Feb. 20, 1951 H. D. FORSE 2,542,320

POWER TRANSMITTING APPARATUS

Filed April 27, 1946 2 Sheets-Sheet 1

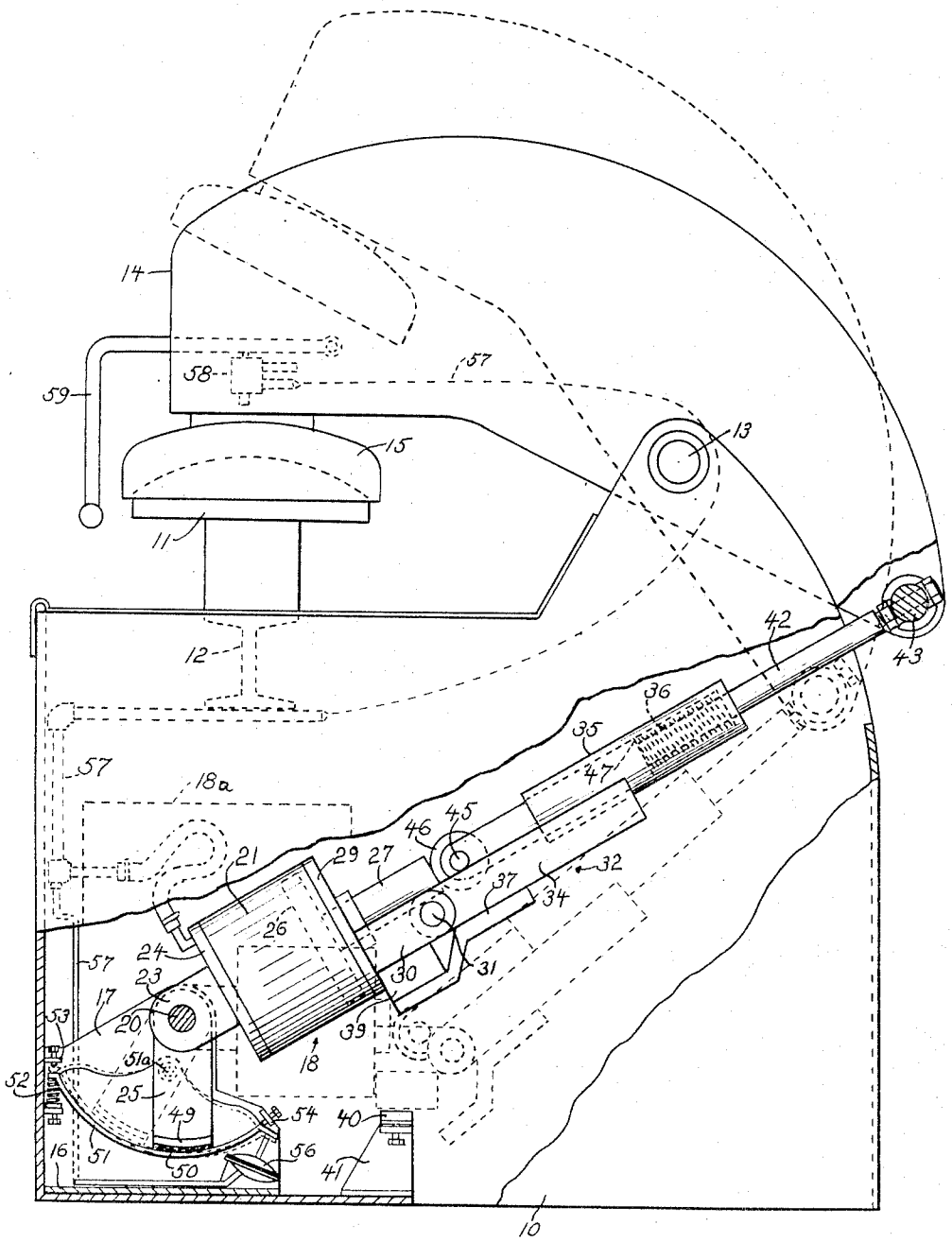


Fig. 1

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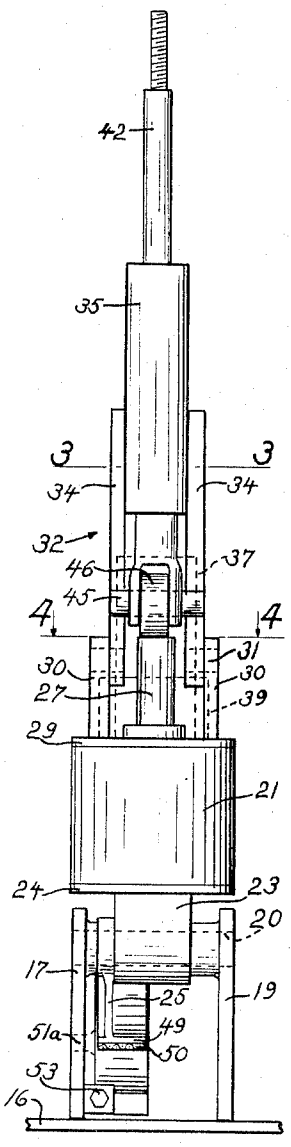


