June 5, 1956 S. W. ALSPAUGH 2,748,862

HYDRAULICALLY OPERATED APPARATUS FOR OPERATING ON THE WALLS OF A PAN SHAPED OBJECT

Filed Jan. 26, 1952 5 Sheets-Sheet 1

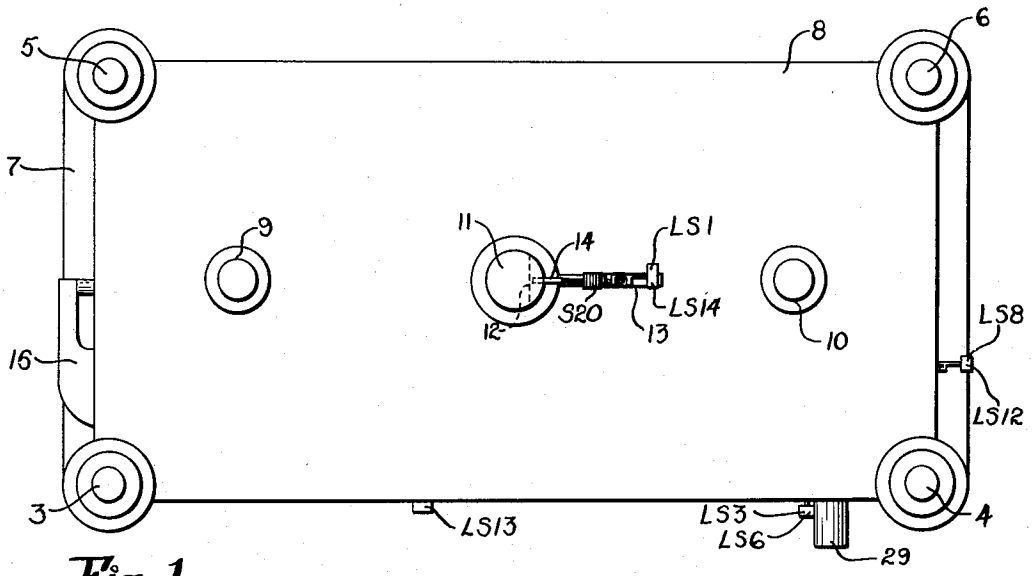


Fig. 1

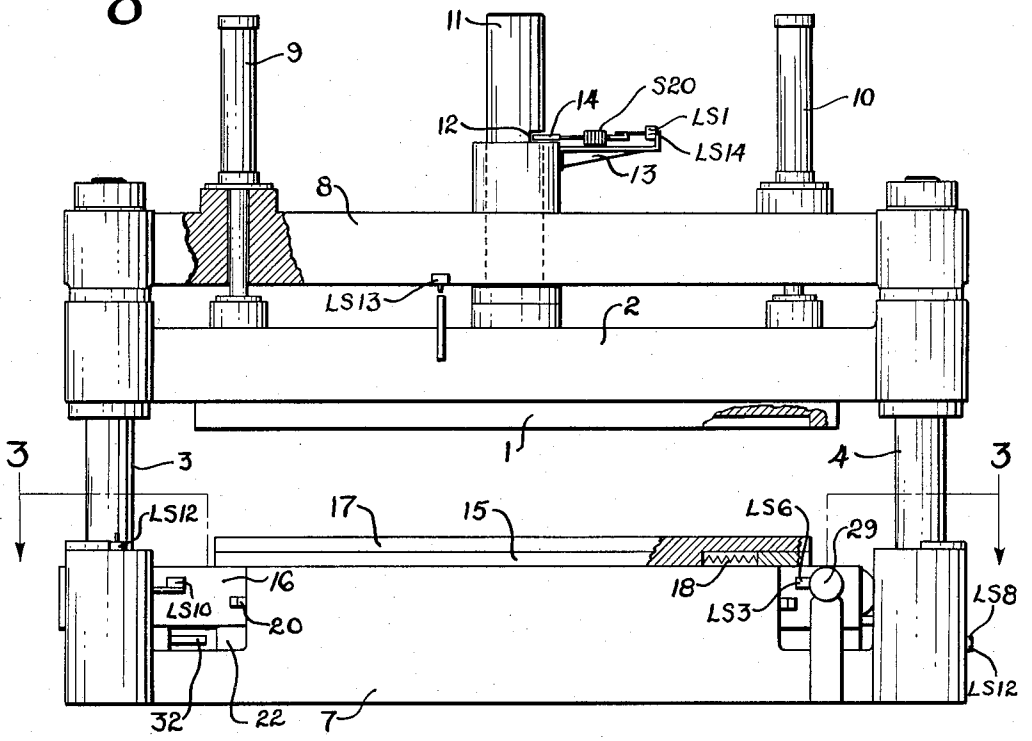


Fig. 2

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June 5, 1956 S. W. ALSPAUGH 2,748,862

