

Feb. 6, 1934.

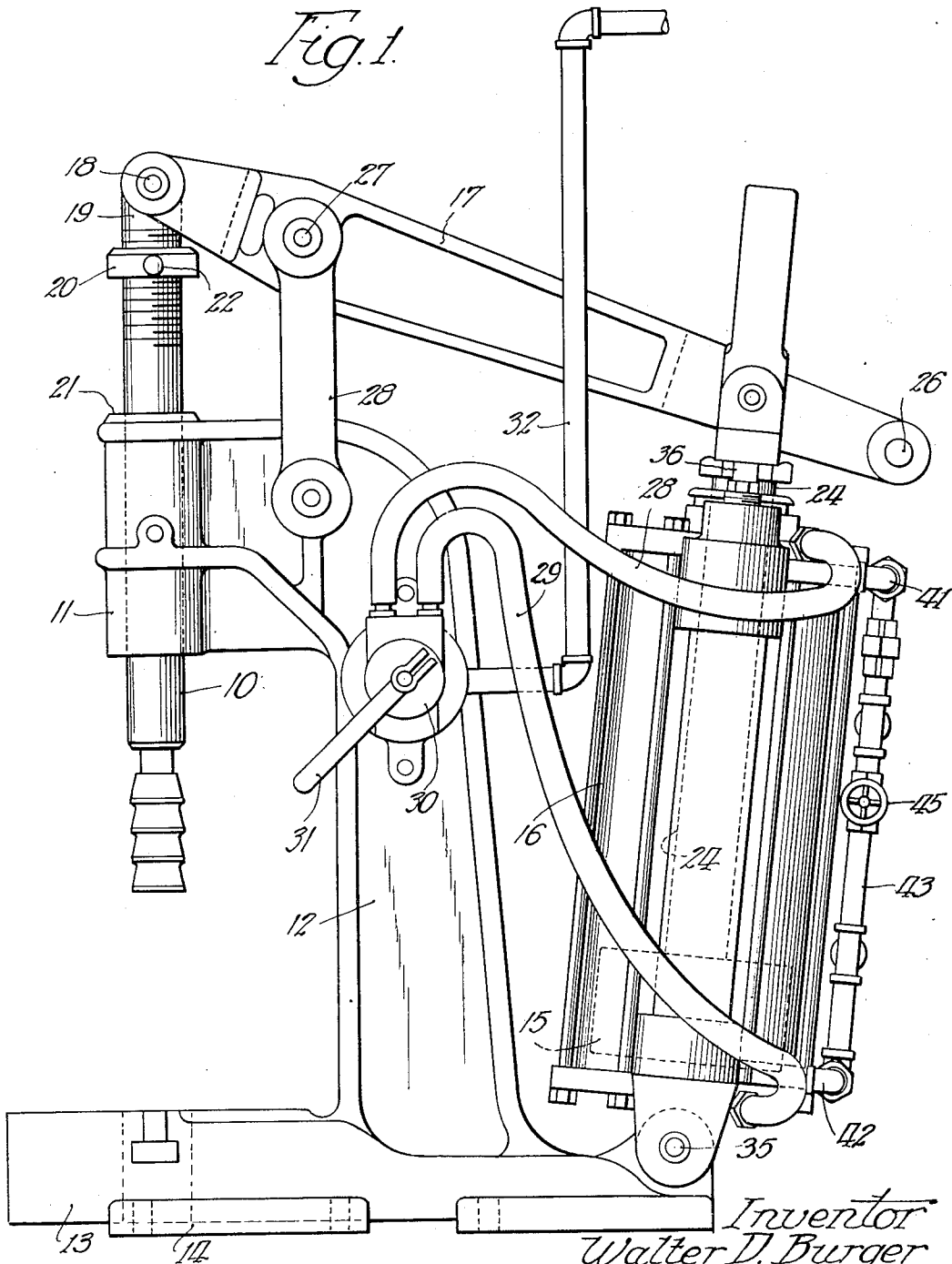
W. D. BURGER

1,945,879

BROACHING PRESS

Filed June 22, 1929

2 Sheets-Sheet 1



Inventor
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By: Roland C. Rehm Atty.