Fig. 2

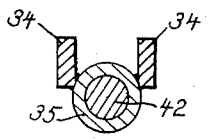


Fig. 3

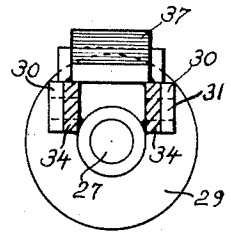


Fig. 4

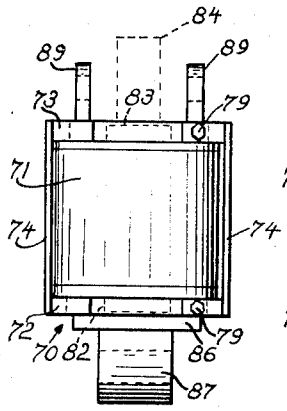


Fig. 5

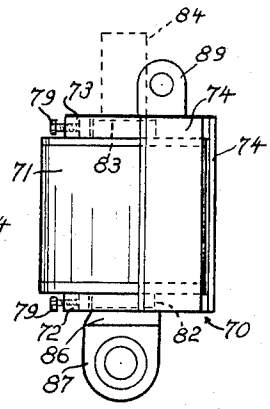


Fig. 6

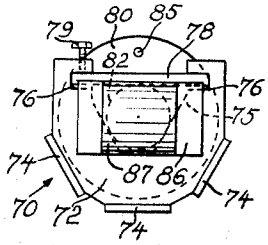


Fig. 7

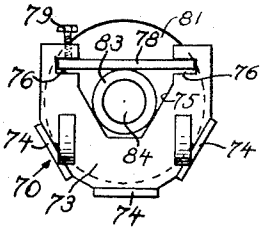


Fig. 8

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POWER TRANSMITTING APPARATUS

Harry D. Forse, Anderson, Ind.

Application April 27, 1946, Serial No. 665,376

5 Claims. (Cl. 74—106)

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This invention relates to improvements in power transmitting apparatus and is especially adaptable for use in operating equipment requiring a two step operation wherein the first step may be of considerable extent but requires little force and the second step is relatively short but requires increased operating energy.

In the operation of certain types of laundry presses and other equipment it is highly desirable that such a two step operation be employed. In the first step of such an operation it is desirable to move the pressing head from a wide open position into a position opposing a complementary pressing buck. This initial step although of considerable extent may be completed with a relatively short movement of the driving element. In the second step of the operation the head is moved a slight distance into opposing relation with the buck and a considerable pressing force is then exerted on the parts to complete the pressing operation. The application of the improved apparatus to pressing equipment as here shown is illustrative only, as it is to be understood that its employment may extend to other fields and uses.

Various kinds of power transmitting equipment has heretofore been used in obtaining such a two step operation. This equipment ranged from compound cylinders for operating the head to separate power means for the head and buck. For the most part this equipment consisted of innumerable parts and was quite complicated and far from dependable. Moreover, maintenance of such equipment requires great skill and special tools for use in practically inaccessible places where operating room was extremely limited. In other words, these intricate and complicated devices required constant servicing and they were usually difficult to work on.

One of the principal objects of advantage and importance in the improved apparatus of this invention is the provision of means for arranging a fluid actuated servo motor of simple cylinder construction to impart a two step operation to a driven member such as a press head.

A further object of advantage and importance resides in the provision of means for arranging the servo motor and operating parts associated therewith to function as a counterbalance to thereby assist in biasing the head toward open position.

Still another and further object of importance and advantage is the provision of means for snubbing the operative movement of the improved apparatus as it approaches either limit

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position in its initial operative step, and of also providing an adjustable stop whereby the opening and return movement of the apparatus may be selectively limited.

Another and still further object of advantage and importance is the provision of means for disposing a compression spring for biasing the head toward open position and the operating mechanism toward inoperative position in such a manner that breakage of the spring does not prevent the biasing function thereof.

