

Sept. 12, 1939.

F. J. RODE

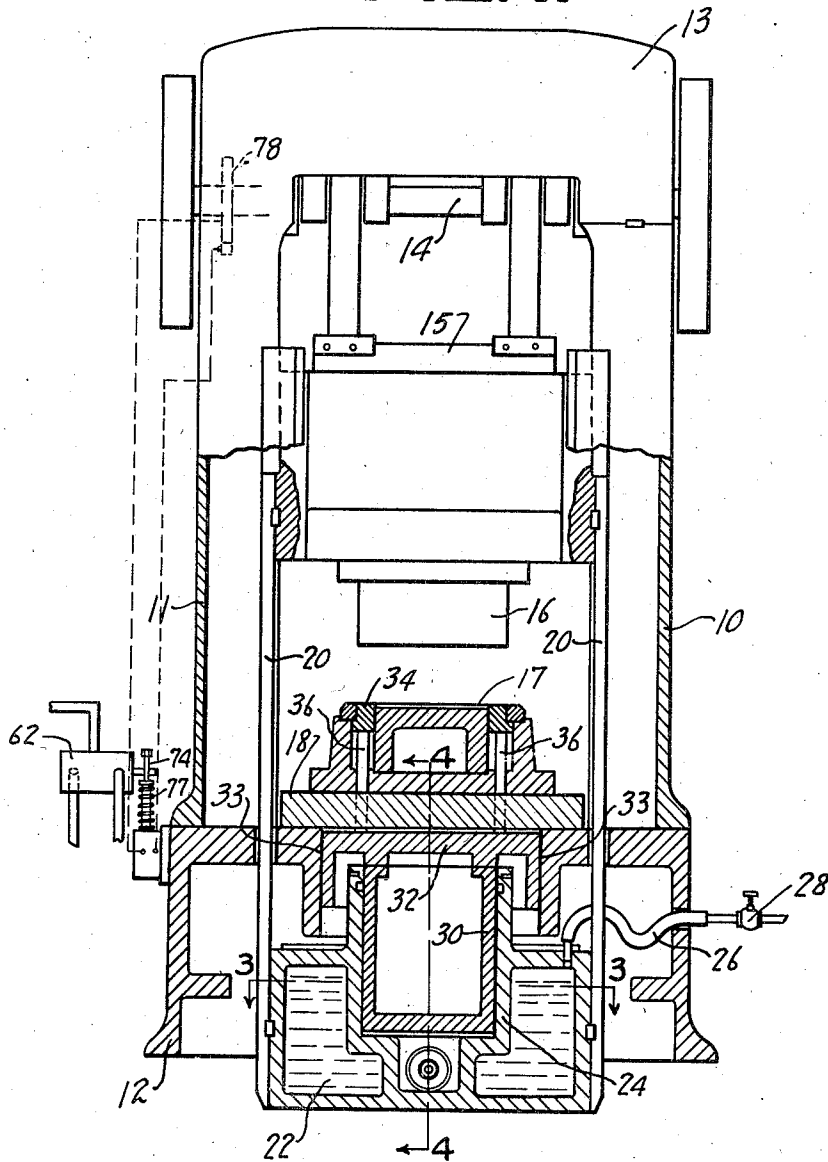
2,172,853

DRAWING PRESS

Filed March 11, 1939

3 Sheets-Sheet 1

FIG. 1.



Inventor
Fredrich J. Rode

By

Owen & Owen

Attorneys

Sept. 12, 1939.

F. J. RODE

2,172,853

DRAWING PRESS

Filed March 11, 1939

3 Sheets-Sheet 2

FIG. 2.

