This invention is directed to an improved quadding and centering mechanism for typographical casting machines of the Linotype class. The general objects of the invention are to provide a device which is inexpensive to manufacture and install and which is reliable and efficient in operation.

Specifically, the improved mechanism is operated by hydraulic pressure, comprising a closed liquid circulating system which includes a single double-acting motor or rotor, which can be connected to either or both of the line clamping jaws or disconnected from both, a liquid reservoir, a continuously operated pump for circulating the liquid through the system, a selector valve for rendering the motor effective for quadding and centering operations or ineffective for a regular machine operation, and an automatically operated slide valve for controlling the timing and pressures of the system. Preferably a rack and pinion connection is provided between the hydraulic motor shaft and the line clamping jaws, the pinion being adjustable into engagement with either rack alone for quadding with the corresponding jaw or into engagement with both racks conjointly in centering with both jaws, and being adjustable out of engagement with both racks to condition the machine for a regular operation.

The exact construction and operation of the mechanism will best be understood from the detailed description to follow. In this connection it may be noted that many of the features utilized have been carried over from the copending application of Abbott and Thompson, Serial No. 378,268, filed September 3, 1953.

The improved mechanism herein shown and described has been designed as an attachment which may not only be applied to new machines but also, without much effort or expense, to old or existing machines designed only for regular operation.

Referring to the drawings:

Fig. 1 is a partial end elevation of a Linotype machine equipped with the present improvements;

Fig. 2 is a top plan view of the driving mechanism for the machine and the rotary pump forming part of the present invention;

Fig. 3 is a front elevation of the slide frame of the machine and showing the manner in which the improved quadding and centering attachment is applied thereto;

Fig. 4 is a top plan view of a portion of the parts shown in Fig. 3, with certain parts shown in section and broken away;

Fig. 5 is an end view, looking from the left, of the parts shown in Fig. 4, the selector valve housing being shown in section;

Figs. 7 to 10 are diagrammatic views showing the four different positions of the selector valve;

Figs. 11 to 14 are diagrammatic section views showing the four different positions of the automatic slide valve during a machine cycle; and

Fig. 15 is a sectional view in diagrammatic form of the hydraulic system which characterizes the invention.

In the regular operation of the machine, the character bearing matrices and expandible spacebands are com-
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with blank spaces at either end, as for quadding, or at both ends for “centering.”

According to the present invention, these various movements of the jaws are effected by means of a single hydraulic power unit, preferably in the form of a reversible, rotatable hydraulic motor or rotor 25 (of the gear type) operatively connected to the jaws by means of racks 11 and 12 and a pinion 13. The racks 11 and 12 are supported and guided by flanged rollers 11a and 12a, respectively, and are arranged in two different horizontal planes in order to enable the pinion 13, which is of sufficient width to accommodate both racks at the same time, to be adjustable to engage either rack alone or become entirely disengaged from both racks.

As best shown in Figs. 4, 5 and 6, the pinion 13 is attached to a vertical shaft 13a, said shaft extending into an upper bearing arm 22 of the casting 24 and connected by means of a spline to the motor shaft 15. The shaft 13a is axially movable within its bearings to adjust the pinion 13 to four positions or levels under control of a knob 23, namely, an upper position for the left hand jaw quadding with the pinion engaged with the rack 11 but disengaged from the rack 12; a lower position for “centering” with the pinion engaged with both racks 11 and 12; a still lower position for right hand jaw quadding with the pinion engaged with the rack 12 but disengaged from the rack 11; and an extreme lower position for regular machine operations with the pinion disengaged from both racks.

The control knob 23 effects the vertical adjustment of the pinion through a mechanical connection (Figs. 4, 5 and 6) which includes a rotatable shaft 21* to which the knob is made fast, a pinion 21 mounted centrally on the shaft and engaged with a vertical rack bar 13b fixed to a collar 14 which is pinned to the shaft 13a. The rotation of the pinion 21 by the selector knob 23 effects the vertical or axial displacement of the shaft 13a, and in so doing locates the pinion 13 in one or another of its four positions. The operator is aided in selecting the position of the control knob by means of a spring-operated detent 14a acting upon a section of the collar 14 of the vertical shaft 13a.

