Aug. 14, 1934 W. FERRIS 1,970,134

HYDRAULIC PRESS

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Fig. 1.

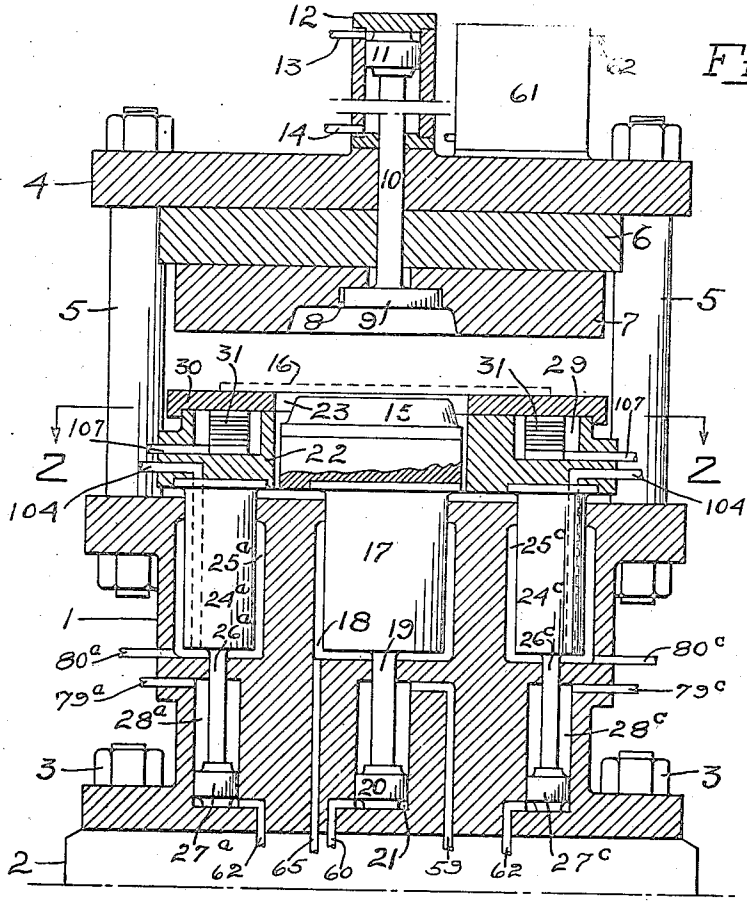


Fig. 2.

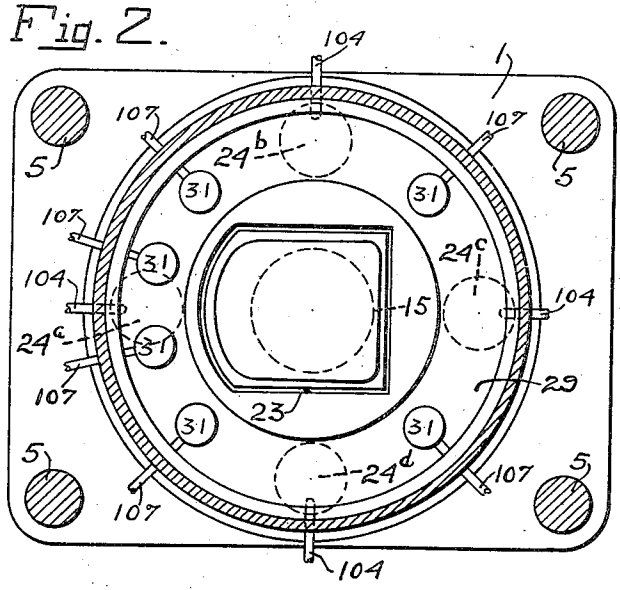
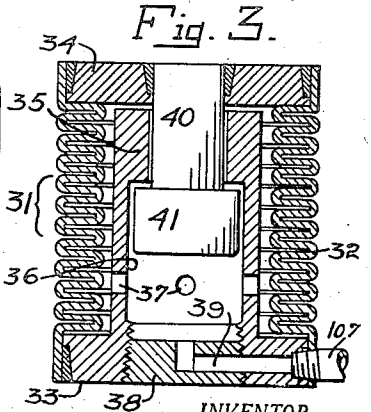


Fig. 3.