A still further object of importance and advantage resides in the provision of means for detachably associating the servo motor with the other working part of the apparatus so that it may be readily and completely removed for servicing or replacement.

An additional object of importance is the provision of quick release means for facilitating removal of the servo motor for repairs or inspection. Furthermore, means are provided for automatically aligning a replacement motor with the push rod prior to it being secured in its supporting cradle.

Additional objects of advantage and importance will become apparent as the following detailed description progresses, reference being had to the accompanying drawings, wherein:

Figure 1 is a side elevational view of a power operated press, parts thereof being broken away to show the power transmitting apparatus which embodies the invention.

Figure 2 is a front elevational view of the power transmitting apparatus shown in Figure 1.

Figure 3 is a transverse section taken on line 3—3 of Figure 2.

Figure 4 is also a transverse section but taken on line 4—4 of Figure 2 looking in the direction indicated by the arrows.

Figure 5 is a top plan view of a supporting cradle with a slightly modified servo motor positioned therein.

Figure 6 is a side elevational view of the device shown in Figure 5.

Figure 7 is an end elevation of the lower end of the structure shown in Figure 5, and

Figure 8 is an end elevation of the opposite end thereof.

The reference numeral 10 indicates generally the base portion of a power operated press which carries a buck 11. The base 10 may be constructed of sheet or plate metal, or other suitable material, and may be formed to meet any particular requirements or conditions. A reinforcing and supporting element, as for instance an I-beam

12, functions to support the buck 11 as well as to add rigidity to the base 10.

Pivotally mounted in the upper portion of the base 10 as at 13 is an operating arm 14 which carries a pressing head 15. Operable rotation of the arm 14 carries the head 15 to and from pressing association with the buck 11. The head 15 and buck 11, either or both, may be heated if desired and the shape and size may be varied at will from the parts illustrated without departing from the spirit and scope of the invention. Likewise an inspection and servicing door 18a may be provided in the base 10.

Positioned within the base 10, preferably in the front lower portion as shown in Figure 1, is a bracket 16 having upwardly extending parallel portions 17 and 19. The parallel portions 17 and 19 are spaced one from another and are apertured near the top to receive a pin 20.

A servo motor indicated in its entirety by the reference numeral 18 and comprising a cylinder 21 having an apertured lug portion 23 is mounted on the pin 20 intermediate the upwardly extending portions 17 and 19 as is best shown in Figure 2. The lug 23 which is fixed to a head 24 of the cylinder 21 carries an arm 25 for a purpose hereinafter more fully described. The cylinder 21 has a piston 26 reciprocably positioned therein and a short piston rod 27 fixed to said piston extends through an aperture in head 29 to the exterior of cylinder 21 as is clearly shown in Figures 1 and 2. The servo motor is thus pivotally secured to the bracket 16 which provides an anchorage for it so that rotational as well as longitudinal operative movement may be delivered at the piston rod end of the servo motor.

Projecting from the head 29 and paralleling the extended piston rod 27 is a pair of spaced apart lugs 30. The lugs 30 are apertured near their outer ends to receive a pin 31 to which a guide member 32 is pivotally secured. The guide member 32 comprises a pair of spaced apart parallel rails, indicated by the reference numeral 34, to the upper portions of which a sleeve 35 is secured as by welding or the like.

The sleeve 35 in addition to maintaining the upper portions of the rails in spaced relation, also houses a compression spring 36. Secured to the lower portions of the rails 34 and on the opposite side from the sleeve is an offset plate 37. The plate 37 in addition to maintaining the lower portions of the rails 34 in spaced parallel alignment also functions in conjunction with an abutment 39 in limiting the rotational movement of the cylinder 21 and the guide member 32 during the power stroke of the device. An adjustable abutment 40 mounted on a bracket 41 provides an auxiliary stop preventing overtravel of the cylinder 21 in its return to starting position.

Reciprocatingly positioned in the sleeve 35 and extending therebeyond in opposite directions is a push rod 42, one end of which is adjustably secured to a cross pin 43 in the arm 14, as is best shown in Figure 1. The opposite end of the push rod is preferably bifurcated, as shown in Figure 2, and the bifurcated portion is apertured to receive a pin 45 upon which a roller 46 is operably positioned.