HYDRAULICALLY OPERATED APPARATUS FOR OPERATING ON THE WALLS OF A PAN SHAPED OBJECT

Filed Jan. 26, 1952 5 Sheets-Sheet 2

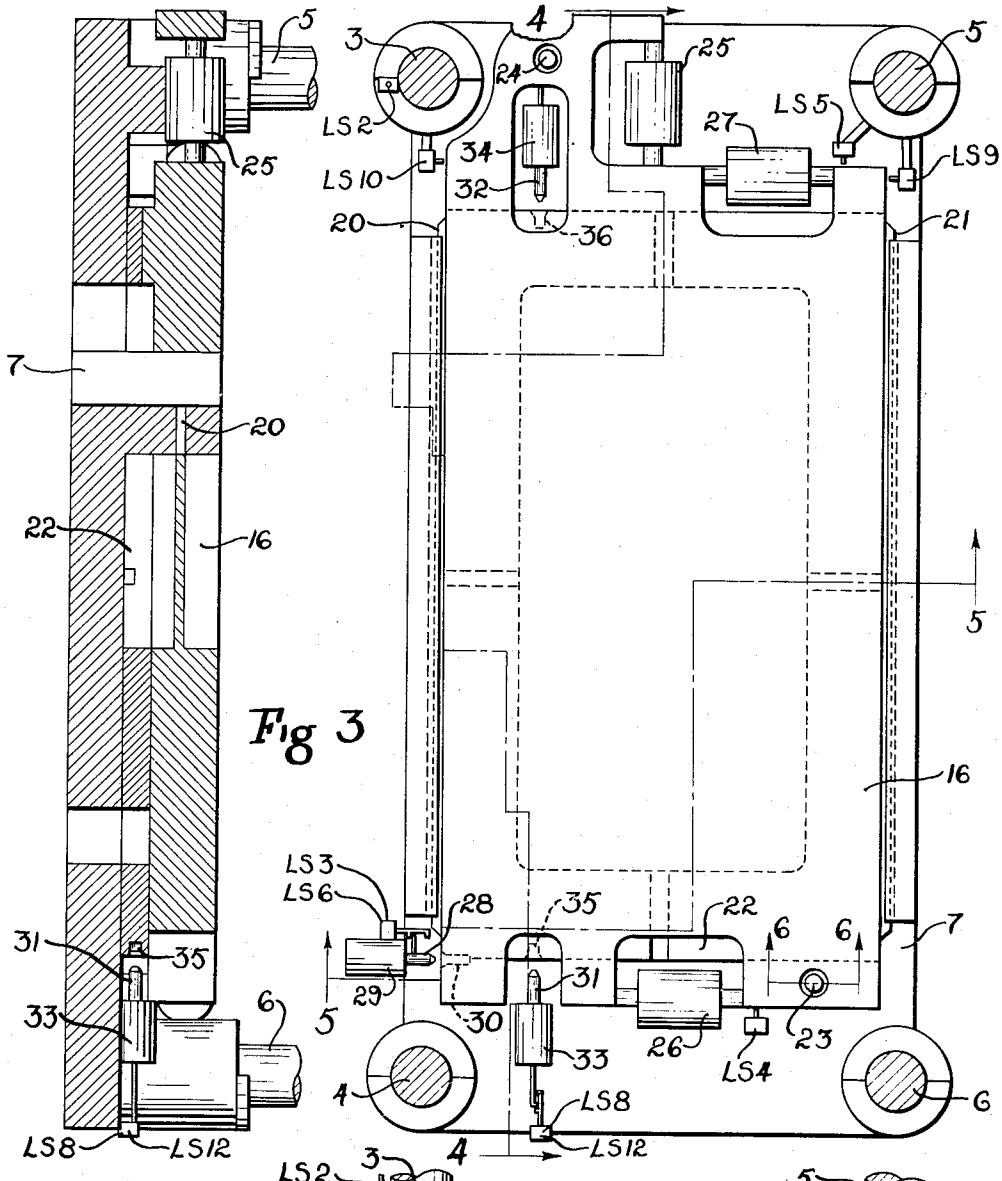


Fig 3

Fig. 4

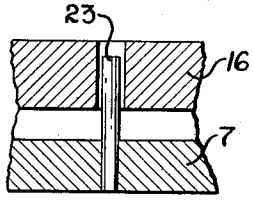


Fig. 6

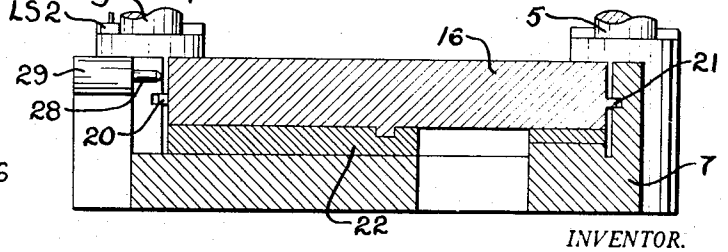


Fig. 5

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June 5, 1956 S. W. ALSPAUGH 2,748,862