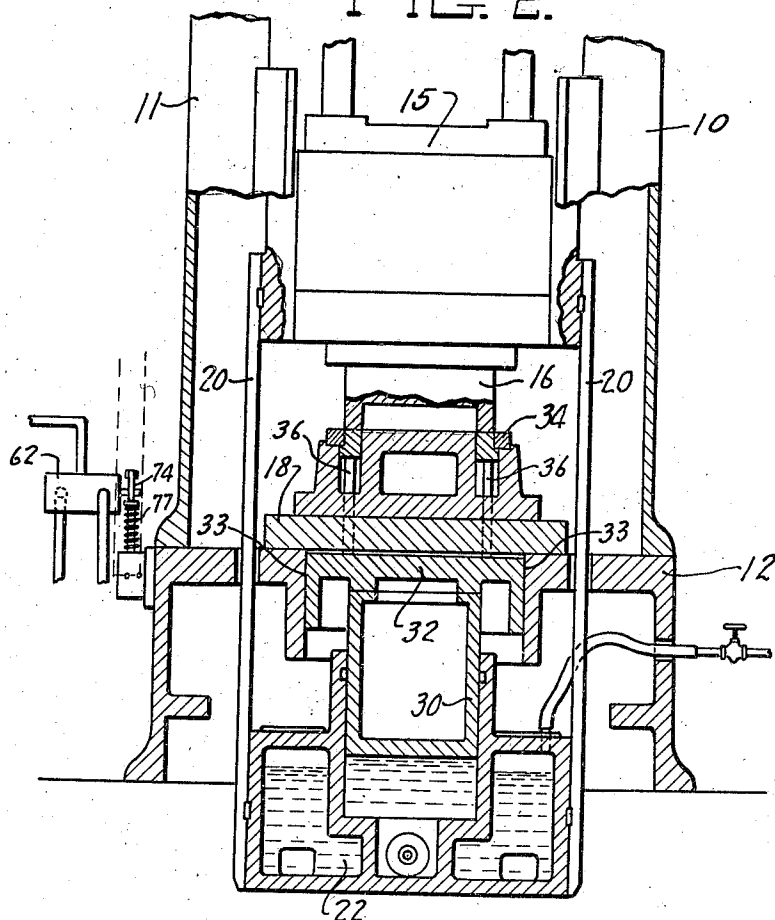
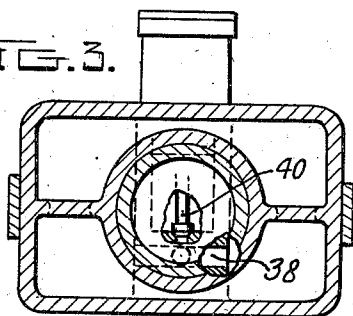


FIG. 3.



Inventor
Friedrich J. Rode

By

Coven & Coven

Attorneys

Sept. 12, 1939.

F. J. RODE

2,172,853

DRAWING PRESS

Filed March 11, 1939

3 Sheets-Sheet 3

FIG. 4.

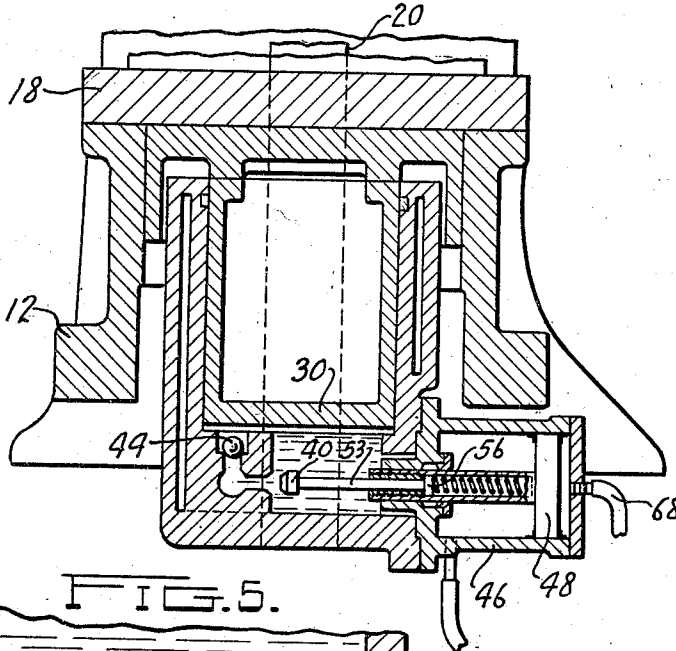


FIG. 5.

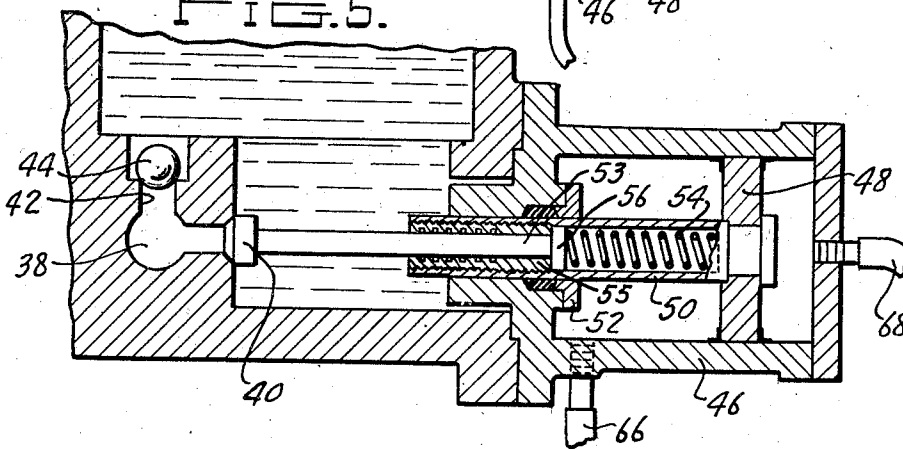
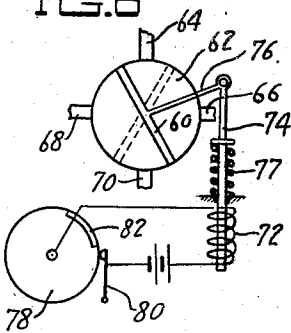