It is to be noted that each end of the pin 45 projects beyond the bifurcated portion of the push rod 42 and provides in effect a roller which engages the rails 34 upon which it is adapted to travel when the push rod 42 moves longitudinally relative to the guide 32. Moreover, the pin-rail engagement takes up the stress and strain which

otherwise would be imposed on the sleeve 35 when the apparatus moved from the dotted line position to the full line position as shown in Figure 1. The push rod 42 comprises a lower enlarged portion and an upper restricted portion to thereby form a shoulder 47 intermediate the ends thereof. The shoulder 47 engages the lower end of the compression spring 36, which biases the push rod 42 and piston rod 27 to the left as shown in Figure 1.

In the rest or starting positions in which they are shown in dotted lines the push rod 42 and piston rod 27 are disposed as a toggle with axes of the arms on converging planes. The initial portion of the power stroke of the piston rod 27 rotates the piston rod and push rod 42 into straight line position so that a direct piston thrust then may be applied to the end of the pivoted arm 14.

As previously stated an arm 25 is rigidly fixed to the lug 23, as is best shown in Figures 1 and 2, so that rotational movement of one member causes similar movement of the other member. The free end of the arm 25 is provided with a flange 49 to the outer surface of which a brake lining 50 is attached. The flange 49 and brake lining 50 are preferably of concavo-convex formation as shown in Figure 1.

Pivotally secured, as at 51a, see Figures 1 and 2, to the upright 17 of bracket 16 is a segmentally shaped brake drum member 51, which is biased in a clockwise direction by an adjustable biasing spring 52. The spring 52 biases the member 51 against an adjustable stop 53 as indicated by the dotted line position of the member in Figure 1. Positioned near the opposite end of the brake member 51 and operable to move that member in a counter clockwise direction against an adjustable stop 54, as shown in solid lines in Figure 1, is a diaphragm motor 56. The brake lining 50 and an opposing portion of the segmentally shaped brake drum member are disposed for operable engagement. When the brake drum 51 is rotated clockwise on its relatively short radius to its biased dotted line position resistance to clockwise movement of the arm 25 on its relatively longer radius progressively increases with such movement and when the brake drum member 51 is rotated counter clockwise to its full line position, as by operation of the diaphragm motor 56, resistance to counter clockwise movement of the arm 25 from a central position on the brake member 51 also increases in relation to the distance traveled. Accordingly it will be apparent that the rotational movement of the servo motor may be adjustably snubbed or retarded as it approaches a limit position in each direction and upon being arrested be maintained in such position.

Extending from a source of supply, not shown, to the servo and diaphragm motors 18 and 56, respectively, is a supply line 57. Control of the flow of operating pressure through the supply line is had by a three way valve 58, which may be operated by a safety guard handle 59 or some other suitable mechanism.

Operation

The improved power transmitting apparatus of this invention may be operated substantially as follows:

Assume, for instance, that the apparatus is at rest as shown in the dotted line position in Figure 1. The piston rod 27 is retracted and the

biasing spring 36 has moved the push rod to the left as shown, and the unsupported servo motor 18 has rotated clockwise to its limit position as defined by the auxiliary stop 40 or the operation of the biased brake mechanism. Additionally, both cylinder 21 and diaphragm motor 56 are exhausted by the opening of the exhaust port in the three way valve 58. In starting the operation of the apparatus the three way valve is operated, as by depressing the safety guard handle 59, thereby opening the supply port and closing the exhaust port. The flow of pressure through the supply line 57 and into the motors 18 and 56 operates to overcome and render ineffective the biasing spring 52 thereby rotating the brake drum member 51 in a counter clockwise direction. This action releases the arm 25 from its dotted line position, whereupon the piston 26 under the influence of supply line pressure, urges the piston rod 27 toward the right. The movement of the piston rod 27 rotates the servo motor 18 and the push rod 42 into coaxial alignment as shown in full lines in Figure 1.

As the apparatus approaches this aligned position the eccentrically positioned brake drum member 51 retards or snubs the movement so that the engagement of the abutment 39 and plate 37 is completed without shock. Thus the first step of the operative movement is completed with the head 15 in close proximity to or slightly engaging the buck 11. The admission of additional pressure into the cylinder 21 causes the piston rod 27 and the push rod 42 to move axially, thereby impressing the head 15 against the buck 11 with increased force and completing the second step of the operative movement.

It is to be noted that movement of the head 15 from its full open position, as shown in dotted lines in Figure 1, into buck opposing position, as shown in full lines in the same view, is caused by rotational and operable axial movements of the servo motor 18. Whereas, movement of the head 15 from its buck opposing position to full pressing position, as when the servo motor is in its aligned position, results from operative axial movement only of the servo motor, consequently then the ratio of operative movement of the head to the axial movement of the piston rod of the servo motor varies during different portions of each power stroke. Accordingly, then if the movement of the piston rod be at a constant rate throughout the power stroke, the movement of the head will be rapid during the initial portion of its movement and at a much slower rate during the remainder of the pressing movement. Thus the present arrangement in which a simple cylinder servo motor furnishes operating power, functions in operating at a constant rate to drive a driven member at varied rates during a single power stroke thereof. In other words, a speed reduction element is introduced so that the rate of movement of the driven member per unit of movement of the driving piston rod varies over different portions of the same stroke.