In addition to controlling the position of the pinion 13, the knob 23 adjusts a rotary type selector valve 27 (see Figs. 7, 8, 9 and 10) to each of four positions. The selector valve 27 is rotatably mounted in a section of the casting 24, which serves as its housing and is provided with a fluid tight seal or cover 27a which is easily removable for inspection or other purposes.

The purpose of the rotary selector valve 27 is to establish hydraulic passages to the motor 25 for quadding and centering operations and to by-pass the flow of hydraulic fluid from the motor during regular machine operations. As most clearly shown in Fig. 15, the hydraulic fluid is stored in a tank or reservoir 33 located near the base of the machine and suspended below a valve housing 40 from a special bracket B bolted to the main frame F of the machine (see Fig. 1), and the hydraulic fluid is circulated through the system by means of a continuously operated rotary gear pump 34 also mounted (see Fig. 2) on the main frame F. The pump 34 is driven from an electric motor G which drives the main cam shaft B of the machine in the usual manner through a mechanical power transmission which includes a small gear 38, a large gear 36 loosely mounted on the main clutch shaft, and a friction or less centrally driven gear 36 by a small pinion 37.

The cycle of operation of the hydraulic system is controlled from the main cam shaft B of the machine by a combination of roller type valve contained within the housing 40. As shown in Fig. 1, a roller follower 42 is provided with a cam follower roller 42a which is maintained in contact with the contour of a special cam 41 on the main shaft B by a tension spring 43 acting on the lower end of the lever. The lower end of the lever 42 is connected to a valve rod 40 by a link 44 pivoted at both ends.

The slide valve unit contained within the housing 40 controls the sequence of the various operations and movements of the jaws during quadding and centering. These operations are as follows: After the line is received between the jaws, the quidding jaw (or jaws) is moved into engagement with the composed line; between first and second justification, the pressure in the jaws (or jaws) is relieved to make possible last minute alignment of the matrices with respect to the mold; then the full pressure on the jaw (or jaws) is restored for the casting operation; after casting, the pressure is again relaxed, but the jaws are still maintained under some pressure in wiping contact with the ends of the line to remove any excess metal from the end matrices and the wise jaws; and finally, the jaw (or jaws) is returned to its original or full length position preparatory to receiving the next line.

The above slide valve unit comprises the cam-actuated rod 40a operable within an upper cylindrical valve chamber 40b, a lower horizontal pressure chamber 40c connected to the valve chamber 40b by ports 40d and 40e at both ends of the chambers 40d, conduits 45, 46, 47 and 48 leading into the valve chamber 40b at spaced intervals, and three cylindrical slide valves 40f, 40g and 40h located within the cylinder 40b and spaced along a connecting rod 40i. In addition to their functions as valve heads, the end rods 40d and 40e serve as seals to prevent the fluid from leaking out of the valve unit.

There are two connections between the valve cylinder 40b and the reservoir 33. One is by way of the pressure chamber 40h through a spring-closed relief type valve 50; the other is directly through a vertical passage 51 (normally closed by the valve head 49a) and a spring-closed relief type valve 52. It may be pointed out here that the pressure required to open the valve 50 is much greater than that required to open the valve 52. Also, an open passage 58 formed in the housing 40 connects the conduit line 46 (an exhaust line) directly with the reservoir 33.

The rotary selector valve 27 is formed with a 180° grooved passage 53 around the outside to cooperate with the two conduits 46 and 47 leading from the valve housing 40, as well as with a third conduit 61 leading from one side of the motor 25 (see Fig. 15). The conduit 45, as shown in Fig. 15, leads directly from the valve housing 40 to the opposite side of the motor. In Figs. 7 to 10, the selector valve 27 is shown in four different positions being moved to these different positions by the rotation of the control knob 23 which adjusts the pinion 13 to as many different positions for quadding with either or both jaws or for regular machine operation. It may be noted that in the first three positions of the valve 27, the conduit 47 (which controls the flow of fluid from the jaw closing movements) connects the groove 53 with the conduit 61 leading to the motor 25, the conduit 46 (which is the exhaust line) being closed in all three positions.