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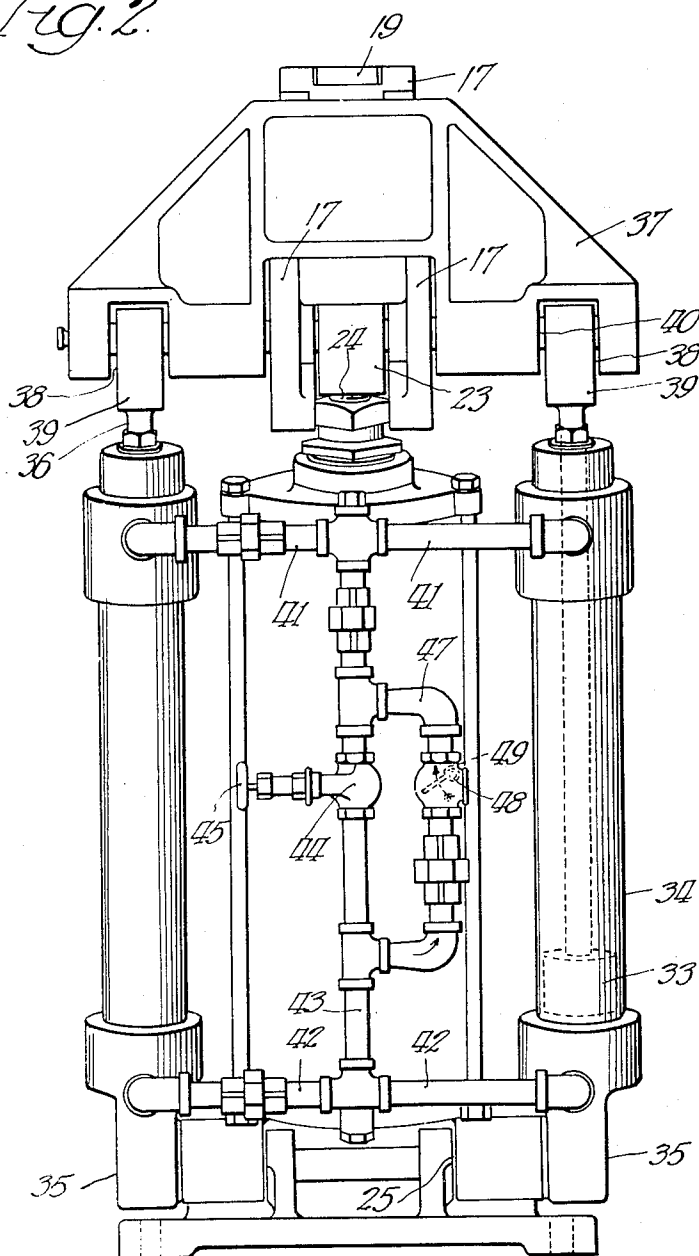
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Fig. 2.



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UNITED STATES PATENT OFFICE

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BROACHING PRESS

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3 Claims. (Cl. 90—33)

This invention relates to pneumatically operated apparatus and among other objects aims to provide apparatus of the character herein disclosed capable of close control without sacrifice of efficiency.

The nature of the invention may be readily understood by reference to one construction embodying the invention and illustrated in the accompanying drawings.

10 In said drawings:

Fig. 1 is a side elevation of a press, the supporting base having been omitted to permit illustration on a larger scale.

15 Fig. 2 is a rear elevation of the press showing the actuating and control mechanism.

The invention has been herein embodied in a vertically operating press, that is, one in which a compressive force is applied and in which the ram, in the form of a plunger 10, operates vertically. The plunger is mounted for vertical reciprocation in a housing 11, in this case integral with the press frame 12 whose base 13 is supported on an appropriate supporting structure not here shown. For connection with such supporting structure the base is provided with laterally extending perforated flanges 14 by means of which the press frame is adapted to be bolted or otherwise appropriately secured to the supporting structure.