FIG. 6.



Inventor
Fredrich J. Rode

Owen & Owen

Attorneys

UNITED STATES PATENT OFFICE

2,172,853

DRAWING PRESS

Fredrich J. Rode, Toledo, Ohio

Application March 11, 1939, Serial No. 261,373

8 Claims. (Cl. 267-1)

This invention relates to drawing presses, and is particularly directed to apparatus for holding a blank during a drawing operation.

Metal drawing presses equipped with cushions which oppose a blank holding slide by a predetermined pressure have the disadvantage that the power required to overcome the pressure of the cushion is subtracted from the available power of the press, so that frequently the remainder is insufficient to accomplish a desired drawing operation. Thus, in a fifty ton press, ten or more tons may be used up in the cushions so that the full power cannot be used in drawing a blank. It has been proposed to overcome this by suspending the cushion from the slide of the press in a manner more fully described hereinafter, so that the force of the cushion is exerted entirely in pinching the metal between the upper die and a blank holding ring. (See my prior Patent No. 1,608,534.)

Structures heretofore known, however, are operated at such relatively low pressures that the area of the cushion cylinders and the expense involved in providing the necessary counterbalancing for the large and heavy equipment required made the structure prohibitively expensive.

The primary object of the present invention is to provide a press having a slide supported cushion in which air is used to fill the cushion under low pressure during the idle portion of the press stroke, and subsequently used during the drawing portion of the stroke to increase the pressure in the cushion to a degree greatly in excess of the filling pressure and thus increase the effectiveness of the cushion equipment many times.

Another object of the invention is to provide a means whereby the desirable features of my prior invention may be incorporated in an economically manufactured device.

Other objects and advantages of the invention will become apparent as the description proceeds, reference being had to the accompanying drawings, in which—

Figure 1 is a somewhat diagrammatic elevational view, with parts in section, of a press incorporating the present invention, the parts being shown at the top of the press stroke;

Fig. 2 is a fragmentary elevational view somewhat similar to Fig. 1, with the parts shown in a position corresponding to the beginning of the drawing portion of the press stroke;

Fig. 3 is a section on line 3-3 of Fig. 1;

Fig. 4 is an enlarged section on line 4-4 of Fig. 1;

Fig. 5 is an enlargement of the cushion cut-off valve portion of Fig. 4, with the valve closed, and

Fig. 6 is a diagrammatic view of a control valve and its operating mechanism.

The present invention is best applied to a hydraulic cushion of known type and includes means to operate the cushion at low pressure until a predetermined point in the press stroke, as when the drawing operation begins, at which time the pressure in the cushion is enormously increased to another predetermined value, the increase being accomplished entirely by air under relatively low pressure, so that no expensive pumping equipment is required. Such a device permits the use of a cushion which is much smaller in area and hence much lighter than those previously employed for the same operation.

Referring to the drawings, and particularly to Fig. 1, the present invention is shown incorporated in a press having side frames 10 and 11, the usual bed 12 and crown 13 in which a crank-shaft 14 is journaled. A slide 15 is driven from crank-shaft 14 and reciprocates in the frame relative to the bed. An upper die 16 is carried by the slide and cooperates with a mating lower die 17 mounted in the usual manner on a bolster plate 18 fixed to the bed 12.

A so-called "hydro-pneumatic" cushion is suspended from the slide 15 by the rods 20 at each side and includes an oil reservoir 22 in which a cylinder 24 is formed, the remainder of the interior of the rectangular reservoir being used for the storage of oil or other liquid under pressure. The pressure on the oil remains substantially constant and is provided by air under pressure from a line 26 in which a suitable regulating valve 28 is interposed.

A cushion piston 30 works in cushion cylinder 24 and at its top engages a pressure pad 32 which may be guided in the bed of the press, as at 33, and which supports a draw ring 34 through the medium of pins 36 extending through the lower die 17 and bolster plate 18. Thus, force exerted on the draw ring 34 is communicated to pressure pad 32 and piston 30, and vice versa.