When the pressing operation is completed or when it is desired that the parts assume their rest positions the valve 58 is operated, as by raising the guard handle 59, to close the supply port and to open the exhaust. With the exhaust port of the valve 58 open pressure within the motors is expelled. The expelling of pressure from the diaphragm motor 56 is assisted by the biasing spring 36. The operation of biasing spring 52 rotates the drum 51 clockwise, thereby freeing the arm 25 for clockwise movement. With

the arm 25 free and the pressure within the cylinder 21 reduced, the servo motor 18 and parts associated therewith, including arm 14, move under the force of gravity into the dotted line rest position.

Modification

Figures 5, 6, 7 and 8 show a slightly modified construction in which a cradle 70 is provided for supporting a servo motor 71. The cradle 70 comprises two end members 72 and 73 secured in spaced parallel association by side and bottom members 74. The parts may be integral, welded, or otherwise secured one to another. Each end member 72 and 73 is provided with a recess which terminates in a centrally located V-shaped opening 75, as is best shown in Figures 7 and 8.

Formed in the upper portion of each end member 72 and 73 and on opposed sides of the V-shaped openings 75 is a bar receiving notch 76 in which a bar 78 is adapted to be removably positioned. A set screw 79 in screw threaded association with an upper portion of each end member 72 and 73 operably engages a portion of one of the bars 78 extending into one of the notches 76.

The servo motor 71 is provided with two similarly appearing heads 80 and 81 which carry concentrically located bosses 82 and 83 respectively. The boss 82 is blank and the boss 83 is apertured to pass a piston rod 84 therethrough. The head 80 is also provided with a fluid supply receiving port 85. The servo motor 71 is assembled with the cradle 70 by inserting the bosses 82 and 83 in the V-shaped openings 75 and then positioning the bars 78 in their notches 76 and then tightening down the set screws 79 so that the central bottom portions of the bars 78 firmly engage the uppermost peripheral portion of an associated boss, thus securing the bosses in the V-shaped openings.

Secured to the end member 72 is a supporting plate 86 which carries an apertured lug 87. Secured to the end member 73 in spaced parallel relation and extending outwardly therefrom is a pair of apertured lugs 89. The lugs 87 and 89 are constructed and spaced to have their apertures in precisely the same relative positions as the apertures in the lugs 29 and 30 so that the cradle 70 is interchangeable with the servo motor 18.

It will be apparent from the foregoing that the servo motor 71 of this unit may be quickly and easily removed from a press or like structure for servicing or replacement by merely loosening two set screws. When the set screws 79 are loosened, the bars 78 may be removed from their notches 76, thus providing a clear path for the removal or installation of a servo motor.

The operation of the modification above described is precisely the same as the operation of the first described embodiment, accordingly the description of operation there given need not be repeated here.

It will also be apparent from the foregoing that herein is provided a simple, sturdy and efficient apparatus for automatically effecting a speed reduction or two step power transmission movement wherein the first step comprises a relatively extensive movement of limited force and the second step comprises a relatively limited movement of considerable force.

As it will be apparent to those skilled in the art to which the improved device of this invention appertains that numerous changes and widely different embodiments of the invention may be made without departing from the spirit and scope

thereof, it is intended that the embodiments shown in the drawings and the description thereof shall be interpreted as illustrative and not in a limiting sense. Reference is therefore to be had to the appended claims for a definition of the limits of the invention.

I claim:

1. A power transmitting apparatus, comprising a toggle, a cylinder attached to one member of said toggle, a piston in said cylinder, a piston rod projecting from one end of said cylinder, a push-rod slidably mounted in the coacting member of said toggle and adapted to be engaged by said piston rod, said piston rod and said push-rod so mounted that they converge at a point inside the pivot center of said toggle.

2. The structure of claim 1 including control means for admitting operating pressure into said cylinder.

3. The structure of claim 1 including means for restraining linear movement of said push-rod until toggle is in substantially straightened position.

4. The structure of claim 1 including means for preventing toggle from going beyond straightened position.

5. The structure of claim 1 including roller means pivotally mounted on end of said push-rod adjacent end of piston rod.

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