April 9, 1968 D. E. BECKETT ETAL 3,376,808

FLUID-OPERATED PRESS

Filed Oct. 24, 1966 2 Sheets-Sheet 1

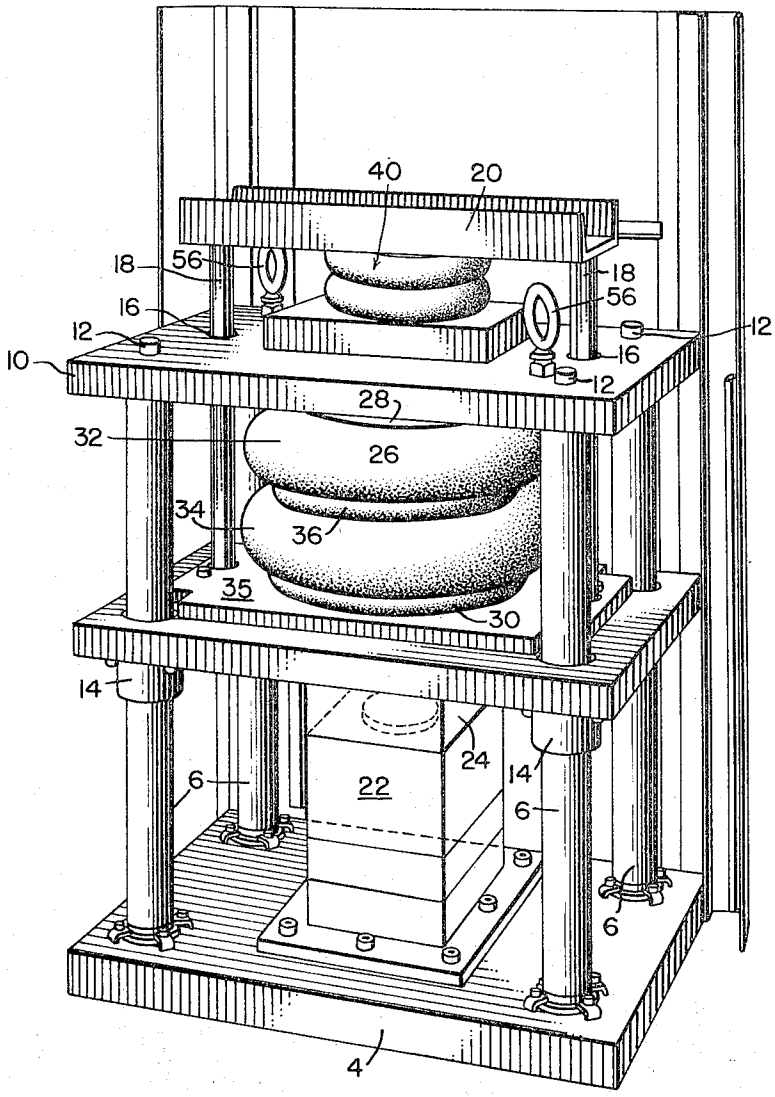


Fig. 1

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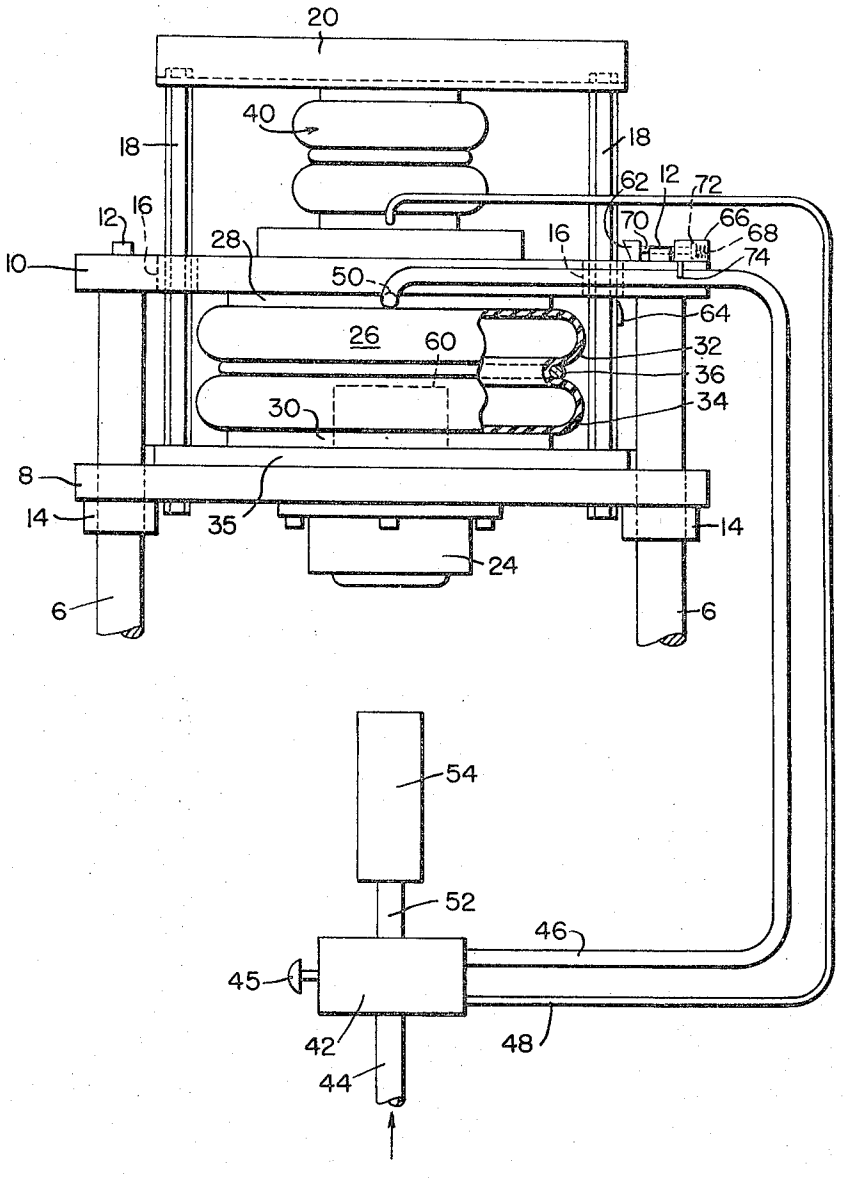


Fig. 2

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FLUID-OPERATED PRESS

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23 Claims. (Cl. 100—53)

This invention relates to a fluid-operated press. The press herein disclosed is adaptable to many uses, including forming, punching, embossing, laminating, and other operations generally performed in a press. While the operating medium preferably is air under compression, it will be understood that the apparatus can be actuated hydraulically, if desired.

An object of the invention is to provide a press including means to advance a movable plate forcefully with great accuracy toward a base plate, and to return the movable platen at a fast rate of speed, the means employed being simple, durable, and economical to operate.

Another object of the invention is to provide a press of the character stated, which is simple and inexpensive to construct, has a minimum number of moving parts, and is relatively free of maintenance expense.

A further object is to embody in a pneumatic press, improved means to conserve operating power while at the same time increasing the output of the press.

