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F. J. BETTER

2,394,655

SERVO-MOTOR

Filed Dec. 1, 1942

2 Sheets-Sheet 1

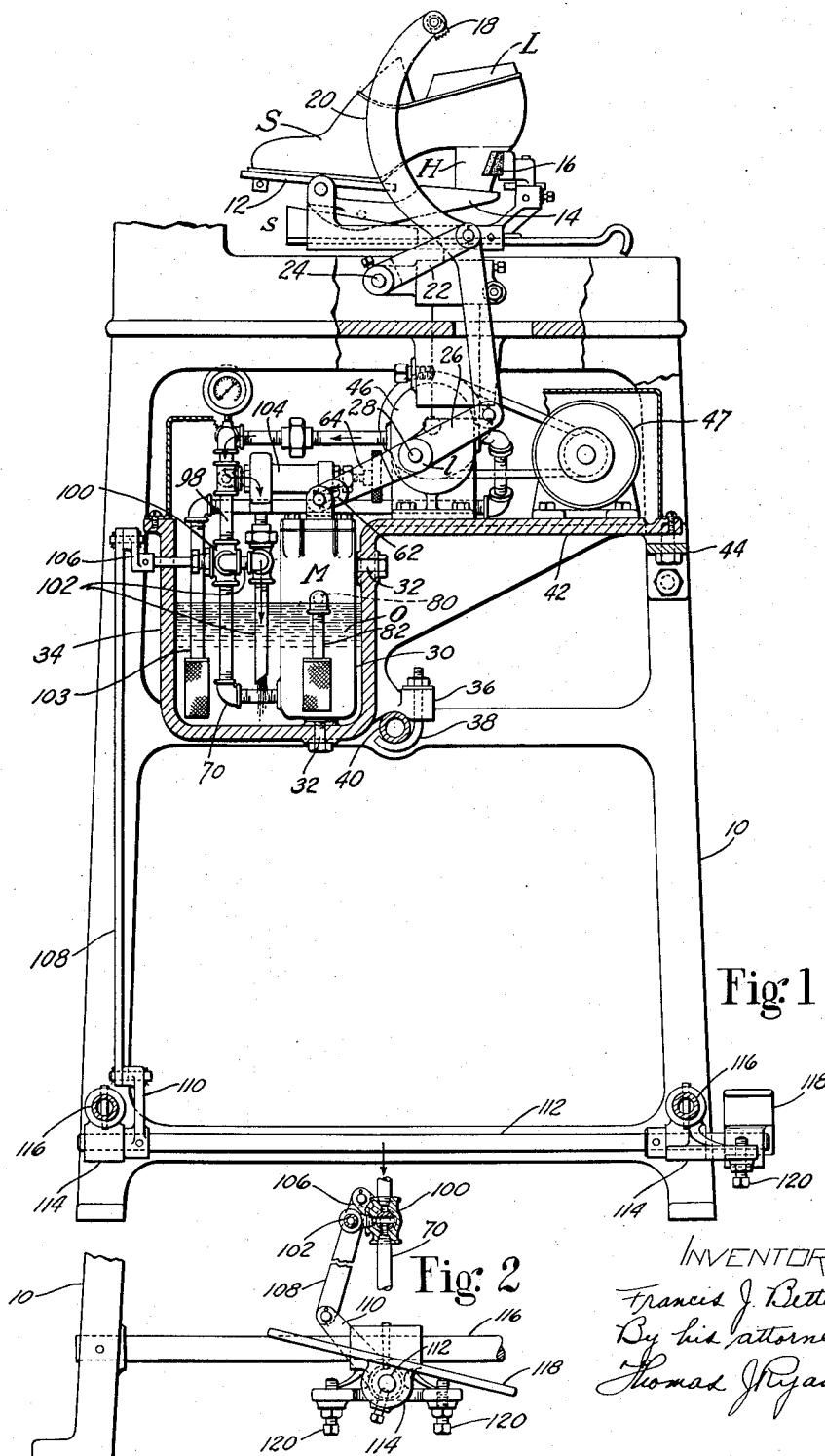


Fig 1

Fig. 2

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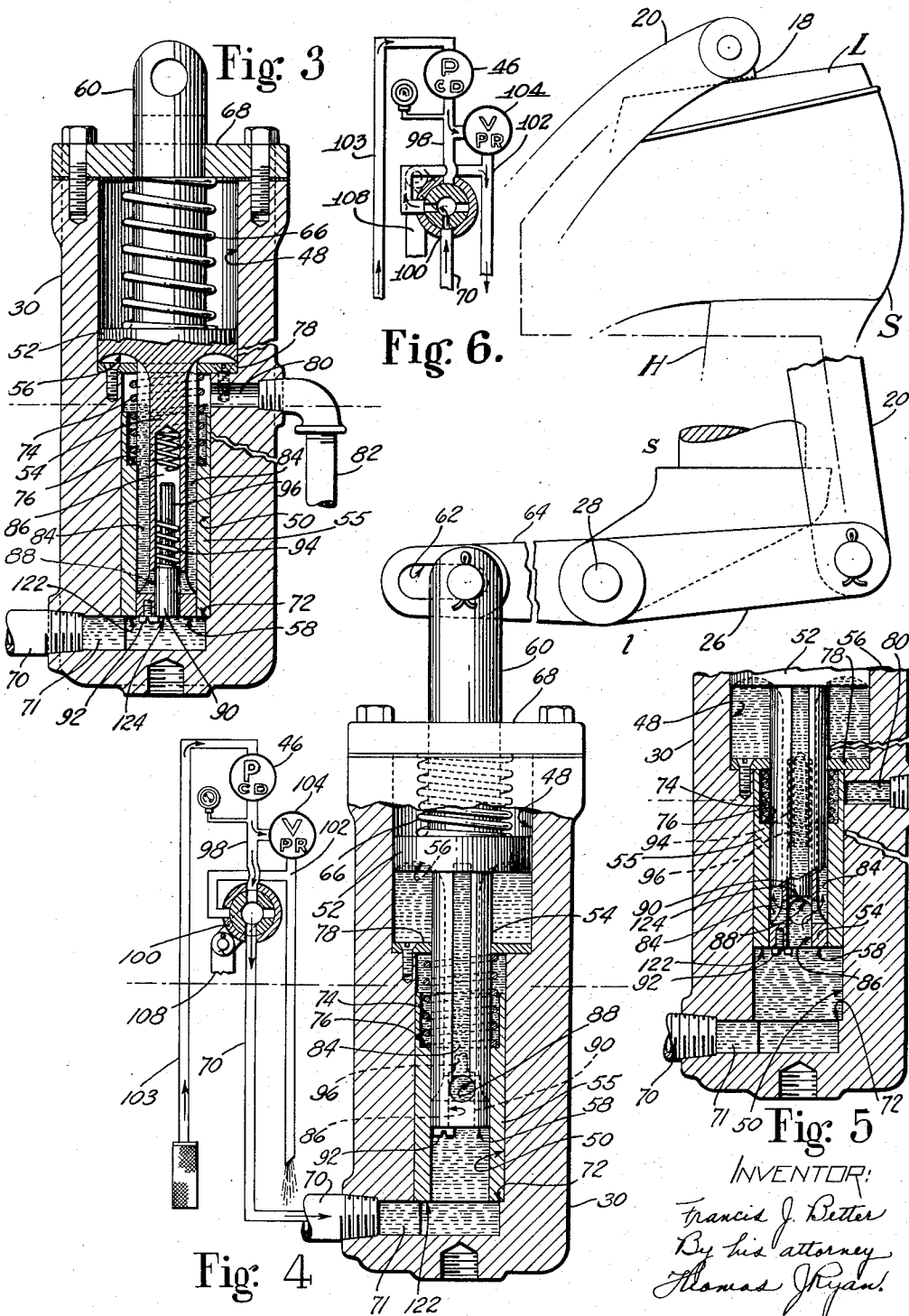
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UNITED STATES PATENT OFFICE

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SERVO-MOTOR

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1 Claim. (Cl. 60—97)

This invention relates to servo-motors by which work-portions may be pressed together in preparation for an operation upon them. An example of a machine to which the invention may usefully be applied is furnished by that disclosed in Letters Patent of the United States No. 1,971,344, Hardy, August 28, 1934, though it may find other desirable applications.