In the fourth position of the valve, however, as shown in Fig. 10, the jaw closing conduit 47 connects via the groove 53 with the exhaust or by-pass conduit 46, the conduit 61 being closed to shut off the flow of fluid to the motor from the selector valve. Actually, therefore, the selector valve 27 has only two different operative positions, one for quadding or centering, which centering, with any one of the three shown in Figs. 7 to 9. In other words, if the selector valve 27 were operated independently, rather than by the control knob 23, it need only be shifted to one or the other of two different positions.

As shown in Figs. 15, the rotary pump 34 is connected at its inlet or suction side by a conduit 37 to the reservoir 33 and at its outlet or pressure side by the conduit 48 to the valve housing 40, the fluid (oil) being circulated con...
tinuously through the system. Preferably, the hydraulic system is closed, air free and filled with liquid at all times.

The position of the rotary selector valve 27 when the knob 23 is turned for quadding with the right hand jaw is shown in Fig. 7. The rotation of the knob 23 to this position, as explained above, positions the pinion 13 to engage the rack 11 and disengage the rack 11. At the beginning of the machine cycle, the slide is in the neutral and at rest position shown in Fig. 11, the fluid being pumped from the pressure line 48 (see Fig. 15) into the valve chamber 40 and then around the valve head 40 into the open passage 56 for return to the reservoir 33. During the machine cycle, the depression 41 of the slide valve control cam 41 (Fig. 1) moves the rod 40 to the high pressure closing position shown in Fig. 12, at which position the fluid is directed from the line 48 to the jaw closing line 47 and then into the passage 53 of the valve 27, and finally from the passage 53 through the line 61 into the motor 25, rotating the motor shaft 15 clockwise (as indicated by the arrow in Fig. 15) and rotating the pinion 13 in the same direction for the jaw closing movement. The hydraulic motor 25 produces high torque but maintains a constant speed, thereby permitting high squeezing pressure to be applied to the line of motor jaws 1 and 2. When further movement of the jaws is prevented and the pressure builds up in chamber 40, the opening of the high pressure relief valve 50 stabilizes the conditions and permits the return of fluid to the reservoir 33. The slide valve is next actuated by the raised surface 41 of the cam 41 which brings the slide to the low pressure closing position represented in Fig. 13, in which position the fluid flows through the low pressure relief valve 52, instead of the valve 50. As explained above, a lighter pressure is required to open the valve 52, so that the pressure on the line is reduced to the desired value during the cycle. The casting operation takes place while the full pressure controlled by the relief valve 50 is applied to the right hand jaw 2. The further rotation of the cam shaft 41 brings the raised surface 41 into engagement with the lever 42, returning the slide valve to the low pressure closing position represented in Fig. 13, to achieve a wiping action between the jaws and the ends of line as the line is being vertically transported from between the vise jaws. The raised surface 41 of the cam 41 next brings the slide valve to the jaw opening position represented in Fig. 14, in which position the passage 51 is blocked by the valve head 40 and the path of flow of the fluid is from the pressure line 48 through the port 40 into the pressure chamber 40 (see Fig. 15) and out through the port 40 into the jaw opening line 45 and thence into the reverse side of the motor 25, the fluid acting to rotate the motor shaft 15 and the pinion 13 in a counterclockwise direction to return the right hand jaw to its original or line receiving position. The fluid from the opposite side of the motor is returned to the reservoir 33 by way of the line 61, selector valve passage 53, conduit 47, and return passage 58.