The foregoing and other objects are attained by the means described herein and illustrated upon the accompanying drawings, in which:

FIG. 1 is a perspective view of the improved press embodying the present invention.

FIG. 2 is a fragmental elevational view of the same, parts being broken away for clarity of disclosure.

In general, the press comprises a base plate 4 upon which are rigidly mounted the several spaced parallel uprights, posts, or die pins 6. The posts or die pins serve to guide a vertically shiftable platen 8, which is bodily movable toward and from base plate 4 in parallelism therewith. A stationary head plate 10 rests upon the posts or die pins 6, and is rigidly secured to the upper ends thereof in any suitable manner, as by means of screws 12 passing through the head plate and having screw-threaded connection with the upper ends of the posts or die pins. The head plate overlies the movable platen 8, and rests in a plane which is parallel thereto. The movable platen may carry bushings 14 accurately fitted to posts 6 for sliding movement thereon.

The head plate 10 may be drilled at locations 16, 16, to slidably accommodate a pair of lifting rods 18, 18, connected rigidly at their lower ends to the movable platen 8. The upper ends of the lifting rods are connected one to the other, by means of a cross-head 20. The lifting rods, the cross-head, and platen 8 constitute a bodily movable rigid structure whereby a lifting force applied to the cross-head elevates the platen along the posts or die pins 6.

