Oct. 31, 1933. D. H. WEST 1,932,760

DUPLEX HYDRAULIC BROACHING MACHINE

Filed March 3, 1931 2 Sheets-Sheet 1

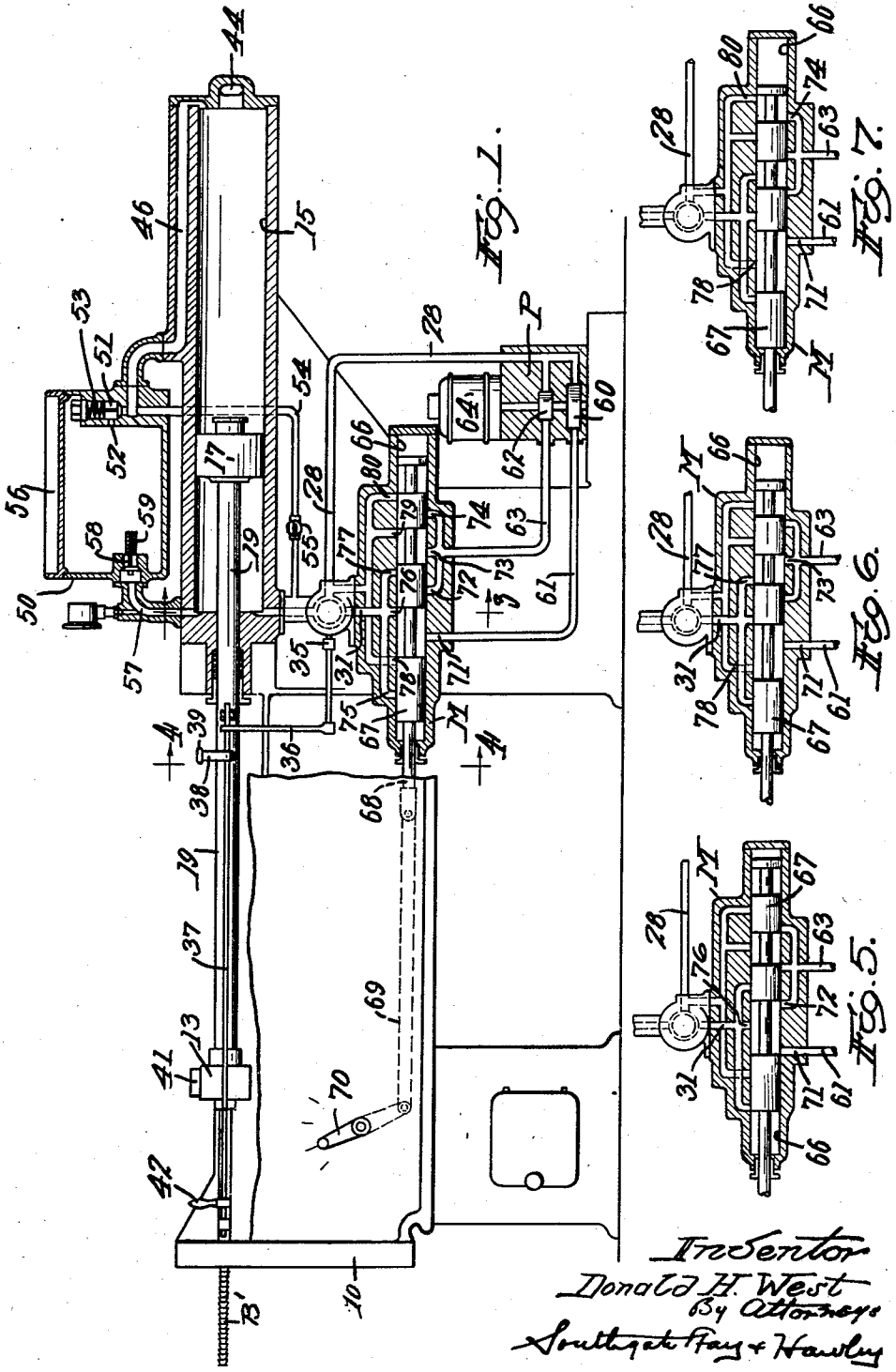


Fig. 1.