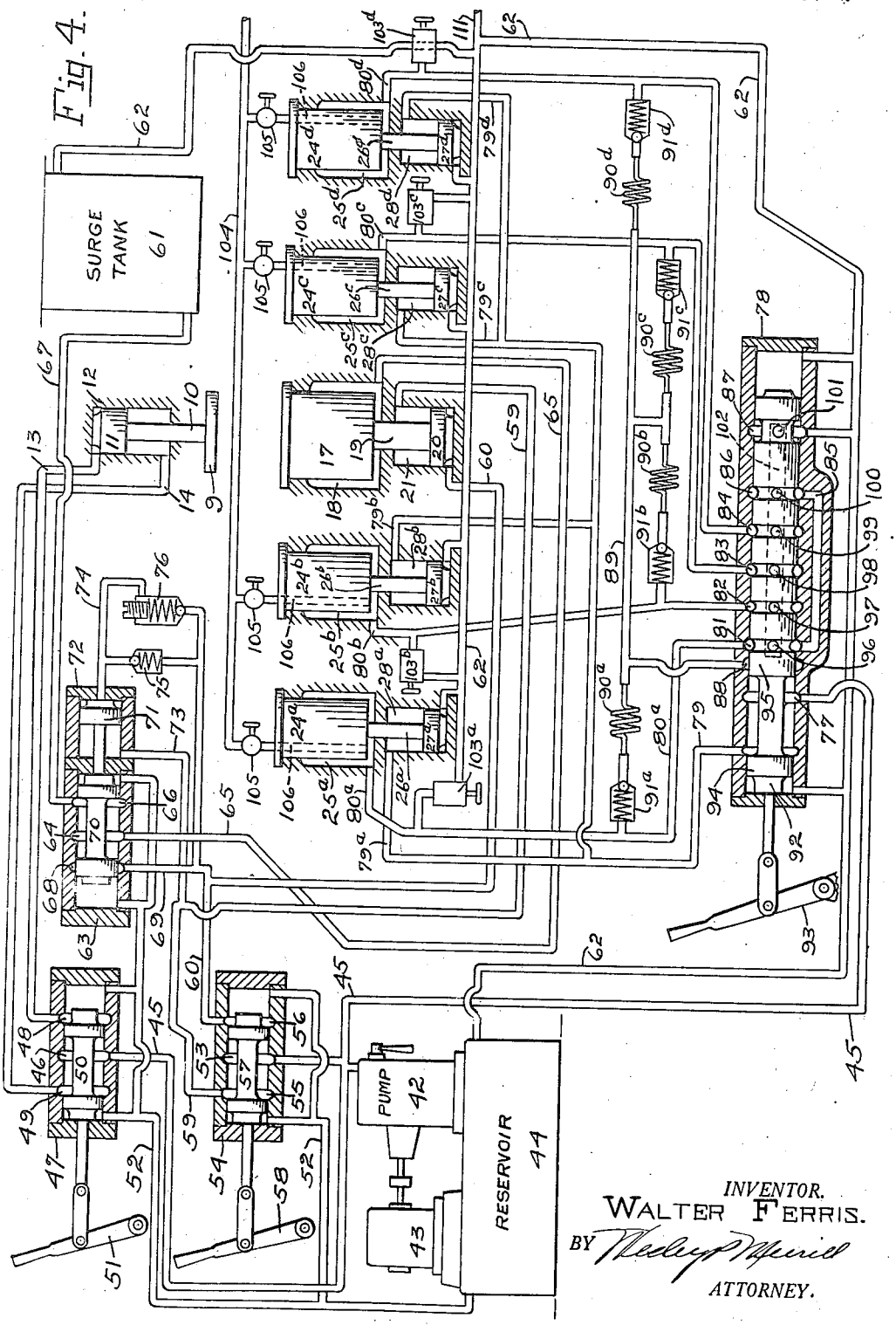
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Filed July 29, 1932 3 Sheets-Sheet 2

Fig. 4.



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Fig. 5.