HYDRAULICALLY OPERATED APPARATUS FOR OPERATING ON THE WALLS OF A PAN SHAPED OBJECT

Filed Jan. 26, 1952 5 Sheets-Sheet 3

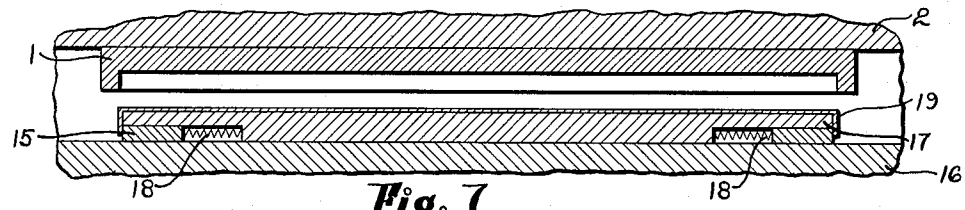


Fig. 7

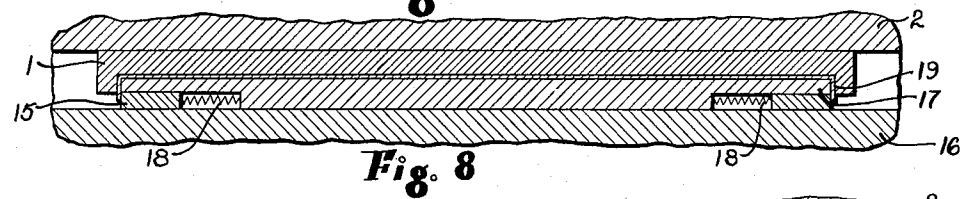


Fig. 8

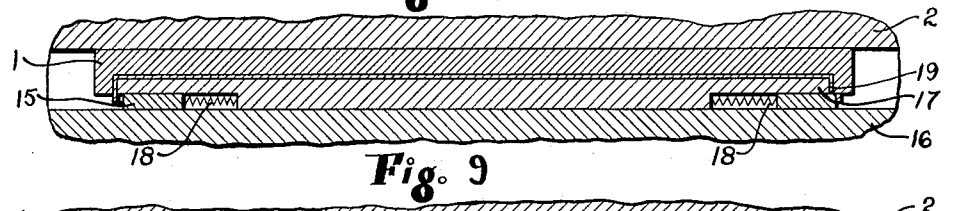


Fig. 9

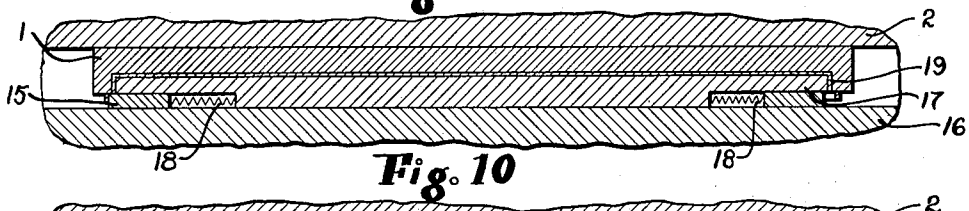


Fig. 10

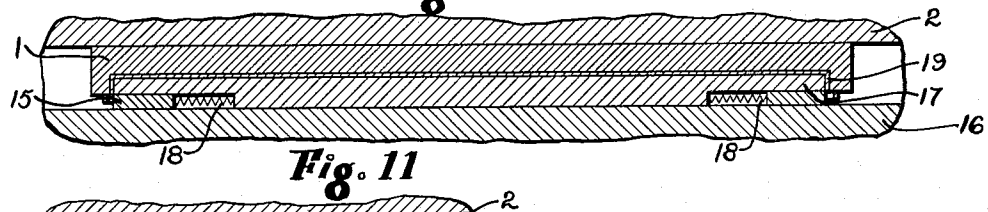


Fig. 11

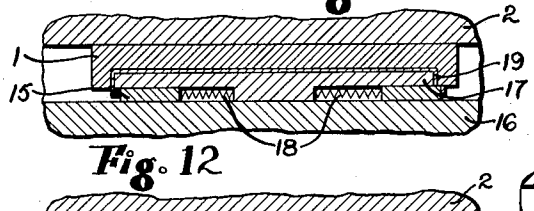


Fig. 12

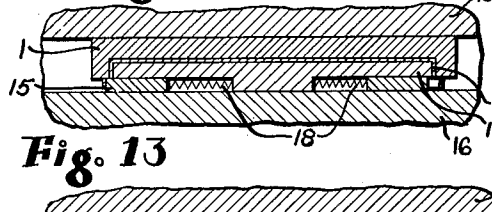