As will be apparent from Figs. 3 and 4, reservoir 22 communicates with the interior of cylinder 24 through a lateral passage 38 which is controlled by a suitable valve 40. In addition, oil can flow into the cylinder through a vertical passage 42, which is controlled by a ball check valve 44 to prevent return of oil to the reservoir

through this passage. This construction is known in the art and serves to provide for rapid filling of the cushion cylinders.

By comparing Figs. 1 and 2, it will be seen that, as the slide of the press moves down, the cushion reservoir 22 and cylinder 24 also move down since the assembly is suspended from the slide. The piston 30, however, remains stationary, being held in place by oil moving through passages 38 and 42 into the cylinder from the reservoir under the pressure of air from line 26. In Fig. 2 the parts are shown in such position that upper die 16 has just closed against the draw ring 34. Further closing movement of the dies will cause a drawing operation to be performed on a blank placed between them.

In most drawing operations, it is desirable to hold the blank under pressure to prevent buckling and wrinkling. The pressure must be sufficient for this purpose and yet not be so high that the metal is prevented from flowing into the drawn area. Cushions are used for this purpose and are regulated to give the desired degree of pressure in pounds per square inch of engaged surface.

In the past, the pressure exerted by the cushion has depended directly on the air pressure on the oil in the reservoir. The present invention, however, includes means to intensify the pressure on the oil in the cylinder to a degree greatly in excess of that existing on the oil in the reservoir, but only during that portion of the press stroke in which drawing is actually accomplished. The principal advantage gained is that a single small cushion can do work which formerly required a battery of large ones. Instead of using a pressure beneath the piston 30 of less than 100 pounds per square inch, this pressure may, in the present instance, reach several thousand pounds.

The pressure intensifying unit is associated with and preferably a part of the control for valve 40. The valve is opened and closed by a pneumatic piston and cylinder assembly including a cylinder 46 fixed to the cushion and in which a piston 48 operates. A tubular piston rod 50 is guided for reciprocation in a suitable gland 52 in a wall of the cushion and the valve stem 53 is mounted for sliding movements in the piston rod and is urged outwardly therefrom by a spring 54. A head 56 on the valve stem acting against a stop sleeve or shoulder 55 in the piston rod causes the valve to be retracted with the piston rod. As shown in Figs. 4 and 5, when air is admitted to the outer end of cylinder 46, piston 48 advances and the valve 40 is closed under the tension of spring 54. The air pressure on the face of piston 48 tends to move the end of the piston rod 50 into the oil below the cushion cylinder and, since the area of the piston is considerably greater than the area of the face of the piston rod, the pressure in the cylinder is greatly intensified. By varying the relative diameters of the piston and its rod and the air pressure on the piston, the range of pressures obtainable in the cushion cylinder is very large.

It will be seen that the pressure and force tending to move the cushion piston 30 upwardly has its reaction against the lower end of the cushion cylinder 24 tending to move it downwardly. Since this is an integral part of the reservoir which is directly attached to the slide of the press, the result is a tendency to pull the slide down to die closing position, and to push up, through piston 30, on the draw ring 34. The

metal blank on which work is to be performed is thus pinched between the upper die 16 and draw ring 34 under a pressure determined by the pressure in the cushion cylinder. As the slide continues to move down, the entire cushion assembly including piston 30, pressure pad 32 and draw ring 34 also move down. Thus, the metal blank is gripped under a constant pressure during the drawing operation and no power from the press is required to furnish the gripping force.

Any suitable means may be utilized to govern the application of air pressure to the valve operating cylinder 46. It will be seen that the cycle of operation is such that during the major portion of the press stroke (such as the idle portion) air is applied in a manner to open valve 40, and that only during a short period is air applied to close the valve and raise the pressure on the cushion piston. This application of pressure is preferably confined to the working portion of the down stroke of the press. Any four-way valve which is capable of alternately directing air to one side or the other of piston 48 and simultaneously exhausting the side not under pressure will suffice. Such a valve is diagrammatically shown in Fig. 6 and as there shown includes a plate 60 working in a housing 62 to which a source of air pressure is connected by pipe 64. Side pipes 66 and 68 are connected to the operating cylinder 46 by flexible connections, and an exhaust or vent passage is provided at 70. The plate may be operated to connect pressure inlet 64 with either of the side pipes by a solenoid 72 connected to the plate by a lever 74 and rock arm 75. Spring 77 biases the lever so that the plate stands normally in position to admit air to pipe 66 and thus to the front of cylinder 46. Current to the solenoid may be derived from any suitable source and its application timed by a rotary switch 78 driven by or mounted on the crank-shaft of the press. The switch preferably includes a brush 80 connected to the power supply and a drum contact 82 connected to the solenoid, so that the period of energization of the solenoid depends on the circular extent of the contact 82. Timing mechanism of this character is well-known in the press art.