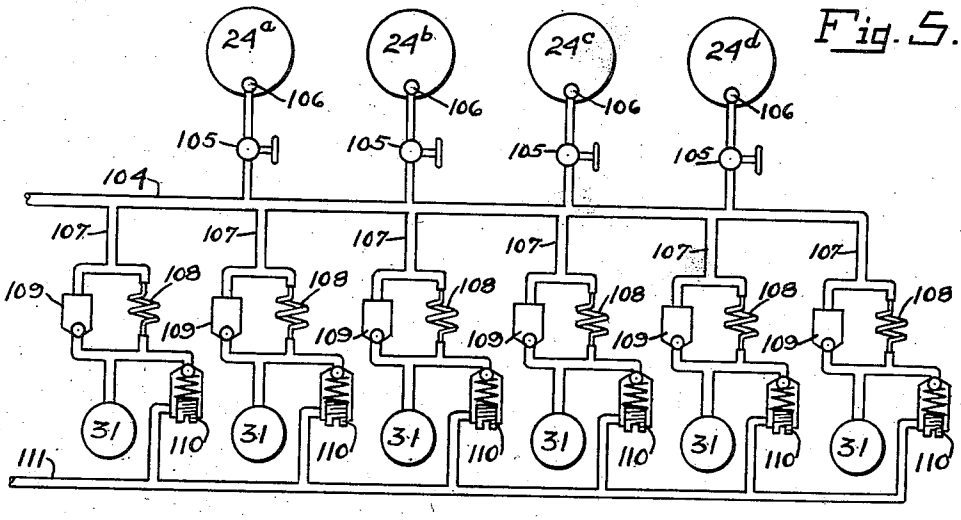


Fig. 6.

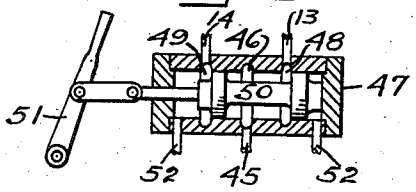


Fig. 7.

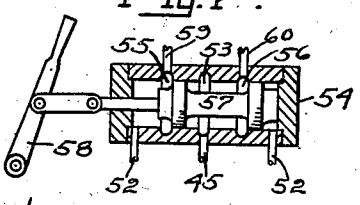


Fig. 8.

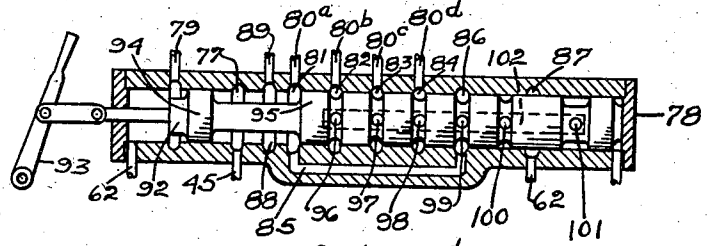


Fig. 9.

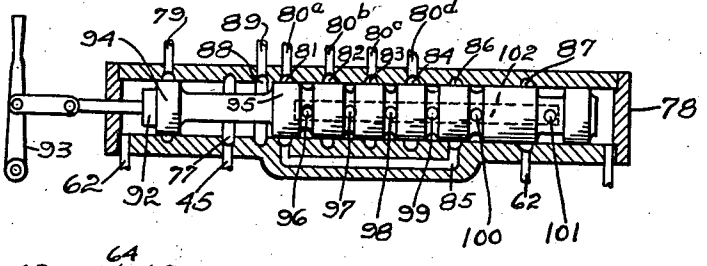
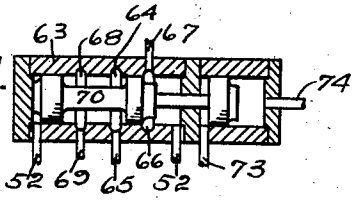


Fig. 10.



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Patented Aug. 14, 1934 1,970,134

UNITED STATES PATENT OFFICE

1,970,134

HYDRAULIC PRESS

Walter Ferris, Milwaukee, Wis., assignor to The Oilgear Company, Milwaukee, Wis., a corporation of Wisconsin

Application July 29, 1932, Serial No. 625,765

20 Claims. (Cl. 113—45)

This invention relates to draw presses.