Fig. 13

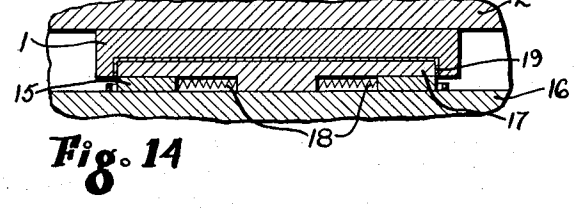


Fig. 14

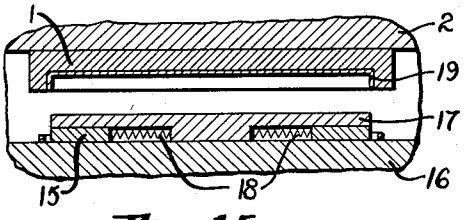


Fig. 15

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June 5, 1956 S. W. ALSPAUGH 2,748,862

HYDRAULICALLY OPERATED APPARATUS FOR OPERATING ON THE WALLS OF A PAN SHAPED OBJECT

Filed Jan. 26, 1952 5 Sheets-Sheet 4

Fig. 16

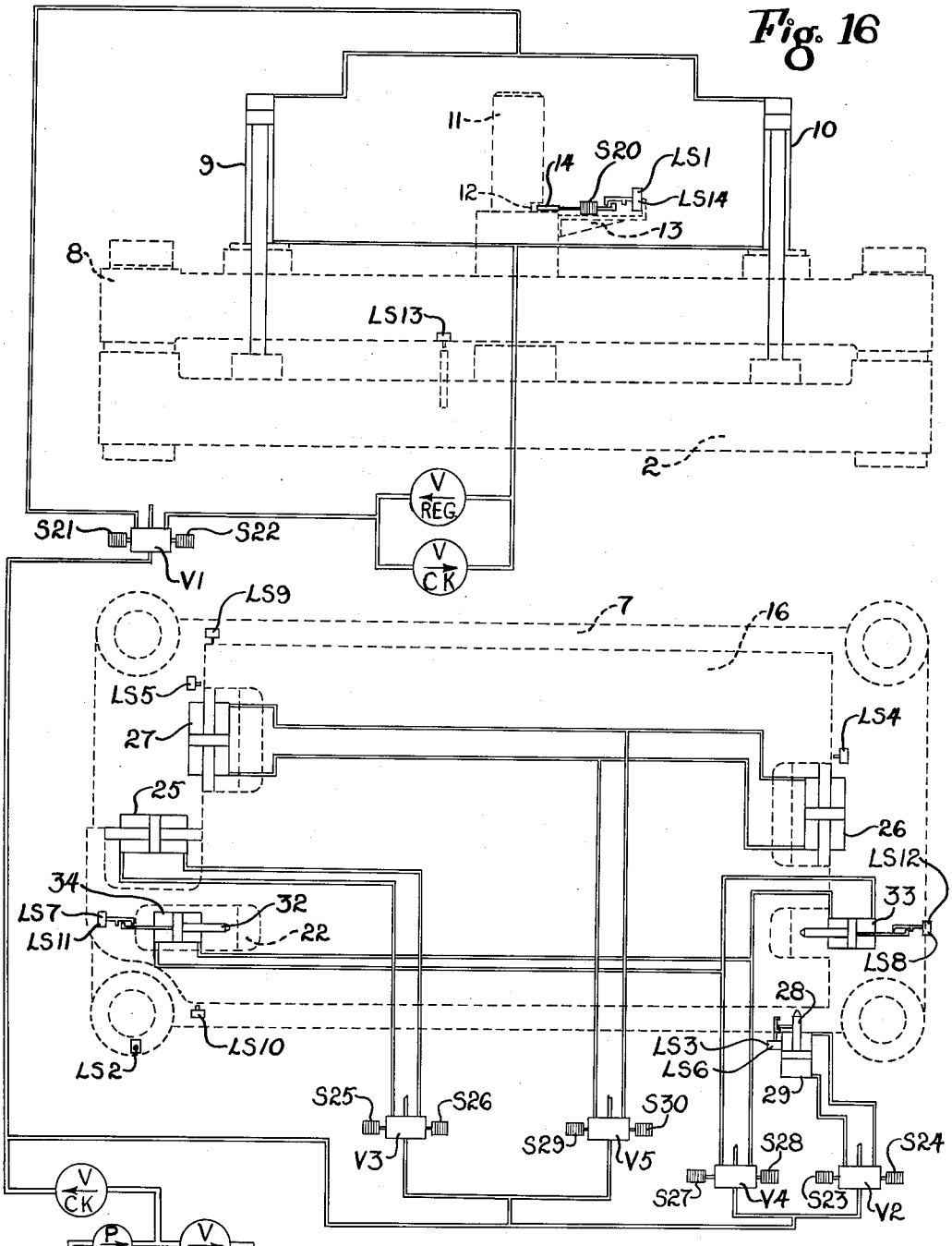
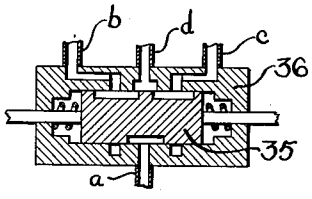


Fig. 17



INVENTOR.