Fig. 7.

Fig. 6.

Fig. 5.

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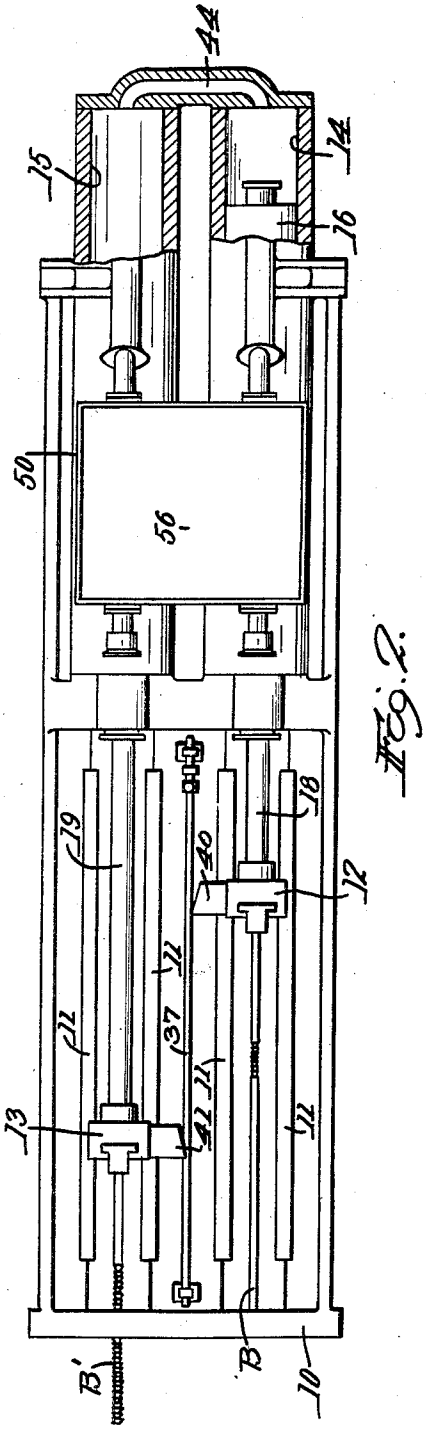


Fig. 2.

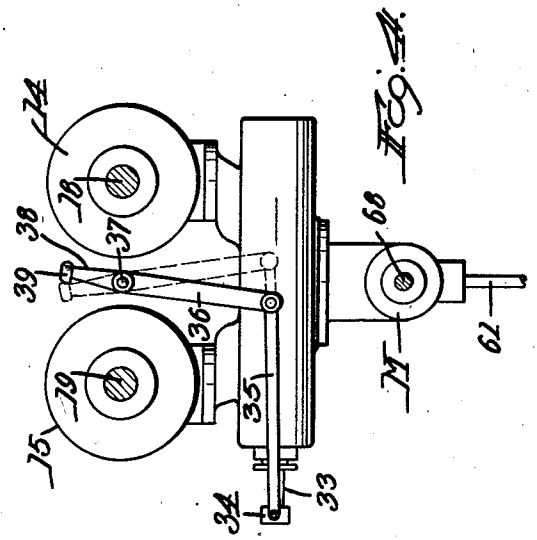


Fig. 4.

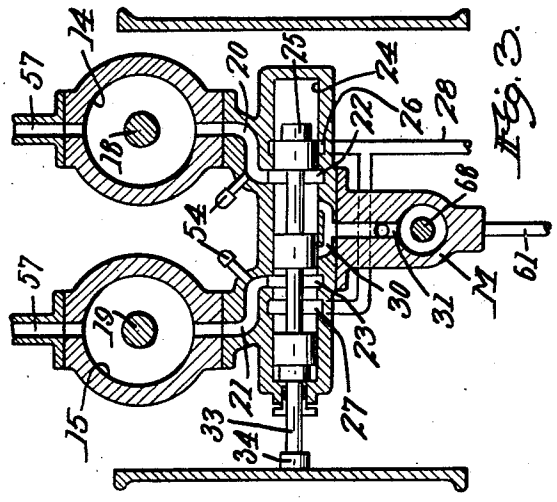


Fig. 3.