The draw press to which the invention applies in particular is provided with a pair of dies for forming articles from sheets or blanks, a blank folder for pressing the margin of the blank against one of the dies to clamp it therebetween during the drawing operation, and means for moving one of the dies toward and from the other die. The clamping pressure applied to the margin of the blank should be carefully adjusted and, in drawing articles of non-uniform configuration, different clamping pressures should be applied to different points around the margin of the blank as the material flows at different rates from those points into the dies.

An object of the invention is to provide a draw press in which different clamping pressures may be applied to the blank at different points around the margin thereof.

Another object is to provide a press with a blank holder which may be readily adjusted to apply different pressures at different points upon the margin of a blank.

Another object is to provide a press of this character which is fluid operated.

Another object is to provide means whereby a plurality of cylinders may be supplied with pressure fluid from a single source and pressure be maintained in one cylinder while fluid is being delivered to another cylinder.

Another object is to provide a press with a fluid operated blank holder in which sylphons are employed for transmitting pressure to selected points upon the margin of the blank.

Another object is to provide a press of this character which is susceptible of close adjustment and control.

According to the invention in a general aspect, the press is provided with a plurality of cylinders which are supplied with pressure fluid from a single source, and means are provided for regulating the pressure in one cylinder without affecting the pressure in another cylinder.

According to the invention in another aspect, the press is provided with a ram cylinder and a blank holder cylinder, pressure fluid is delivered freely from a suitable source to the ram cylinder to operate a ram arranged therein, and a choke is connected between the blank holder cylinder and said source to enable the same to maintain pressure in the blank holder cylinder while delivering fluid to the ram cylinder.

According to the invention in another aspect, the blank holder of the press is provided with fluid actuated sylphons which may be moved from place to place to exert pressure upon the blank at different points around the margin thereof.

The invention is illustrated by the press shown in the accompanying drawings in which the views are as follows:

Fig. 1 is a central vertical section through the press, the view being somewhat diagrammatic in character and the piping and certain other parts being omitted or broken away.

Fig. 2 is a plan view on the line 2—2 of Fig. 1.

Fig. 3 is a central vertical section through one of the sylphons shown in Fig. 1.

Fig. 4 is a diagram of one part of the hydraulic circuit and shows the valves in central longitudinal section with the plungers thereof in the positions occupied when the press is idle.

Fig. 5 is a diagram of another part of the hydraulic circuit.

Figs. 6, 7, 8, 9 and 10 are views showing the plungers of the several valves in different positions from those shown in Fig. 4.

The press shown in Figs. 1 and 2 is provided with a base 1, which is arranged upon a suitable foundation 2 and rigidly secured in a stationary position thereon by anchor bolts 3, and with a crosshead 4 which is supported above the base 1 and fixed in a stationary position relatively thereto by four columns or strain rods 5.

The crosshead 4 carries upon the under side thereof a bolster 6 to the under side of which a stationary female die 7 is attached and provided at its center with a recess 8 to receive the head 9 of a knockout plunger 10 which extends through the bolster 6 and the crosshead 4 and has a piston 11 secured to its upper end and fitted in a knockout cylinder 12 arranged upon the top of the crosshead 4.

Liquid for advancing the plunger 10 to force a piece of work out of the die 7 is supplied to the upper end of the cylinder 12 through a pipe 13, and liquid for retracting the plunger 10 is delivered to the lower end of the cylinder 12 through a pipe 14.

The upper stationary die 7 coacts with a lower movable male die 15 to form or draw a blank 16 into the shape determined by the configuration of the dies which, as shown, are adapted to form a substantially rectangular receptacle.

The lower die 15 is moved toward and from the upper die 7 by a press ram 17 which is fitted in a cylinder 18 and provided upon its lower end with a tail rod 19 having a piston 20 fixed thereon and fitted in a cylinder 21. The cylinders 18 and 21 are arranged within and carried by the

base 1 and are shown as being formed integral therewith.

During the drawing operation, the blank 16 is gripped between the lower face of the die 7 and a pressure ring 22 having formed therein a central opening 23 which accommodates the lower die 15 and conforms substantially to the periphery of the recess in the die 7.