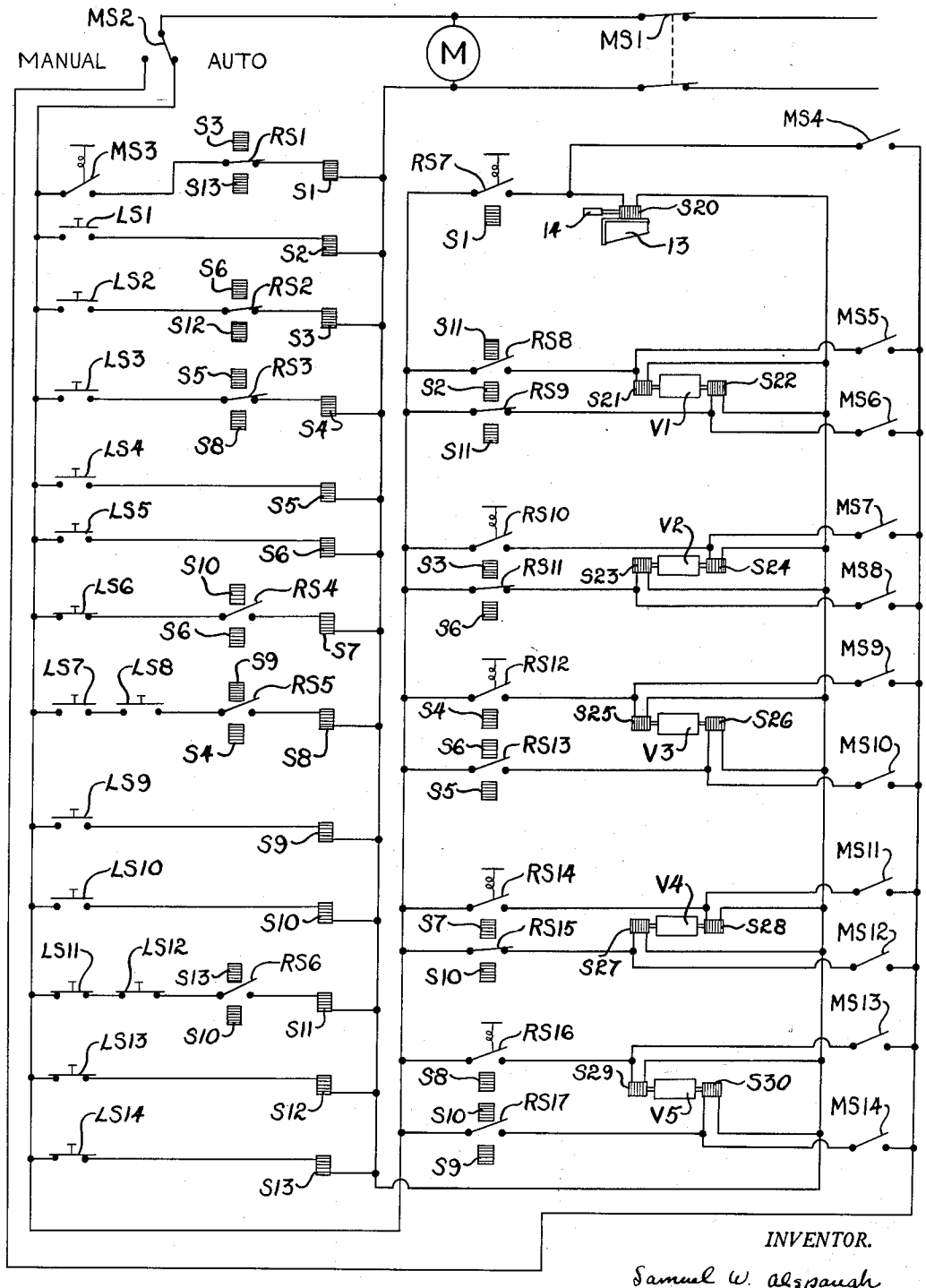
BY Samuel W. Alspaugh

Willits, Hardman & Fehr

June 5, 1956 S. W. ALSPAUGH 2,748,862

HYDRAULICALLY OPERATED APPARATUS FOR OPERATING ON THE WALLS OF A PAN SHAPED OBJECT

Filed Jan. 26, 1952 5 Sheets-Sheet 5



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Fig. 18

United States Patent Office 2,748,862 Patented June 5, 1956

2,748,862

HYDRAULICALLY OPERATED APPARATUS FOR OPERATING ON THE WALLS OF A PAN-SHAPED OBJECT

Samuel W. Alspaugh, Tipp City, Ohio, assignor to General Motors Corporation, Dayton, Ohio, a corporation of Delaware

Application January 26, 1952, Serial No. 268,425

8 Claims. (Cl. 164—56)

This invention relates to a metal working apparatus and more particularly to a hydraulically operated apparatus for operating on the walls of a pan-shaped object used in the manufacture of domestic appliances or the like.