In the machine of the above patent, a heel and a lasted shoe are positioned for the attachment of the heel to the heel-seat of the shoe, and are then clamped for the operation upon them when a treadle is depressed by the operator. This brings a clamping member into contact with the crown of the last-cone, and then applies a sufficient force to maintain the parts in the relation in which they have been placed. To obtain this initial engagement promptly, the treadle must be moved through a considerable distance, and, in doing this, the attention of the operator may be distracted from the proper holding of the shoe and heel in position upon the support. When clamping pressure is applied, a substantial force must be exerted by the operator and held for a considerable time. An object of my invention is to provide for the clamping of the work by simple, compact and effective hydraulic mechanism, which will minimize the necessity for attention and effort on the part of the operator, a slight movement initiating the operation and the clamping force being applied under power. In the attainment of this object, the hydraulic mechanism or servo-motor has a cylinder and a piston operating therein. To the cylinder of the motor, used as previously indicated or in other connections, a pressure-conduit delivers, and the piston in the cylinder has surfaces of different effective areas to which pressure is applied from the conduit. A spring-actuated valve, carried by the piston, controls the application of pressure to these surfaces to vary the force exerted by the motor. A spring-actuated valve-sleeve is shown as surrounding the piston and governing the introduction to and discharge of fluid from the cylinder through an inlet-and-outlet opening to permit the proper action of the piston. Both of these valves are within the cylinder and upon the piston.

In the accompanying drawings illustrating a particular embodiment of the invention,

Fig. 1 shows a heel-attaching machine with my improved servo-motor in side elevation;

Fig. 2, a front elevation of the controlling treadle and connected valve;

Fig. 3, an enlarged central vertical section

through the motor with the elements in their normal positions corresponding to Fig. 1, the upper portion of the cylinder above the dash-dot line being turned through 90° from the actual relation, to better show the inlet-and-outlet-connection;

Fig. 4, an enlarged central vertical section through the motor, with the clamp and a portion of its connections in side elevation, and illustrating the elements upon contact of the clamp with the crown of the last, a portion of the hydraulic connections being indicated diagrammatically;

Fig. 5, a partial central vertical section through the motor with the elements as related during the application of clamping pressure; and

Fig. 6, a diagrammatic view of the hydraulic connections, with the operator-actuated valve in exhaust-position.

Upon a frame 10 (Fig. 1) is mounted a support s for a shoe S and heel H. This support is shown as having a plate 12 upon which the tread-surface of the sole of the shoe may rest, a member 14 receiving contact of the tread-surface of the heel and a back-stop 16 for said heel. A clamping member 18, movable into engagement with the crown of a last L within the shoe, is carried by a yoke 20 hung upon a pair of arms 22 pivoted at 24 upon a portion of the support s. The lower ends of the yoke-arms are joined to spaced arms 26 of an actuating lever l fulcrumed at 28. To the pivotal connection between the yoke-arms and the actuating lever may be joined treadle-connections, such as those of the previously mentioned patent, for the direct application of pressure to the work by the operator. The frame carries tools for operating upon the work, as disclosed in said patent, but which require no consideration here.