If the press is used in performing a forming operation, the forming dies 22 and 24 may be bolted or otherwise secured to the base plate 4, and to movable platen 8, respectively. If necessary, die 22 may be built up, as suggested by FIG. 1, so as to accommodate the dies to the press stroke of platen 8.

The downward or work stroke of platen 8 is performed by means of a flexible inflatable air bag or bellows 26, which is interposed between the movable platen 8 and the stationary head plate 10. The air bag or bellows may be constructed of heavily reinforced neoprene rubber or similar material. Metallic end plates 28 and 30 seal the ends of the bag against leakage of compressed air, while at the same time providing a firm and durable

mounting of the bag to plates 8 and 10. The bag may include one or more convolutions, indicated at 32 and 34, with a constriction ring 36 defining the convolutions and limiting lateral expansion of the bag when inflated. The numeral 35 indicates a rigid pressure-distributing plate located between the platen and end plate 30.

From the foregoing explanation, it will be understood that inflation of the bag or bellows 26 with air under pressure, results in lowering the movable platen 8 and its die part 24, toward the complementary die part 22 which registers with die part 24. In so moving to the lowered position, platen 8 carries with it the cross-head 20, as previously explained.

A second inflatable air bag or bellows 40 is interposed between the stationary head plate 10 and cross-head 20, and serves to elevate or return the movable platen 8 to retracted or home position, while air exhausts from the main or primary air bag 26. Air bag 40 may be constructed similarly to air bag 26, but is much smaller in diameter and of lesser capacity than bag 26. By so reducing the size and capacity of air bag 40, platen 8 may be returned to home position at a rapid rate, and with the use of very little compressed air. As a result, the hourly productive capacity of the press is increased, and a substantial saving of compressed air power is realized.

With reference to FIG. 2, there is illustrated by way of example, a simplified form of control means for the press, which in practice might be elaborated upon in the interests of convenience and safety, as may be required or preferred. As shown, a control valve 42 receives compressed air from a suitable source of supply 44. A valve actuator 45 may be manipulated, either directly by hand, or indirectly by automatic or semi-automatic means, to direct compressed air to one air bag while exhausting air from the other air bag. Thus, for example, the valve may direct a charge of compressed air into tube 46 for inflating the air bag 26 to lower the platen 8 and its die part 24, while exhausting air from bag 40 by way of tube 48.

To elevate the platen and die part 24, valve 42 may be manipulated to supply compressed air to bag or bellows 40, by way of tube 48, while at the same time exhausting air from bag or bellows 26 through tube 46.

It should here be noted that the exhausting of air from bag 26 shall be very rapid or unrestricted, to ensure a rapid elevating of platen 8 by air bag 40. The rapid or unrestricted exhausting of air bag 26 may be attained in various ways, as by enlarging the exhaust port 50 and tube 46, and providing for rapid escape of air through a quick-exhaust port of control valve 42, or through a separate quick-exhaust valve. As is obvious, separate air feed and exhaust ports may be incorporated in each air bag structure, with suitable valving provided for, thereby enabling the tubes 46 and 48 to serve as supply lines only. The valving and piping arrangement is subject to considerable modification and elaboration, as will be appreciated.

In the example illustrated, exhaust air released through valve 42 may be conveyed by means of a pipe 52, to an exhaust air silencer or muffler 54 (FIG. 2).

The secondary air bag or bellows 40 may be quite small in size, and will consume only a minimal amount of compressed air, because its sole function is to lift the weight of movable platen 8 and die part 24. The absence of heavy springs or other counter-balancing means is particularly to be noted, since such means necessitate additional power consumption in the operation of a press. Noteworthy also is the fact that the larger air bag or bellows 26 applies compressive force over a large area of the movable platen 8, this resulting in great stability and smooth frictionless travel of the platen along the die

pins or posts 6, and eliminating any tendency of the platen to arch or bend under high pressure advancements. Such factors reduce materially the stresses which may be expected to induce wearing of parts and serious maintenance problems.

With reference to FIG. 2, the numeral 60 indicates a bumper or limiting device, the purpose of which is to limit the extent to which air bag 26 may collapse during upward travel of platen 8 to home position. The bumper may be built into the air bag, if desired. However, other forms of limiting means may be provided for the purpose, as will be understood.