Many types of mechanisms have been previously devised which were adapted for various operations on the walls of pan-shaped objects but these were either complex and cumbersome or suitable only for operations on relatively small articles.

It is an object of the present invention to provide a simple and powerful apparatus for operating on the walls of relatively large pan-shaped articles.

In accordance with the invention, a pair of complementary dies and a series of hydraulic actuators or servomotors are mounted on a frame in such a manner as to have the servomotors sequentially impart a closing motion to the dies, successive relatively transverse reciprocations to the dies, and a separation of the dies.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a plan view of the machine embodying the invention;

Fig. 2 is an elevational view of the machine with certain portions broken away;

Fig. 3 is a plan view taken along the line 3—3 of Fig. 2;

Fig. 4 is a sectional view taken along the line 4—4 of Fig. 3;

Fig. 5 is a sectional view taken along the line 5—5 of Fig. 3;

Fig. 6 is a partial section taken along the line 6—6 of Fig. 3;

Figs. 7 through 15 are partial vertical sections which illustrate the steps in a shearing operation;

Fig. 16 is a schematic view of the hydraulic actuating system superposed on a dotted representation of the machine;

Fig. 17 is an enlarged section across one of the valves in the hydraulic system in Fig. 16; and

Fig. 18 is a schematic view of the electrical control circuit for the hydraulic system of Fig. 16.

Referring now to the drawings, wherein like reference characters designate the same parts throughout the several views, particular reference being first had to Figs. 1 and 2, it will be noted that a die 1 having depending marginal walls is mounted on a die holder 2 which is journaled for vertcal movement on the posts 3 through 6 of the bed 7. A top plate 8 is fixed to the posts and supports the double-acting hydraulic servomotors 9 and 10 which will raise and lower the die holder 2 between the limits set by the depending corner portions of the top plate 8 and the raised corner portions of the bed 7. A rod 11 with a slot 12 is fixed to the die holder 2 and is vertically journaled in the top plate 8 which carries a

safety lock 13 having a slidable bar 14 adapted for engagement in the slot 12. A frame-like complementary die 15 is fixed to a die plate 16 which is slidably supported for transverse reciprocations on the bed 7. A work holder 17 is slidably superposed on the complementary die 15 and slidably supported on the die plate 16 by a depending pad lying within the complementary die 15. A series of compression springs 18 exend between the pad of the work holder 17 and the inner walls of the complementary die 15 and serve to normally center the work holder 17.

Referring additionally now to Figs. 7 through 15, it will readily be seen that the shearing of the walls of a pan-shaped work piece 19 is accomplished by placing it on the work holder 17 (Fig. 7), by lowering the die 1 to the shear or trim position (Fig. 8), by reciprocating the complementary die 15 to the right (Fig. 9) and left (Fig. 10) to shear the side walls, by centering the complementary die 15 (Fig. 11), by reciprocating the complementary die 15 to the rear (Fig. 12) and front (Fig. 13) to shear the remaining walls, by centering the complementary die 15 (Fig. 14), and by raising the die 1 (Fig. 15) so that the trimmed work piece 19 may be removed. A conventional knock-out device may be provided to automatically eject the trimmed work piece 19 from the die 1 as it is raised.

Referring now to Figs. 3 through 6 for a more detailed description of the mounting of the die plate 16 and the hydraulic servomotors associated therewith, it is noted that the die plate 16 is slidably supported for limited movement in any horizontal direction by the tongues 20 and 21 which fit into opposed grooves in the bed 7. A guide plate 22 is interposed between the die plate 16 and the bed 7 and is slotted on its upper surface to receive a pair of keys depending from the die plate 16 and is also slotted on its lower surface to receive a pair of keys projecting from the bed 7. The guide plate 22 thus serves to direct the horizontal movement of the die plate 16 into a pair of paths which are at right angles to each other.

A pair of stop pins 23 and 24 are mounted on the bed 7 and protrude into holes in the die plate 16 to limit its movement. Reciprocation of the die plate 16 along one horizontal path is accomplished by a double-acting hydraulic servomotor 25 mounted on the bed 7 while reciprocation along the other transverse path is accomplished by the similarly mounted double-acting hydraulic servomotors 26 and 27. A guide pin 28 which is reciprocated by a double-acting hydraulic servomotor 29 mounted on the bed 7 engages a bore 30 in the die plate 16 when extended. The bore 30 has a tapered opening so that the engagement of the guide pin 28 will cam the die plate 16 to a central position after it has been reciprocated by the servomotor 25. A pair of lock pins 31 and 32 are similarly reciprocated by the double-acting hydraulic servomotors 33 and 34 which are also mounted on the bed 7 and which engage bores 35 and 36 in the guide plate 22 to cam and lock it when extended.