The pressure ring 22 is moved toward and from the die 7 by four identical rams each of which is designated by the reference numeral 24 and distinguished from the other rams 24 by the addition of the exponent *a*, *b*, *c*, or *d* to its reference numeral. Each ram 24 is arranged in a cylinder 25 and provided with a tail rod 26 having a piston 27 fixed to its lower end and fitted in a cylinder 28, and the cylinders, tail rod and piston associated with each ram have the same exponent added to the reference numerals thereof as is added to the reference numeral of the ram with which the same are associated. The cylinders 25 and 28 are arranged within and carried by the base 1 and have been shown as being formed integral therewith.

The rams 24 are adapted to raise the pressure ring 22 and clamp the margin of the blank 16 between it and the lower face of the die 7, and the force or pressure exerted by any one of the rams 24 may be varied by varying the fluid pressure in its cylinder 25 to thereby apply different pressures upon different parts of the margin of the blank.

In order to further vary the pressures upon different parts of the margin of the blanks and to apply a particular pressure upon any particular point thereof irrespective of the position of that point relative to the positions of the rams 24, the pressure ring may be provided with an annular channel 29, a cover plate or top plate 30 which covers the channel and normally rests upon the side walls thereof, and a plurality of sylphons 31 which may be arranged in selected positions in the channel 29 and supplied individually with pressure fluid to exert individual pressures upon different points around the margin of the blank.

Each sylphon 31 has its side wall formed of an expansible metal bellows 32 and its ends closed by two heads 33 and 34 which are welded or otherwise rigidly secured in position to form fluid-tight joints with the bellows.

The lower head 33 has a projection 35 formed thereon and extending upward into the bellows, and the upper end of this projection may be positioned a short distance below the head 34 to limit the downward movement thereof.

The projection 35 is provided in the lower part thereof with a bore 36 which is in open communication with the interior of the bellows 32, as by perforations 37, and is closed at its lower end by a plug 38 rigidly fastened in the head 33.

The bellows 32 is expanded to raise the head 34 by liquid delivered through a duct 39 which is formed in the head 33 and communicates with the bore 36, and the upward movement of the head 34 is limited by a stop pin 40 which has its head 41 arranged in the bore 36 to engage the upper end thereof from which it is normally spaced a short distance, for instance, about one-eighth inch. The stop pin 40 extends loosely through the upper end of the projection 35 and has its upper end welded or otherwise rigidly secured to the head 34.

The sylphons are shown arranged in the channel 29 with the heads 33 downward but they may as readily be arranged therein with the heads 33 upward if so desired.

Liquid for operating the press is supplied by a positive displacement pump 42 which is driven at a constant speed by an electric motor 43 and delivers liquid from a reservoir 44 into a supply pipe 45 having three branches for the delivery of liquid to three separate control valves. A pump which may be employed is illustrated and described in Patent No. 1,798,198 issued March 31, 1931 to Walter Ferris and John P. Ferris.

One branch of the supply pipe 45 is connected to a port 46 in a control valve 47 which controls the delivery of liquid from the pump 42 to the knockout cylinder 12 and has the pipes 13 and 14 connected thereto in communication, respectively, with two ports 48 and 49 arranged upon opposite sides of the port 46.

The flow of liquid through the valve 47 is controlled by its plunger 50 which is operated by a lever 51. When the plunger 50 is in the position shown in Fig. 4, the pump 42 may deliver liquid through the supply pipe 45, the valve 47 and the pipe 14 to the lower end of the cylinder 12 and raise the piston 11, and liquid expelled from the upper end of the cylinder 12 by the piston 11 is exhausted through the pipe 13 and the valve 47 into a drain pipe 52 which is connected to both ends of the valve 47 and discharges into the reservoir 44. When the plunger 50 is in the position shown in Fig. 6, the flow of liquid in the pipes 13 and 14 is reversed and the piston 11 will force the knockout plunger 10 downward to eject the work from the die 7.

A second branch of the supply pipe 45 is connected to a port 53 in a reversing valve 54 which controls the delivery of liquid to the cylinder 21 and has two ports 55 and 56 arranged upon opposite sides of the port 53 and controlled by a plunger 57 which is operated by a lever 58. The port 55 has connected thereto one end of a pipe 59 the other end of which is connected to the upper end of the cylinder 21. The port 56 has connected thereto one end of a pipe 60 the other end of which is connected to the lower end of the cylinder 21.