As a safety feature, means may be provided to preclude accidental or unexpected descent of platen 8 from the normal home position. Such means may comprise a latch member 62 adapted to engage a keeper 64 on lifting rod 18, whenever platen 8 is fully elevated to the home position. Latch member 62 may be normally yieldingly extended into the path of travel of keeper 64, by means of a spring-loaded pneumatic cylinder 66, the spring 68 of which tends always to project the piston rod 70 on which latch 62 is mounted. The piston 72 on rod 70 is subject to retractile movement against the force of compression spring 68, by pressure of air admitted ahead of the piston through a branch tube 74 having connection with air supply tube 46.

Whenever supply tube 46 is charged with air under pressure, to inflate the bag 26 for lowering the platen 8, tube 74 will conduct air to cylinder 66 for moving piston 72 and latch 62 to the right. Such movement of latch 62 effects disengagement of the latch from keeper 64, which at the time is elevated to a position overlying and abutting the latch. Latch 62 remains retracted so long as pressure of air is present in tube 46.

When tube 46 is not pressured, spring 68 will advance latch 62 toward lifting rod 18, and into the path of travel of keeper 64. Accordingly, when air bag 40 is charged by way of tube 48 to elevate the platen 8, latch keeper 64 will be raised through opening 16 to strike and displace the spring-urged latch 62, which immediately will plunge under the keeper to hold the platen safely in elevated position. The latch will remain engaged with keeper 64, until pressure of air is admitted to cylinder 66 for withdrawing the latch. The face of the latch, or the face of keeper 64, or both, may be inclined as shown upon FIG. 2, so that the keeper will override the latch when elevated to the fully retracted position of platen 8.

The safety device above described may be arranged to latch both of the lifting rods 18, if desired. This may be accomplished by providing another latch and keeper set operative upon the other lifting rod, with suitable connecting linkage operating to enforce simultaneous movements of both latches under the control of cylinder 66. As an alternative, the second latch set may be actuated by a cylinder separate from cylinder 66, and having connection with air supply tube 48.

From the foregoing, it will be understood that the safety device will hold the platen 8 in the elevated home position, in the event of any failure of air pressure in supply tube 48, air bag 40, or the pressure system as a whole. Accidental injury to workmen attending the dies beneath the platen is thereby effectively prevented.

The reference character 56 denotes a handling or lifting eye, of which two may be provided, to facilitate placement of the press upon a factory floor. In practice, a protective shroud may be provided (not shown), enveloping the operating mechanism of the press, but leaving exposed the space between platen 8 and base plate 4 so as to permit the changing and mounting of die parts 22 and 24.

In the larger versions of the press, where platen 8 and head plate 10 may be quite extensive in area, the number of air bags employed may be increased. In that event, the platen-advancing air bags would be subject to simultaneous inflation so as to ensure equalization of the forces tending to advance the platen. Similarly, the platen retracting air bags would operate in unison, with equalization of the lifting forces operative upon the platen.

The representation of dies 22 and 24 is to be regarded as exemplary only, in the present disclosure, since it will readily be appreciated that the press is adaptable to various forms of service. Also, as previously mentioned, the illustrated control means for the press is subject to considerable modification and elaboration, it being understood that the control means shown is representative only, and has been greatly simplified so as to avoid burdening the disclosure unnecessarily.

It is to be understood that various modifications and changes may be made in the structural details of the apparatus, within the scope of the appended claims, without departing from the spirit of the invention.

What is claimed is:

1. A fluid-operated press comprising in combination: a platen, and means guiding the platen for movement between a position of advancement, and a retracted home position; a flexible inflatable primary bellows operative upon the movable platen for advancing said platen upon introduction of fluid under pressure into said primary bellows; a flexible inflatable secondary bellows operative upon the movable platen to return said platen to home position; and control means for selectively directing pressurized inflating fluid into either of said bellows while the other of said bellows deflates incident to the exhausting of fluid from said other bellows.

2. A press as specified by claim 1, wherein the secondary bellows is of lesser fluid capacity than the primary bellows, to expedite the retractile movement of the platen.