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UNITED STATES PATENT OFFICE

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DUPLEX HYDRAULIC BROACHING MACHINE

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Application March 3, 1931. Serial No. 519,751

7 Claims. (Cl. 90—33)

This invention relates to a broaching machine of the type in which two broaching heads are provided.

It is the general object of my invention to provide improved hydraulic operating and control mechanism for a duplex broaching machine, by means of which the broaches may be operated alternately and at selected and definite speeds and strokes.

A further object is to provide a construction by which the broaches will be hydraulically operated simultaneously in opposite directions, so that one broach will be returning to initial position while the second broach is making its cutting strokes.

I further provide for automatically reversing the travel of the broaches as the cutting stroke of either broach is completed.

My invention further relates to arrangements and combinations of parts which will be hereinafter described and more particularly pointed out in the appended claims.

A preferred form of the invention is shown in the drawings, in which

Fig. 1 is a sectional side elevation of my improved broaching machine;

Fig. 2 is a plan view thereof, partly in section;

Figs. 3 and 4 are detail sectional elevations, taken along the lines 3—3 and 4—4 in Fig. 1; and

Figs. 5, 6 and 7 are sectional views showing the manual control valve in different positions.

Referring to the drawings, I have shown a duplex broaching machine comprising a bed or frame 10 (Fig. 2) provided with guideways 11 for a pair of broaching heads 12 and 13. A broach B is mounted in the head 12 and a broach B' is mounted in the head 13. Hydraulic cylinders 14 and 15 are mounted at the right hand or head end of the bed 10, and pistons 16 and 17 are slidable in these cylinders 14 and 15 and are connected by piston rods 18 and 19 to the broaching heads 12 and 13 respectively.

The left hand or operative ends of the cylinders 14 and 15 are connected by passages 20 and 21 (Fig 3) to annular ports 22 and 23 formed in the cylindrical outer wall of a valve chamber 24 in which a piston valve 25 is slidably mounted. Additional annular ports 26 and 27 in the valve chamber 24 are connected through suitable passages to an exhaust pipe 28 (Fig. 1). A fifth annular port 30 (Fig. 3) is connected by a passage 31 to a manual hydraulic control valve mechanism M to be described.

When the piston valve 25 is moved to the left, as shown in Fig. 3, oil or other fluid under pressure will be admitted from the valve mechanism M through the passage 31 to the ports 30 and 22 and through the passage 20 to the left hand end of the cylinder 14, thus forcing the piston 16 to the right in Fig. 1 and drawing the broach B through the work. At the same time, the left hand end of the second cylinder 15 is connected through the passage 21 and ports 23 and 27 to the exhaust pipe 28, thus permitting oil to flow from the left hand end of the cylinder 15 during the idle or return stroke of the piston 17 and broach B'.

When the piston valve 25 is moved to its extreme right hand position, the described connections will be reversed and the piston 17 will be given an operative stroke to the right in Figs. 1 and 2.

The position of the piston valve 25 is controlled by reversing mechanism which will now be described. The piston valve 25 is provided with an outwardly projecting valve stem 33 at one end, which valve stem has an enlarged head 34 connected by a link 35 (Fig. 4) connected to an arm 36 on a rock shaft 37 (Fig. 2) extending longitudinally of the bed 10 and between the broaching heads 12 and 13.

An arm 38 is adjustable lengthwise on the rock shaft 37 and is provided with a cam roll 39 positioned for engagement by cam plates 40 and 41, mounted on the broaching heads 12 and 13 respectively.

As the broaching head 12 completes its operative stroke to the right, the cam plate 40 will engage the cam roll 39 and move it to the dotted line position shown in Fig. 4, thus shifting the piston valve 25 to the right in Fig. 3 and causing the broaching head 13 to receive an operative movement. At the end of this movement, the piston valve 25 is automatically returned to its initial position and the cycle of operations is repeated.