30 In the present case the ram is actuated by pneumatic means in the form of a piston 15 and cylinder 16 operatively connected to the ram, in this case, by a lever or ratio arm 17 which not only serves to transmit the power to the ram but permits the design of a press in which the ram stroke may be less or greater than the piston stroke. The ratio arm 17 is forked at its forward end and pivoted at 18 to a threaded fitting 19 into which the upper end of the plunger 10 is screwed. A nut 20 longitudinally adjustable on the threaded upper end of the plunger provides means for limiting the downward stroke of the plunger by engagement with the upper end 21 of the housing 11, if in any case it be desirable to terminate the plunger stroke at a point short of its maximum stroke. A set screw 22 serves to hold the nut 20 at its adjusted position.

50 The lever 17 whose opposite end is also forked, is connected on the opposite side of its fulcrum point to the pneumatic means,—in this case being pivoted to the fitting 23 into which the upper end of the piston rod 24 of piston 15 is screwed. To compensate for longitudinal movement of lever 17 (to permit the movement in a rectilinear path to which its front end is constrained by direct connection with the plunger) the cylinder 16 is provided with a pivotal connection 25 to base 13. Such pivotal connection also advantageously permits the connection of

the piston rod 24 either at an intermediate point of the lever 17 as here shown, or at its end 26, depending upon the desired ratio between the piston stroke and the plunger stroke. The fulcrum 27 of ratio arm 17 is connected to frame 65 12 through a link 28 pivoted at its ends respectively to the lever and frame. The position of the fulcrum point 27 depends upon the desired stroke ratio between the plunger and power cylinder, and the press may be equipped with a 70 ratio arm having an appropriately located fulcrum point to provide approximately the desired ratio.

The piston 15 is in the present case actuated by air under pressure supplied to the upper and 75 lower ends of the cylinder 16 through appropriate ports communicating with conduits 28 and 29 in the form of flexible hose, the ends of which are connected to control valve 30, operated by hand lever 31. The valve directs the air either 80 above or below the piston as desired and opens the opposite port through the appropriate hose connection, to the exhaust. Air under pressure is supplied to the control valve through pipe 32.

The operation of the pneumatic means is controlled in this case by hydraulic means in the form of a piston 33 and hydraulic cylinder 34 operatively connected to the press mechanism to govern the rate of movement of the ram. In the present case the hydraulic means is connected to the 90 lever 17 coaxial with the point of connection of the piston rod 24. The hydraulic means in this case comprises a pair of hydraulic cylinders and pistons, located on opposite sides of the pneumatic cylinder, the cylinders being pivoted at 35 coaxial 95 with the pivot 25 of the pneumatic cylinder. The piston rods 36 of the hydraulic pistons 33 are connected to lever 17 through a yoke 37 which spans lever 17 and is recessed at 38 adjacent its ends to receive the fittings 39 to which it is pivotally connected and which fittings are connected with piston rods 36. Since the afore- 100 said pivotal connections with lever 17 are coaxial in the present arrangement, the pivoting of the pneumatic and hydraulic piston rods to the lever 105 17 and the latter to the yoke 37 may be effected by a single pivot shaft 40 extending longitudinally through the yoke 37.

The hydraulic cylinders are provided with a passage which permits the hydraulic liquid (oil 110 in the present case) to pass from one side of the piston to the other during the movement of the pistons. Such passage is herein shown in the form of pipe connections 41 and 42 communicating with the upper and lower ends, respectively, 115 of the cylinders and connected by a conduit 43. The rate of passage of the oil from one side to the other of the pistons is controlled by adjusting the effective area of the passage, and adjustment is effected in the present case by a needle 120

valve 44 of appropriate design located in the conduit 43 and controlled by a valve handle 45. Thus the rate of travel of the pistons 33, and the consequent rate of movement of the plunger 10 may be closely controlled, such rate varying from a speed which is barely noticeable to a speed which is substantially that of the free movement of the piston 15 under air pressure. Thus the rate of travel of the plunger may be adjusted to the needs of the particular work performed and such rate may be made uniform notwithstanding variations of pressure in the pneumatic cylinder due to expansion of the air therein. In usual practice the air pressure supplied to cylinder 16 is greatly in excess of the actual power requirements and it is, therefore, possible to cut off the air inlet port of the cylinder at an intermediate point of the piston stroke.