When quadding with the left hand jaw, the selector valve 27 will be adjusted to the position shown in Fig. 9, but the cycle of the slide valve is, of course, the same as described above. Thus, in the neutral position indicated in Fig. 11, the fluid flows through the chamber 40 to the return passage 58 back to the reservoir 33. The slide valve is then moved to the high pressure closing position, represented in Fig. 12, where the fluid flows from the pump discharge line 48 through the jaw opening line 47, the passage 53 in the selector valve 27, then through the pipe line 61, and finally to the motor 25. Motor shaft 15 and pinion 13 will be rotated clockwise as before but, since the pinion is connected with the rack 11 and disengaged from the rack 12, the left hand jaw will be moved to the right as required.

For centering the cylinder valve will be adjusted to the position shown in Fig. 8 but, again, the operation of the slide valve will be the same. In this instance, the pinion 13 will be engaged with both racks 11 and 12 and hence, when rotated clockwise, will move the two jaws equidistantly toward each other for the line closing action and later restore the jaws simultaneously to their original or line receiving positions.

When the selector valve 27 is adjusted to the "regular" position, as represented in Fig. 10, by rotation of the knob control 23, the cycle of the slide valve unit 40 does not have any effect on the jaws, the reason being that the selector valve passage 53 causes the fluid to by-pass the motor and return by way of the exhaust conduit 46 to the reservoir 33. Under this setting of the control knob 23, the pinion 13 is disengaged from the racks 11 and 12 and the jaws are not actuated.

As mentioned above, during regular operation of the machine, it is equally desirable to relieve the pressure on the justified line first and second justification for purposes of alignment of the matrices with respect to the mold. This is accomplished by moving the left hand jaw a small increment against the end of the line before first justification and then, after first justification, backing the left hand jaw off the slight increment required by the vertical alignment and the face adjustment which is necessary before final justification takes place. During second justification, the jaw is again moved a small increment to compress the line just before the justification bar 3 rises. After casting, the left hand jaw is backed off the increment and restored to normal position.

The mechanism herein provided for achieving the above action of the left hand jaw is controlled by the vertically disposed, spring-actuated rod 8 loosely connected at the lower end to the arm 6 of the spring-actuated, cam-controlled lever 6. The lever 6 is pinned to the lower end of the rod 8, and the pin travels in a vertical slot (see Fig. 1). The rod is always under the upward tension of a spring 65 (Figs. 1 and 3) but is normally maintained in its lower position by the lever 6. The upper end of the rod 8 is pivotally attached to an arm 66 (see Fig. 4) and arm being an extension of a sleeve 67 which is loosely mounted on a connecting shaft between the left hand jaw rack 11 and the connecting block 110. The inner surface of the sleeve 67 is threaded into a fixed annular collar 68 accommodated within a housing and locked therein by a screw 69. As viewed in Fig. 4, the connecting block 110 hangs normally against the right face of the arm 66 in the open position of the jaws. As the rod 8 rises, the arm 66 rotates the sleeve 67, and the threaded engagement of the sleeve with the collar 68 effects translation of the sleeve with respect to the collar, moving the left hand jaw a small distance to the right. The downward movement of the rod 8 reverses the movement of the parts, allowing the jaw to return to normal position. In quadding with the right hand jaw, the arm 66 will be actuated as for a regular machine operation but its purpose under such condition is merely to establish the proper banking position for the left hand jaw rather than to relieve the pressure on the line for alignment purposes. In quadding with the left hand jaw, the block 110 will be out of contact with the arm 66 and hence its actuation under such conditions will be entirely idle.

While the operation of the mechanism will have been understood from the foregoing detailed description, a few added words of explanation may be helpful. The selector valve 27 of course controls the path of fluid through the hydraulic system and the automatically operated valve unit 40 controls the sequence of operation.
What is claimed is:

1. In a typographical casting machine, the combination of a pair of line clamping jaws, each of which is movable from a normal full line receiving position to a quadding position and return, and hydraulic pressure mechanism for effecting at least the quadding movement of one or both of the jaws, said mechanism comprising a closed liquid circulating system which includes a liquid reservoir, a continuously operated pump for continuously circulating the liquid through the system, and a single reversible hydraulic motor common to both jaws, together with machine conditioning means for connecting said motor to either jaw for quadding or with both jaws for centering, or for disconnecting the motor from both jaws for a regular machine operation, and an adjustable selector valve for admitting the continuously circulating liquid into the motor when the machine is conditioned for a quadding or centering operation and for shutting off the liquid from the motor when the machine is conditioned for a regular machine operation.