It will be apparent, therefore, that I have provided a duplex hydraulic broaching machine in which provision is made for automatically reversing the machine and for causing alternate operative movements of the two broaching heads. A handle 42 is provided on the rock shaft 37 by which the machine may be reversed manually at any desired point or may be stopped by placing the valve 25 in mid-position.

At their outer or right hand ends, as viewed in Fig. 2, the cylinders 14 and 15 are connected by an open passage 44 through which oil may flow freely back and forth from one cylinder to

the other in accordance with the movements of the pistons 16 and 17.

The outer end of each cylinder is also connected through an overflow passage 46 (Fig. 1) to a reserve tank or reservoir 50, mounted above the broaching machine and preferably provided with a removable cover 56 to exclude dirt therefrom. A check valve 51 is interposed between the overflow passage 46 and a port 52 leading into the tank 50. This check valve is pressed downward by a spring 53 but will open when the pressure in the passage 46 exceeds a predetermined amount.

A pipe 54 (Fig. 1) leads from each overflow passage 46 to the corresponding cylinder supply passage 20 or 21 (Fig. 3). A shut-off valve 55 is provided in each pipe 54, which is normally left closed.

One of these valves 55 will be opened when it is desired to shorten the stroke of the broaching heads. This will allow oil under pressure to be delivered through the passage 20 or 21 to the inner or left hand side of the piston 16 or 18 and through the pipe 54 and passage 46 to the outer or right hand side. The piston area at the left hand side is reduced by the cross section of the piston rod and consequently greater pressure will be exerted on the outer or right hand side of the piston, thus moving the piston to the left to shorten the stroke the desired amount, while the other piston remains at its extreme inner or left hand position.

A connection 57 (Fig. 1) is made from the inner end of each cylinder to the tank 50, which connection is provided with a check valve 58 opening outward from the tank. A spring 59 moves this check valve toward closed position but normally leaves the valve slightly "cracked" to permit escape of air from the cylinder. When the cylinders are filled with oil, the pressure of the oil closes the check valves 58. The valves 58 may also be manually opened to allow oil to flow from the tank 50 into the cylinders when initially preparing the machine for operation.

I will now describe the mechanism for supplying oil or other fluid under pressure to the broaching machine and for controlling the speed of operation. Oil is preferably supplied by a dual capacity pump P having a large pumping unit 60 connected by a pipe 61 to the control valve mechanism M and having a small pump 62 connected to the valve mechanism M by a pipe 63. Both pumps are connected to the common return or exhaust pipe 28 previously described and the pumps are both driven by an electric motor 64 or in any other convenient manner.

The valve mechanism M comprises an open passage or cylinder 66 in which a piston valve 67 is mounted for axial movement. The valve 67 is provided with a valve rod 68 extending through one head of the cylinder 66 and connected by a link 69 to a hand lever 70 by which the valve mechanism may be manually adjusted.

The piston valve 67 is shown as comprising four spaced piston sections connected by reduced portions which provide annular passages between the several ports of the cylinder.

The discharge pipe 61 from the large pump 60 is connected directly to a port 71 in the wall of the cylinder 66. The pipe 63 from the small pump 62 is connected to a series of ports 72, 73 and 74. The supply pipe 31 for the reversing valve mechanism is connected by branch passages to a series of ports 75, 76 and 77. The exhaust pipe 28 is also connected through branch passages to a series of ports 78, 79 and 80.

In Figs. 1, 5, 6 and 7 I have indicated the positions of the valve 67 corresponding to medium, high and low speed operation, and neutral position.

Referring to Fig. 5, showing high speed operation, it will be evident that the output of both the large and small pumps is delivered through the pipes 61 and 63 and ports 71 and 72 to the port 76 connected through the passages 31 and the reversing valve mechanism and through one of the passages 20 or 21 to the operative end of the corresponding cylinder. At the same time all of the exhaust connections from the pipe 28 to the valve mechanism M are closed or connected to a neutral space between two piston sections.