3. A press as specified by claim 2, wherein the secondary bellows constitutes the sole means of retracting the movable platen to home position.

4. A press as specified by claim 1, wherein is included means for exhausting fluid from the primary bellows at a rate faster than the exhaust of fluid from the secondary bellows.

5. A press as specified by claim 4, wherein the secondary bellows consitutes the sole means of retracting the movable platen to home position.

6. A press as specified by claim 1, wherein the secondary bellows constitutes the sole means of retracting the movable platen to home position.

7. The press as specified by claim 1, wherein the primary bellows overlies an extensive area of the platen, to minimize any tendency of the platen to bend while undergoing advancement of the primary bellows.

8. The press as specified by claim 7, wherein the secondary bellows is of lesser fluid capacity than the primary bellows; and the combination includes means for exhausting fluid from the primary bellows at a rate faster than the feed of fluid to the secondary bellows, said secondary bellows constituting the sole means of retracting the movable platen to home position.

9. The press as specified by claim 8, wherein is included releasable means to latch the platen in retracted home position, and means operative incident to inflation of the primary bellows, for disabling said latch means.

10. The press as specified by claim 1, wherein the primary bellows includes means to exert platen-advancing force upon the platen in close proximity to the platen-guiding means.

11. The press as specified by claim 1, wherein is included releasable means to latch the platen in retracted home position, and means operative to disable said latch means incident to inflation of the primary bellows.

12. The press as specified by claim 1, wherein is included means limiting the extent to which the primary bellows may be collapsed upon deflation thereof.

13. A fluid-operated press comprising in combination: a rigid base plate; a plurality of upright posts fixed upon the base plate in spaced parallelism; a stationary head plate fixed to the upper ends of the upright posts at a distance from the base plate; movable platen disposed intermedi-

ate the base plate and the head plate, and including means cooperating with said posts for guiding the platen toward and from the base plate, between a position of advancement and a retracted home position; a cross-head disposed above the head plate in spaced substantial parallelism therewith; a pair of upright lifting rods extending above and below the head plate, said rods having lower ends fixed to the movable platen, and upper ends fixed to the cross-head, whereby movements of the cross-head toward and from the head plate are transmitted to the movable platen; a flexible inflatable primary bellows interposed between the head plate and the movable platen, said bellows when inflated and expanded acting to drive the platen toward the base plate and into the position of advancement aforesaid; a flexible inflatable secondary bellows disposed between the cross-head and the head plate, said secondary bellows when inflated and expanded acting to move the cross-head away from the head plate, while drawing the attached platen toward said plate and into the retracted home position aforesaid; and control means for selectively directing pressurized inflating fluid into either of said bellows while the other of said bellows deflates incident to the exhausting of fluid from said other bellows.

14. A press as specified by claim **13**, wherein the secondary bellows is of lesser fluid capacity than the primary bellows, and has a rate of expansion greater than that of the primary bellows, utilizing the same source of pressurized fluid.

15. A press as specified by claim **14**, wherein the secondary bellows constitutes the sole means of retracting the movable platen to home position.

16. A press as specified by claim **13**, wherein is included means for exhausting fluid from the primary bellows at a rate faster than the exhaust of fluid from the secondary bellows.

17. A press as specified by claim **16**, wherein the secondary bellows constitutes the sole means of retracting the movable platen to home position.

18. A press as specified by claim **13**, wherein the secondary bellows constitutes the sole means of retracting the movable platen to home position.

19. A press as specified by claim **13**, wherein the primary bellows overlies an extensive area of the platen, and exerts platen-advancing force upon the platen in close proximity to the platen guiding means aforesaid.

20. The press as specified by claim **19**, wherein the secondary bellows is of lesser fluid capacity than the primary bellows; and the combination includes means for rapid exhausting of fluid from the primary bellows, at a rate faster than the feed rate of fluid to the secondary bellows.

21. The press as specified by claim **20**, wherein the secondary bellows constitutes the sole means of retracting the movable platen to home position.

22. The press as specified by claim **13**, wherein is included releasable means to latch the platen in retracted home position, and means operative incident to inflation of the primary bellows, for disabling said latch means.

23. The press as specified by claim **22**, wherein is included means limiting the extent to which the primary bellows may be collapsed upon deflation thereof.

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