The smooth and uniform travel of the plunger 10 permits the apparatus to be used in operations for smoothly and uniformly applying an operating force (pressure in the present instance),—such operations, for example, as broaching and pressing in long bearings where there is the danger of tearing or distorting the metal unless smoothness and uniformity of power delivery is secured. In the present instance the plunger 10 is shown equipped with a push broach 46 which requires a very smooth delivery of power to secure a smooth and finished piece of work.

Rapid return or retreat of plunger 10 after its operation is advantageously effected, in the present arrangement, by by-passing the returning oil around needle valve 44. This is effected herein by a conduit pipe 47 connected to conduit 43 on opposite sides of the needle valve and provided with a swing check valve 48. The swing check 49 in the check valve is so arranged that, as indicated by the arrow associated therewith, the oil may travel upwardly through conduit 47, i. e., from below to above the pistons 33 but not in the reverse direction. In traveling in such reverse direction it must travel through the needle valve 44 which effectively controls the downward or power stroke of the ram.

To compensate for variation in volume between the space above the pistons 43 and that below (the difference being caused by the space occupied by the piston rod 36), the fluid space is not entirely filled with oil. This does not cause any non-uniformity in the active stroke of the plunger 10 because during such stroke the lubricant travels from the smaller volume above the pistons 33 to the larger volume below,—hence there is no point of the active stroke during which the space above the pistons 33 is not fully filled with oil. On the return stroke it makes little difference whether the space in the cylinders 34 is completely filled with oil because the return movement is intended to be a free or unchecked movement.

Obviously the invention is not limited to the details of construction of the illustrative mechanism since these may be variously modified. Moreover, it is not indispensable that all features of the invention be used conjointly, since they may be employed in various different combinations and sub-combinations.

Having described one embodiment of my invention, I claim:

1. A broaching press or the like comprising in combination, a broach holder, pneumatically

actuated means including a cylinder and piston for actuating said holder, a lever for transmitting power from said pneumatically actuated means to said holder, means including a yoke for pivotally connecting said pneumatically actuated means with said lever, a stationary supporting frame including means constraining said holder to travel in a straight line, hydraulic braking means including a piston and a cylinder connected with said yoke, means for permitting the hydraulic fluid to pass from one side to the other of said hydraulic piston, means for controlling the passage of said fluid during the power stroke of said head, said controlling means being constructed and arranged to permit a free passage of the fluid in the opposite direction to permit a rapid return of said head, means for pivoting said pneumatically actuated means to said supporting frame so that the former is free to follow the movement of said lever, a control valve for said pneumatically actuated means carried on said stationary frame, and flexible conduits extending from said control valve to said pneumatically actuated means for conducting the pneumatic fluid, whereby said pneumatically actuated means is free to move independently of said control valve.

2. A broaching press or the like comprising in combination, a tool holding head, a supporting structure having a guideway to guide said head in a straight line, an operating lever for said head and pivoted to permit said head to travel in a straight line, pneumatic actuating means including a piston and cylinder fulcrumed to said lever for operating said head and pivotally connected to said supporting structure to compensate for angularity of said lever, hydraulic braking means including a piston and cylinder connected with said lever to secure a uniform operative travel for said head regardless of power variations of said pneumatic actuating means, means for permitting the hydraulic fluid to pass from one side to the other of said hydraulic piston, and restricting means for restricting the passage of said fluid only during the power stroke of said head leaving said pneumatic means unchecked on the return travel.

3. A broaching press of the character described comprising in combination, a broach holding head, pneumatically actuated means including a cylinder and piston for actuating said head, a lever connecting said head with said pneumatic means to transmit driving power to said head, pivotal connections to compensate for the angularity of said lever, hydraulic braking means including a piston and cylinder connected with said lever to secure a uniform operative travel for said head, pipes connecting the ends of said hydraulic cylinder on opposite sides of said piston and having a control valve therein to regulate the speed of travel of said head on the power stroke, and a by-pass pipe around said valve and connecting with the respective ends of said hydraulic cylinder and having a check valve associated therewith arranged to close said by-pass against passage of fluid on the power stroke but arranged to allow the free return passage of the fluid around said valve on the return stroke of said tool head.

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