The clamp-actuating mechanism of the present invention, organized for ready substitution for the treadle mechanism, is furnished by a servo-motor M, having a cylinder 30 attached at its lower end and forward side by screws 32 to the bottom and front wall of a tank 34. This tank has projecting from its wall lugs 36 attached by hooked bolts 38 to a tie-rod 40 of the frame. Extending forwardly from the top of the tank is a horizontal shelf 42 secured to a bar 44 bolted between the sides of the frame. Upon the shelf are a rotary pump 46 for supplying under pressure the motor-fluid, preferably such a liquid as oil, and an electric motor 47 by which the pump is driven. The cylinder 30 of the motor M has

bores of two diameters, the upper 48 being larger than the lower 50 (Figs. 3, 4 and 5). In the cylinder-portion 48, a piston 52 is movable with the usual sliding fit. Depending from the piston is an extension 54 spaced from the cylinder-wall by a surrounding valve-sleeve 55, sliding within the bore 50 and about the piston-extension. The concave under surface 56 of the piston 52 surrounding the extension 54 has an effective area greater than the end surface 58 of the extension 54. This compound piston 52, 54 has a rod 60 projecting upwardly from it, this being connected through a slot 62 to an arm 64 of the actuating lever 1, the arms 26 of which are joined to the work-clamping yoke 20. An expansion-spring 66 interposed between the piston 52 and the head 68 of the cylinder 30 hold said piston normally lowered, as appears in Fig. 3 of the drawings. Here, the lower extremity of the extension 54 is just above a port 71, through which a conduit 70 delivers liquid from the pump 46 to the bottom of the cylinder 30. The valve-sleeve 55 is urged normally down upon a shoulder 72 in the cylinder, just above the port 71, by an expansion-spring 74, abutting against a shoulder 76 upon the valve-sleeve and upon a ring 78 fixed to the bottom of the cylinder-bore 48. This spring lowers the upper edge of the valve-sleeve below an inlet-and-outlet-port 80 near the top of the cylinder-bore 50, this port being connected by a conduit 82 to a body of oil O in the tank 34. In the piston-extension 54 are passages joining the upper and lower cylinder-portions. These passages are shown as a plurality of grooves 84, formed in the extension from points somewhat above its lower end to merge into the piston-surface 56, the lower extremities of the grooves being connected to an axial bore 86 in the extension by openings 88 through the extension-wall. Flow of liquid through these passages is controlled by a valve-plunger 90 sliding in the bore 86 and held normally down against a stop-screw 92 threaded into the end of the extension, by an expansion-spring 94 surrounding the stem 96 of the plunger and seated against the upper end of the bore.

The conduit 70 is connected through a three-way valve 100 (Figs. 1 and 2) to a conduit 98 to which pressure is supplied by the pump 46. By actuation of this valve, pressure may be applied to the cylinder 30 or cut off and the conduit 70 connected for exhaust of the cylinder into the tank through a conduit 102. During exhaust, the oil, drawn from the tank through a conduit 103 by the continuously operating pump, escapes through an adjustable relief-valve 104 to the conduit 102. To shift the valve 100 between its two positions, there is fastened to its plug an arm 106 joined by a link 108 to an arm 110, fast upon one end of a shaft 112 journaled in hangers 114, 114 depending from tie-rods 116, 116 at the bottom of the frame 10. Upon the forward extremity of the shaft is secured a double treadle 118, limited in its oscillation in opposite directions by stop-screws 120, 120 threaded vertically through the adjacent bracket. If the right-hand side of the treadle is depressed by the operator, the valve 100 is set for exhaust from the cylinder 30 (Figs. 2 and 6). Opposite movement of the treadle positions the valve to apply pressure to the cylinder (Fig. 4).