In the shearing operation, the guide pin 28 will be disengaged from the die plate 16 which will then be reciprocated by the servomotor 25, and the guide plate 22 which is prevented from movement by the engaged lock pins 31 and 32 will confine the reciprocation to one path. The guide pin 28 will then engage and center the die plate 16 by its camming action. The lock pins 31 and 32 will then be disengaged from the die plate 16 which will then be reciprocated by the servomotors 26 and 27 along with the guide plate 22, and the guide pin 28 will confine the reciprocation to the other transverse path. The lock pins 31 and 32 will then engage and center the guide plate 22 along with the die plate 16 by their camming action.

It should be noted here that the various movements of the machine are caused by the sequential operation of the hydraulic servomotors and that these servomotors are controlled by an electrical system which may be manually or automatically operated. For automatic operation a series of position limit switches LS 1 through LS 14, which are normally spring opened, are mounted as shown at various locations on the machine so that the completion of any one movement will initiate the next movement.

Referring now to Figs. 16. 17 and 18 for a description of the hydraulic and electrical systems, it will be noted that a motor driven pump feeds hydraulic fluid to the various servomotors under the control of the valves V1 through V5 which valves may be identical in construction and are controlled by the solenoids S21 through S30. Fig. 17 is an enlarged section of one of these valves and it will be noted that the valve piston 35 is normally spring centered in its casing 36 to close the inlet line *a* and open the servomotor lines *b* and *c* to the reservoir line *d*. Energization of a left solenoid will shift the valve piston to the left and will close the line *b* to the line *d* while it opens the line *b* to the line *a* leaving the line *c* remain open to the line *d*. Conversely, the energization of a right solenoid will shift the valve piston to the right and will close the line *c* to the line *d*, while it opens the line *c* to the line *a* leaving the line *b* remain open to the line *d*. A regulating valve and a check valve are provided between the valve V1 and the servomotors 9 and 10, so that the weight of the die holder 2 may be supported by a proper setting of the relief pressure of the regulating valve. The pump outlet is provided with a check valve to maintain fluid in the feed lines when the pump is inoperative, and is also provided with the usual regulating valve for relief purposes.

Referring now to the electrical system, it should be noted that a manual switch MS1 is provided which will start the motor and drive the pump. A manual switch MS2 is provided so that the machine may be either manually controlled or automatically operated. Manual switches MS4 through MS14 provide manual control while manual switch MS3 will initiate automatic operation. The relay switches RS1 through RS6, RS8, RS9, RS11, RS13, RS15, and RS17 are opened or closed by the indicated solenoids S1 through S13 and it is noted that these relay switches remain in whatever position they were last energized to until they are energized to another position. The relay switches RS7, RS10, RS12, RS14, and RS16 on the other hand, are normally spring opened, and will close only so long as the indicated solenoids are energized.

As previously noted, the limit switches LS1 through LS14 are normally spring opened and closed only when some movable part of the machine is at its limit of movement. It might be pointed out here that the bar 14 of the safety lock 13 is spring biased against the rod 11 at all times that the solenoid S20 is deenergized. The sequential operation of the machine through an automatic cycle will now be described and it is pointed out that various switches in Fig. 18 are shown in the positions they will have after an automatic operating cycle has been completed, that is, when the die holder 2 is in its up position and the safety lock 13 is engaged in the slot 12 of the rod 11.

MS3 is manually closed to disengage the safety lock 13. Disengagement of the safety lock 13 operates LS1 which lowers the die holder 2. The die holder 2 when lowered operates LS2 which releases the guide pin 28 from the die plate 16, and MS3 may be released at this time. The release of the guide pin 28 operates LS3 which moves the die plate 16 to the right to operate LS4. LS4 moves the die plate 16 to the left to operate LS5. LS5 re-engages the guide pin 28 with the die plate 16 camming it to center and operates LS6. LS6 releases the lock pins 31 and 32 from the guide plate 22 to operate

LS7 and LS8. LS7 and LS8 move the die plate 16 to the rear to operate LS9. LS9 moves the die plate 16 to the front to operate LS10. LS10 re-engages the lock pins 31 and 32 with the guide plate 22 camming it to center along with the die plate 16 and operates LS11 and LS12. LS11 and LS12 raise the die holder 2 to its up position, whereupon the safety lock 13 will engage in the slot 12 of the rod 11. Raising the die holder 2 to its up position operates LS13 and engaging the safety lock 13 operates LS14, and the cycle is now completed and ready for a recycling by the manual closing of MS3.

It should be apparent that the machine may be manually directed through its cycle by placing the manual switch MS2 in the manual position and by the proper sequential manual operation of manual switches MS4 through MS14.