2. In a typographical casting machine, the combination of a pair of line clamping jaws, at least one of which is movable from a normal full line receiving position to a quadding position and return, and hydraulic pressure mechanism for effecting both the quadding and return movements, a continuously operated pump for continuously circulating the liquid through the system which includes a liquid reservoir, a continuously operated pump for continuously circulating the liquid through the system, and a single reversible hydraulic motor operated by the circulating liquid, together with machine conditioning means for connecting the motor to the jaw for a quadding operation or for disconnecting the motor from the jaw for a regular machine operation, an adjustable selector valve for admitting the continuously circulating liquid into or for shutting it off from the motor according as the machine is conditioned for a quadding or regular machine operation, and an automatically operated valve which, when the machine is conditioned for a quadding operation, first admits the liquid into one side of the motor for the quadding movement of the jaw before the casting operation and later admits the liquid into the opposite side of the motor for the return movement of the jaw after the casting operation.

3. A combination according to claim 2, wherein the closed liquid circulating system includes a high pressure relief valve which controls the pressure exerted by the motor during both of its jaw quadding and jaw return movements.

4. A combination according to claim 2, wherein the closed liquid circulating system includes return passages which connect the opposite sides of the motor to the reservoir and which permit the return of the liquid to the reservoir during the jaw quadding and jaw return movements of the motor.

5. In a typographical casting machine, the combination of a pair of line clamping jaws, each of which is movable from a normal full line receiving position to a quadding position and return, and hydraulic pressure mechanism for effecting both the quadding and return movements of either one of the jaws, said mechanism comprising a closed liquid circulating system which includes a liquid reservoir, a continuously operated pump for continuously circulating the liquid through the system, and a single reversible hydraulic motor common to both jaws, together with machine conditioning means for connecting said motor to either jaw for quadding or with both jaws for centering, or for disconnecting the motor from both jaws for a regular machine operation, and an automatically operated valve which, when the machine
is conditioned for a quadding or centering operation, first admits the liquid into one side of the motor for the quadding or centering movement of the jaws before the casting operation and later admits the liquid into the opposite side of the motor for the return movement of the jaws after the casting operation.

6. In a typographical casting machine, the combination of a pair of line clamping jaws, each of which is movable from a normal line receiving position to a quadding position and return, and fluid pressure mechanism for effecting both the quadding and return movements of both jaws, said mechanism including a single reversible fluid operated motor common to both jaws, together with machine conditioning means for connecting said motor to either jaw for quadding or with both jaws for centering, or for disconnecting the unit from both jaws for a regular machine operation, together with an adjustable selector valve controlled by the machine conditioning means for admitting fluid to the motor when the machine is conditioned for a quadding or centering operation and for shutting off the fluid from the motor when the machine is conditioned for a regular operation.

7. In a typographical casting machine, the combination of a pair of line clamping jaws, each of which is movable from a normal line receiving position to a quadding position and return, a single reversible power driven shaft for effecting both the quadding and return movements of both jaws, a power operated device for rotating said shaft in opposite directions, racks connected to the respective jaws, and a pinion mounted on and rotated by said power driven shaft, said pinion being adjustable into mesh with either rack for quadding with the corresponding jaw or with both racks for centering with both jaws, and said pinion being further adjustable out of mesh with both racks for a regular machine operation, and means for effecting such adjustments of the pinion, together with means controlled by the pinion adjusting means for actuating the power operated device when the pinion is in mesh with either one or both racks and for deactivating the power operated device when the pinion is out of mesh with both racks.

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