I wish it understood that my invention is not limited to any specific construction, arrangement or form of the parts, as it is capable of numerous modifications and changes without departing from the spirit of the claims.

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

1. In a drawing press, a slide, a blank gripping means including a relatively movable piston and cylinder working one within the other, one of said members being suspended from said slide so as to move therewith, means to fill oil under low pressure into the space behind said piston during the idle portion of the down stroke of the press, means to close communication to said space, and means operating simultaneously with said last means to increase the oil pressure in said space to a degree greatly in excess of the filling pressure, at the time the drawing portion of the press stroke is commenced.

2. In a drawing press, a slide, a blank gripping means including a relatively movable piston and cylinder working one within the other, one of said members being suspended from said slide so as to move therewith, means to fill oil under low pressure into the space behind said piston

during a predetermined portion of the stroke of the press, and pneumatically operated means to close communication to said space and to increase the oil pressure in said space to a degree greatly in excess of the filling pressure, at the time the drawing portion of the press stroke is commenced.

3. In a drawing press, a slide, blank gripping means including a reservoir and cylinder suspended from the slide and a piston working in said cylinder, means to force liquid from said reservoir into said cylinder during a descending movement of the slide to maintain said piston stationary, a valve to open and close communication between said reservoir and cylinder, means to actuate said valve, and means to increase the pressure on liquid which is trapped in said cylinder by closing of said valve, at the beginning of the drawing portion of the press stroke.

4. In a drawing press, a slide, blank gripping means including a reservoir and cylinder suspended from the slide and a piston working in said cylinder, means to force liquid from said reservoir into said cylinder during a descending movement of the slide to maintain said piston stationary, a valve to open and close communication between said reservoir and cylinder, pneumatic means to actuate said valve, and means to increase the pressure on liquid which is trapped in said cylinder by closing of said valve, at the beginning of the drawing portion of the press stroke.

5. In a drawing press, a slide, blank gripping means including a reservoir and cylinder suspended from the slide and a piston working in said cylinder, means to force liquid from said reservoir into said cylinder during a descending movement of the slide to maintain said piston stationary, a valve to open and close communication between said reservoir and cylinder, means to actuate said valve, and pneumatic means to increase the pressure on liquid which is trapped in said cylinder by closing of said valve, at the beginning of the drawing portion of the press stroke.

6. In a drawing press, a slide, blank gripping means including a reservoir and cylinder suspended from the slide and a piston working in said cylinder, means to force liquid from said reservoir into said cylinder during a descending movement of the slide to maintain said piston

stationary, a valve to open and close communication between said reservoir and cylinder, pneumatic means to actuate said valve, and pneumatic means to increase the pressure on liquid which is trapped in said cylinder by closing of said valve, at the beginning of the drawing portion of the press stroke.

7. In a drawing press, a slide, blank gripping means including a reservoir and cylinder suspended from the slide and a piston working in said cylinder, means to force liquid from said reservoir into said cylinder during the idle portion of the down stroke of the press to maintain said piston stationary, a valve to open and close communication between said reservoir and cylinder, pneumatic means to actuate said valve, said means including a cylinder attached to said reservoir and a piston connected to said valve by a lost motion connection including a spring between a part of said piston and the stem of said valve, whereby said valve is positively opened and resiliently closed, and said piston having a part extending into the cushion cylinder to communicate pressure to liquid trapped therein, said valve being closed at the beginning of the drawing portion of the press stroke.

8. In a drawing press, a slide, blank gripping means including a reservoir and cylinder suspended from the slide and a piston working in said cylinder, means to force oil from said reservoir into said cylinder during a descending movement of the slide and cylinder to maintain the piston stationary, an air cylinder carried by said reservoir, a piston operating in said air cylinder and having a piston rod extending into the cushion cylinder, a valve carried by said last named piston and adapted to open and close communication between the reservoir and cushion cylinder, means to introduce air into said air cylinder and thus move said valve to cut-off position and by applying pressure to said piston rod increase the pressure in said cushion cylinder to a degree greatly in excess of the filling pressure, said last means operating in relation to the extent of downward movement of said slide, whereby said valve is open during the idle portion of the down stroke of the press and closed during the drawing portion of the down stroke.