In Fig. 1 the valve 67 is in position for operation at medium speed. The large pump 60 is connected through the pipe 61 and ports 71 and 76 to the passage 31 and through the reversing valve mechanism to the operative cylinder. At the same time the small pump 63 is by-passed through the ports 73 and 79 to the exhaust or return pipe 28. Consequently the operative piston is moved by the fluid supplied by the large pump only.

The connections for low speed operation are shown in Fig. 6, in which the discharge of the small pump 62 is put through the pipe 63 and ports 73 and 77 to the passage 31 and through the reversing valve mechanism to the operative cylinder. At the same time the large pump 60 is by-passed through the pipe 61 and ports 71 and 78 to the return pipe 28.

If the piston valve 67 is moved to the extreme left hand position indicated in Fig. 7, the pump 60 will be connected through the pipe 61 and ports 71 and 78 to the exhaust and the small pump 62 will be similarly connected through the pipe 63 and ports 74 and 80 to the exhaust, thus by-passing the entire discharge of both pumps and delivering no oil to the reversing valve mechanism or to the cylinders.

Having thus described my improved broaching machine, it will be seen that I have provided a machine in which two broaching heads may be alternately operated at any one of three selected speeds and for any desired stroke, the construction also providing for automatic reversal of movement of the broaching heads at the ends of their working strokes.

I also provide three fixed and definitely related working speeds, selectively controlled by the setting of the hand lever 70, which may also be set in neutral position to stop all operations of the broaching machine. Furthermore, the reversing valve mechanism may be operated manually as well as automatically and may be set in mid-position to stop the machine if desired. Ordinarily, however, the machine will be stopped by throwing the hand lever 70 to neutral position.

Having thus described my invention and the advantages thereof, I do not wish to be limited to the details herein disclosed, otherwise than as set forth in the claims, but what I claim is:—

1. In a duplex broaching machine, a pair of broaching heads, a cylinder and piston for each head, a two-volume pump, and means to selectively connect either part of said pump to the operative end of a selected cylinder and to simultaneously connect the corresponding end of the second cylinder to the return of said pump.

2. In a duplex broaching machine, a pair of

broaching heads, a cylinder and piston for each head, a two-volume pump, and means to selectively connect either part or both parts of said pump to the operative end of a selected cylinder and to simultaneously connect the corresponding end of the second cylinder to the return of said pump.

3. In a duplex broaching machine, a pair of broaching heads, a cylinder and piston for each head, a two-volume pump, means to selectively connect either part or both parts of said pump to the operative end of a selected cylinder and to simultaneously connect the corresponding end of the second cylinder to the return of said pump, and means to reverse said connections.

4. The combination in a duplex broaching machine as set forth in claim 3, in which said selective means comprises a cylinder having ports connected to the two parts of said pump and to the broaching machine cylinders and to the return of said pump, and a piston valve manually movable axially to selected positions in said cylinder corresponding to different speeds of the broaching heads.

5. The combination in a duplex broaching machine as set forth in claim 3, in which said selective means comprises a cylinder having ports connected to the two parts of said pump and to the broaching machine cylinders and to the return of said pump, and a piston valve manually movable axially to selected positions in said cylinder corresponding to high, medium and low speeds of the broaching heads, and to a neutral position.

6. In a duplex broaching machine, a pair of broaching heads, a cylinder and piston for each head, a two-volume pump, means to selectively connect either part or both parts of said pump to the operative end of a selected cylinder and to simultaneously connect the corresponding end of the second cylinder to the return of said pump, and automatic means rendered operative at the completion of a working stroke of said machine effective to reverse said connections.

7. In a duplex broaching machine, a pair of broaching heads, a cylinder and piston for each head, a two-volume pump, and means to selectively connect either part of said pump to the operative end of a selected cylinder and to simultaneously connect the corresponding end of the second cylinder and the inoperative part of said pump to the return of said pump.

DONALD H. WEST.