apparatus comprising a housing provided with an elongated chamber, an apertured partition disposed in fixed relation within said chamber to form a pair of contiguous compartments, an elongated reciprocatory first element mounted for slidable engagement within the partition aperture, an elongated reciprocatory second element disposed within one of said compartments and in aligned, continuous abutting relation with said first element, a movable unit operatively connected to said reciprocating elements for controlling the direction of movement thereof, and means carried by said first element and slidably contacting the aperture-forming portion of said partition and cooperating therewith to form a passageway effecting intermittent independent intercommunication of said compartments with said movable unit whereby movement of the latter is effected, said passageway being formed only when said first element is in predetermined positions of reciprocatory movement.

3. A hydraulic driving apparatus comprising a housing provided with an elongated chamber, a partition disposed in fixed relation within said chamber to form a pair of compartments, said partition having a first opening interconnecting said compartments and a second opening angularly disposed with respect to said first opening and effecting communication of said first opening with a port formed in said housing, an elongated reciprocating first element occupying said partition first opening and effecting isolating of one compartment from another, an elongated reciprocatory second element disposed within one of said compartments and in aligned, continuous abutting relation with said first element, means for supplying hydraulic pressure to each compartment to effect actuation of said elements in opposite directions, and means carried on said first element and in slidable engagement with the portion of said partition defining said first opening to alternately effect communication of one of said compartments with said second opening.

4. A hydraulic driving apparatus comprising a housing provided with an elongated chamber; a partition disposed within said chamber and forming first and second compartments, said partition having a first opening interconnecting said compartments and a second opening angularly disposed with respect to said first opening and intermediate the ends thereof for effecting communication of said first opening with a port formed in said housing; a hydraulically responsive elongated reciprocating element occupying said partition first opening and effecting isolating of one compartment from the other; a source of hydraulic pressure; a reservoir for hydraulic fluid; a hydraulic pressure accumulator communicting with said source and operatively connected to said first compartment and operable to act on the portion of said element disposed within said compartment and effect, at a predetermined time, movement of said element in one relative direction; a movable control unit operatively connected to said source, said reservoir, said second compartment and said housing port; and means carried by said element and slidably cooperating with said partition first opening to alternately effect communication of each compartment with said second opening; said control unit, when said element means effects communication between said first compartment and said second opening, being in one position of movement and responsive to said accumulator pressure and effecting interconnection of said source and said second compartment whereby the portion of said element, disposed within said second compartment is acted upon by said hydraulic pressure and said element is actuated in a second relative direction; said control unit, when said element means effects communication between said second compartment and said partition second opening, assuming a second position of movement whereby said element is actuated in said one direction by said accumulator pressure and said reservoir and said second compartment are interconnected.

5. The apparatus recited in claim 4, wherein the means carried by said element comprises a pair of longitudinally spaced elongated ways formed in the periphery of said element, one of said ways cooperating with the portion of said partition first opening intermediate said first compartment and said second opening and the other way alternately cooperating with the portion of said partition first opening intermediate said second compartment and said second opening; cooperation of said ways with said partition first opening portions being dependent upon the positions of reciprocating adjustment of said element.

6. A hydraulic driving apparatus comprising a source of hydraulic pressure, a reservoir for hydraulic fluid, a housing provided with an elongated chamber, an apertured partition disposed within said chamber and forming contiguous first and second compartments, said first compartment being in continuous communication with said source, a hydraulically responsive reciprocating element mounted for slidable engagement within the partition aperture and effecting isolation of the first compartment from the second compartment, said element being formed of two separate abutting sections, one section being disposed wholly within said second compartment and the second section being disposed both in said first and second compartments, and a movable unit operatively connected to said source, said reservoir and said second compartment for controlling the direction of movement of said element; said unit, when in one position of movement, being responsive to said source of pressure and effecting interconnection of said source and a portion of said element second section whereby said element sections are actuated as a unit in a direction toward one end of said chamber; said unit, when in a second position of movement, being out of communication with said source and effecting interconnection of said reservoir and said element second section portion whereby said element sections are actuated as a unit in a direction toward the opposite end of said chamber.

7. The apparatus recited in claim 6 wherein said ele-

ment sections are in coaxial and continuing abutting relation, and movement of said unit is automatic.

8. The apparatus recited in claim 6, wherein the resultant force exerted on said element one section to effect actuation of said element sections as a unit in the direction toward said one end of said chamber is of a greater magnitude than the resultant force exerted on said element second section to effect actuation of said element sections as a unit in the direction toward said opposite end of said chamber.

9. The apparatus recited in claim 6, wherein said second element section carries relatively spaced means, one means being operative to form a first fluid communicating passageway between said first compartment and said movable unit, when said element sections are in one position of reciprocation, and the second spaced means being operative to form a second fluid communicating passageway between said movable unit and said second compartment, when said element sections are in a second position of reciprocation.

10. A hydraulic driving apparatus comprising a housing provided with an elongated chamber separated into two compartments by an apertured partition, said partition being provided with a first opening interconnecting said compartments, and a second opening angularly disposed with respect to said first opening and intermediate the ends thereof for effecting communication of said first opening with a port formed in said housing, a first source of hydraulic pressure in continuous communication with one of said compartments, a second source of hydraulic pressure in intermittent communication with said second compartment, said first and second sources being in continuous communication with one another, a reservoir for hydraulic fluid in selective communication with said second compartment, a hydraulically responsive reciprocating element formed of a pair of abutting elongated sections, one section occupying said partition first

opening and having a portion thereof continuously acted upon by the hydraulic pressure from said first source, said one section having longitudinally spaced grooved segments, one of said segments, when said element is in one position of reciprocating adjustment, cooperating with said partition first opening to form a fluid passageway interconnecting said one compartment and said second opening, and the other grooved segment, when said element is in a second position of reciprocating adjustment, cooperating with said partition first opening to form a fluid passageway interconnecting said second compartment and said second opening.

11. The apparatus recited in claim 1, wherein the elongated reciprocatory first element is in continuous slidable engagement with the portion of said partition defining an aperture thereof.

12. A hydraulic driving apparatus, comprising a housing provided with an elongated chamber, an apertured partition disposed within said chamber and forming a pair of contiguous compartments, an elongated reciprocatory element mounted for slidable engagement within the partition aperture, a movable unit operatively connected to said reciprocatory element for controlling the direction of movement of said element, and means carried by said element comprising longitudinally spaced ways formed in the periphery of said element slidably cooperating with the aperture-forming portion of said partition to effect automatic movement of said unit upon reciprocation of said element.

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