When the plunger 57 is in the position shown in Fig. 4, liquid from the pump 42 may flow through the pipe 45, the valve 54 and the pipe 59 to the upper end of the cylinder 21 and move the piston 20 downward, and the liquid expelled from the lower end of the cylinder 21 by the piston 20 is exhausted through the pipe 60 and the valve 54 into the drain pipe 52 which is connected to both ends of the casing of the valve 54. When the plunger 57 is moved to the position shown in Fig. 7, the flow of liquid in the pipes 59 and 60 is reversed and the piston 20 will be moved upward.

When the piston 20 is moved upward, the ram 17 is moved upward and draws liquid into the cylinder 18 from a surge tank 61 which is ordinarily arranged upon the crosshead 4 as shown in Fig. 1. When the piston 20 moves downward, the ram 17 is moved downward and expels liquid from the cylinder 18 into the surge tank. The level of the liquid in the surge tank is limited by an overflow pipe 62 which discharges into the reservoir 44.

The flow of liquid between the cylinder 18 and the surge tank 61 is controlled by an automatic valve 63 which has a port 64 formed therein and connected by a pipe 65 to the cylinder 18, a port 66 arranged upon one side of the port 64 and connected by a pipe 67 to the surge tank, and a port 68 arranged upon the other side of the port 64 and connected by a pipe 69 to the pipe 60.

The flow of liquid through the valve 63 is controlled by its plunger 70 which is operated by a piston 71 rigidly connected to one end thereof and fitted in a cylinder 72 arranged upon one end of the valve casing. The cylinder 72 has its inner end connected to the pipe 59 by a pipe 73 and its outer end connected to the pipe 60 by a pipe 74 which has a check valve 75 and a resistance valve 76 connected in parallel therein. The check valve 75 permits liquid to be exhausted freely from the outer end of the cylinder 72 but forces liquid delivered thereto to pass through the resistance valve 76.

When the valve plunger 57 has been moved to the position shown in Fig. 7 and liquid delivered to the lower end of the cylinder 21 has raised the piston 20 and the ram 17 until sufficient resistance has been encountered by the ram to cause the pressure in the pipe 60 to rise sufficiently to overcome the resistance of the valve 76, liquid will break through the valve 76, enter the cylinder 72 and move the piston 71 and the valve plunger 70 to the position shown in Fig. 10, thereby closing communication between the cylinder 18 and the surge tank 61 and opening communication between the cylinder 18 and the pipe 60 which at this time is in direct communication with the pump 42 through the valve 54 and the supply pipe 45. Liquid from the pump 42 then flows to the cylinder 18 and acts upon the ram 17 and causes it to exert a high pressure upon the blank being formed between the dies 7 and 15.

The third branch of the supply pipe 45 is connected to a port 77 in a blank holder valve 78 through which liquid is delivered to the blank holder cylinders 25 and 28.

Liquid is delivered to and discharged from the upper ends of the cylinders 28 through a pipe 79 which is connected to the casing of the valve 78 at the left of the port 77 and is provided with four branches 79^a, 79^b, 79^c and 79^d which are connected, respectively, to the cylinders 28^a, 28^b, 28^c and 28^d. In order that the pistons 27 may reciprocate freely, the lower end of each cylinder 28 is connected to the overflow pipe 62.

The four cylinders 25^a, 25^b, 25^c and 25^d are connected, respectively, by four pipes 80^a, 80^b, 80^c and 80^d to four ports 81, 82, 83 and 84 which are formed in the casing of the valve 78 at the right of the port 77 and equally spaced from each other, and the port 81 is connected by a duct 85 to a port 86 arranged at the right of the port 84.

The casing of the valve 78 also has a port 87 arranged therein at the right of the port 86 and a port 88 arranged between the ports 77 and 81. The overflow pipe 62 is connected to the port 87 and to both ends of the valve casing, and the port 88 has a pipe 89 connected thereto. The pipe 89 is connected to the four pipes 80^a, 80^b, 80^c and 80^d through four chokes 90^a, 90^b, 90^c and 90^d and four check valves 91^a, 91^b, 91^c and 91^d, respectively. The chokes 90 allow a very limited volume of liquid to flow from the pipe 89 to each pipe 80 and the check valves 91 prevent the flow of liquid in the opposite direction.