In the drawing and description the machine which exemplifies my invention has been specifically applied to a simple wall trimming or shearing operation as an aid to rapid understanding. But my invention is applicable to other types of metal working operations, such as slitting, punching, forming, and extruding, by providing the machine with dies adapted for the particular purpose. The dies used in the machine may trim the edges of the workpiece to various contours and may in addition punch holes and slots and form indentations and the like in the walls of the workpiece in accordance with known practice.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted as will come within the scope of the claims which follow.

What is claimed is as follows:

1. In combination, holding die means, cutting die means, first fluid pressure means operating in a first direction of movement for moving one of said die means relative to the other die means in said first direction of movement, first limit control means responsive to the relative movement of said die means to a predetermined position along said first direction of movement for reversing said first fluid pressure means to reverse the relative movement of said die means in said first direction, and second limit control means responsive to the relative movement of said die means in said reverse direction to a second predetermined position for stopping the action of said first fluid pressure means.

2. In combination, holding die means, cutting die means, first fluid pressure means operating in a first direction of movement for moving one of said die means relative to the other die means in said first direction of movement, first limit control means responsive to the relative movement of said die means to a predetermined position along said first direction of movement for reversing said first fluid pressure means to reverse the relative movement of said die means in said first direction, and second limit control means responsive to the relative movement of said die means in said reverse direction to a second predetermined position for stopping the action of said first fluid pressure means, second fluid pressure means operating in a direction of movement transverse to said first direction of movement for moving one of said die means relative to said other die means along said transverse direction of movement, said second limit control means including means for rendering effective said second fluid pressure means for relative movement in said transverse direction, and third limit control means responsive to the relative movement of said die means to a third predetermined position along said transverse direction of movement for reversing said second fluid pressure control means.

3. In combination, holding die means, cutting die means, first fluid pressure means operating in a first direction of movement for moving one of said die means relative to the other die means in said first direction of movement, first limit control means responsive to the relative movement of said die means to a predetermined

position along said first direction of movement for reversing said first fluid pressure means to reverse the relative movement of said die means in said first direction, and second limit control means responsive to the relative movement of said die means in said reverse direction to a second predetermined position for stopping the action of said first fluid pressure means, second fluid pressure means operating in a direction of movement transverse to said first direction of movement for moving one of said die means relative to said other die means along said transverse direction of movement, said second limit control means including means for rendering effective said second fluid pressure means for relative movement in said transverse direction, and third limit control means responsive to the relative movement of said die means to a third predetermined position along said transverse direction of movement for reversing said second fluid pressure control means, and fourth limit control means responsive to the relative movement of said die means to a fourth predetermined position along the reverse movement in said transverse direction for stopping said second fluid pressure control means.

4. In combination, holding die means, cutting die means, movable locking means for locking said die means for relative movement along a first line of movement, fluid pressure means for relatively moving said die means along said first line, limit control means responsive to the movement of said locking means to locking position for initiating operation of said fluid pressure means.

5. In combination, holding die means, cutting die means, movable locking means for locking said die means for relative movement along a first line of movement, fluid pressure means for relatively moving said die means along said first line, limit control means responsive to the movement of said locking means to locking position for initiating operation of said fluid pressure means, and second limit control means responsive to the relative movement of said die means to a predetermined position along said first line for reversing the operation of said fluid pressure means.

6. In a machine for operating on the walls of a pan-shaped object, a bed, a guide plate slidably keyed along a straight path on its lower surface to said bed, a first die plate slidably keyed along a straight path on its lower surface to said guide plate, said paths being right angularly related, a second die plate cooperating with said first die plate, a retractable lock member having a rectilinear connection with said guide plate for restricting said guide

plate to one of said paths, a retractable guide member having a rectilinear connection with said die plate for restricting said die plate to another of said paths, and fluid actuators for sequentially moving said plates along said paths.

7. In a machine for operating on the walls of a pan-shaped object, a bed, a guide plate slidably keyed along a straight path on its lower surface to said bed, a die plate slidably keyed along a straight path on its lower surface to said guide plate, said paths being right angularly related, a second die plate cooperating with said first die plate, a fluid actuated lock member connected to said bed plate adapted for camming engagement with said guide plate to restrain said guide plate from movement along its keyed path, a fluid actuated guide member connected to said bed plate adapted for camming engagement with said die plate to restrain said die plate from movement along its keyed path, and fluid actuators adapted to move said plates along said paths.

8. In combination, holding die means, cutting die means, first fluid pressure means operating in a first direction of movement for moving one of said die means relative to the other die means along said first direction of movement, second fluid pressure means operating in a direction of movement transverse to said first direction for moving one of said die means relative to the other die means along said transverse direction of movement, first retractible locking pin means aligned with said first direction and extending into interlocking relation with one of said die means for interlocking said one die means to guide said one die means for relative movement along a definite line in said first direction, and second retractible locking pin means aligned with said transverse direction and extending into interlocking relation with the other of said die means for interlocking said other die means to guide said other die means for relative movement along a definite line in said transverse direction.

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