With the valve 100 as illustrated in Fig. 2, the operator applies a heel H to the heel-seat of a shoe S, and places them together upon the support s, contact of the rear of the heel with the back-stop 16 determining the point at which the

crown of the last L within the shoe will be engaged by the clamp. At this time, the clamp is elevated by its connection to the piston 52, 54, which is lowered by the spring 66, exhaust from the cylinder 30 to permit this having occurred through the port 71, conduit 70, valve 100, and conduit 102 to the tank 34. The valve-sleeve 55 has been depressed by the spring 74, so the port 80 is open, and the plunger-valve 90 closes the openings 88 to the passages through the piston-extension 54. The cylinder-space below the piston 52 is filled with oil, drawn in from the tank through the conduit 82 and port 80. This is as illustrated in Fig. 3. The discharge from the pump 46 is wasting back to the tank through the conduit 102. The operator, having determined that the relation of the cup of the heel to the heel-seat of the shoe is correct, depresses the left-hand side of the treadle 118. The valve 100 closes the connection between the exhaust-conduit 102 and the conduit 70 leading to the cylinder, and applies pressure from the pump 46 to the surface 58 of the cylinder-extension 54, as may be seen in Fig. 4. The piston rises rapidly and, through the actuating lever 1 and its connections, brings the clamp 18 promptly into engagement with the crown of the last L. On account of the relatively small capacity of the cylinder-portion within the valve-sleeve 55, this action requires the delivery of but little oil by the pump. At the beginning of this movement, the cylinder-space beneath the piston 52 was filled with oil, as already explained, and this condition is continued during the elevation, the oil entering from the tank 34 through the port 80. As soon as contact of the clamp with the last occurs, the rise of the piston is stopped with the elements related as appears in Fig. 4. The pump-pressure through the port 71 now becomes effective upon the surface 122 of the valve-sleeve 55, where it projects beyond the cylinder-shoulder 72, and also upon the surface 124 of the valve-plunger 90. The sleeve is raised to close the port 80, while the plunger frees the openings 88 (Fig. 5). The pressure is thereupon exerted through these openings and the grooves 84 on the larger piston-surface 56, and applies to the clamp 18 a much increased force to hold the work securely for the operations upon it. When the chosen maximum clamping pressure has been attained, the oil from the pump blows off through the relief-valve 104 by way of the conduit 102. The attachment of the heel having been completed, the operator restores the treadle 118 to the position of Fig. 2. Pressure is now cut off the cylinder 30, and this is connected through the conduit 70 and the valve 100 to the exhaust-conduit 102. The spring 94 lowers the valve-plunger 90 to close the openings 88 and the springs 74 and 66, respectively, restore the valve-sleeve 55 and the piston 52, 54 to their initial positions, the valve-sleeve opening the port 80. The oil, which entered during the elevation of the piston, is displaced through the ports 71 and 80 by the descent of said piston, leaving, however, the lower cylinder-space filled with oil for the prompt application of full pressure for the succeeding operation. The descent of the piston, through the actuating lever 1 and its connections, raised the clamp 18 from the last. The released shoe with its attached heel may now be removed from the support s.

It is to be noted that by the motor of this invention, the operator is provided with reliable means, economical in operation, to apply quickly to the work clamping pressure of the desired mag-

nitude with little effort on his part. There should further be observed, the simplicity of the hydraulic motor, with its valves compactly arranged within the cylinder.

Having described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

In combination, a cylinder having portions of different diameters, there being an inlet-and-outlet opening in the portion of smaller diameter at the end adjacent to the portion of greater diameter, a conduit delivering fluid under pressure to the portion of smaller diameter, a work-clamping piston movable in the cylinder-portion of greater diameter and having an extension lying in the portion of smaller diameter, there being passages in the piston-extension connect-

ing the cylinder-portions, a spring-closed valve movable in the extension and opened by pressure supplied through the conduit to admit such pressure through the piston-passages to the larger cylinder-portion, and a sleeve surrounding the piston-extension within the smaller cylinder-portion and controlling the flow through the inlet-and-outlet opening, said sleeve being spring-actuated in one direction to open said inlet-and-outlet opening and admit fluid to the cylinder and actuated in the other direction by pressure admitted through the conduit to close the inlet-and-outlet opening, increase in pressure in the smaller cylinder-portion then opening the spring-closed valve for the application of work-clamping pressure from the conduit to the piston.

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