The flow of liquid through the valve 78 is controlled by its plunger 92 which is operated by a lever 93 and provided with a piston 94, to control communication between the pipe 79 and the port 77, and with an elongated piston 95 to control communication between the port 77 and the other ports. The elongated piston 95 is provided with transverse passageways 96, 97, 98, 99, 100 and 101 which, when the plunger 92 is in the position shown in Fig. 4, register with the ports 81, 82, 83, 84, 86 and 87 respectively. The transverse passageways all communicate with each other through a longitudinal passageway 102 which is formed within the elongated piston 95 and closed at each of its ends.

When the plunger 92 is in the position shown in Fig. 4, liquid from the supply pipe 45 may flow through the valve 78 and move the pistons 27 and the rams 24 downward, and the liquid expelled from the cylinders 25 by the rams 24 may flow through the pipes 80 and the valve 78 to the overflow pipe 62.

When the plunger 92 is in the position shown in Fig. 8, the port 81 is open to the port 77 and communication is established between the port 77 and the ports 82, 83, and 84 through the transverse passageways 96, 97 and 98, the longitudinal passageway 102, the transverse passageway 99, the duct 85 and the port 81, thereby permitting liquid to flow from the supply pipe 45 through the valve 78 and the pipes 80 to the cylinders 25 and raise the rams 24 to grip the blank 16 between the pressure ring 22 and the die 7. The pressure which the rams 24^a, 24^b, 24^c and 24^d may exert upon the blank is limited, respectively, by adjustable resistance valves 103^a, 103^b, 103^c, and 103^d connected between the pipes 80^a, 80^b, 80^c and 80^d, respectively, and the overflow pipe 62.

When the valve 78 has its plunger 92 in the position shown in Fig. 9, the ports 81, 82, 83, 84 and 86 are closed by the piston 95 to prevent the escape of liquid from the cylinders 25 through the valve 78, and the port 88 is open to the port 77 to permit pressure to extend from the supply pipe 45 through the pipe 89, the chokes 90 and check valves 91 into the cylinders 25 to maintain pressure therein. The pressure in each cylinder 25 is determined by its resistance valve 103 which may be adjusted to vary that pressure, and a variation in pressure in one cylinder 25 is prevented from affecting the pressure in any other cylinder 25 by the chokes 90 and the check valves 91. Consequently, the pressure in each cylinder 25 is independent of the pressure in any other cylinder 25.

Liquid for operating the sylphons 31 is supplied thereto through a manifold pipe 104 which is connected to each cylinder 25 through a shutoff valve 105 and a duct 106 formed in the ram 24 and extending therethrough.

If all of the shutoff valves 105 remained open, pressure in all of the cylinders 25 would equalize through the pipe 104 and the maximum pressure obtainable therein would be determined by the resistance valve 103 which was adjusted to open at a lower pressure than the other resistance valves 103. In order to permit different pressures to be created in the several cylinders 25, all of the shutoff valves 105 are closed except the one which is connected to the cylinder 25 whose resistance valve 103 is adjusted to open at a pressure higher than the pressure required to open the other resistance valves 103. Consequently, the pipe 104 may have a pressure created therein which is substantially equal to the highest pressure created in any of the cylinders 25.

Each sylphon 31 is connected to the pipe 104 by a pipe 107 (Fig. 5) which has a choke 108 and a check valve 109 connected in parallel therein. The choke 108 permits liquid to flow from the pipe 104 to the sylphon 31 at a limited rate, and the check valve 109 permits liquid to flow freely from the sylphon 31 to the pipe 104 but prevents it from flowing in the opposite direction except through the choke 108.

The pressure in each sylphon 31 is limited by an adjustable resistance valve 110 which has its inlet connected thereto and its outlet connected to a drain pipe 111 which discharges into the overflow pipe 62. Each resistance valve 110 is adjusted to open at the maximum pressure desired in the sylphon to which it is connected and, as the chokes 108 limit the flow of liquid to each sylphon, a different pressure may be obtained in each sylphon and the pressure in any sylphon may be regulated or varied without affecting the pressure in any other sylphon.

The combined capacity of all of the chokes 108 is less than the capacity of one choke 90 in order that each choke 90 may supply to the cylinder 25 to which it is connected a volume of liquid sufficient to maintain therein the maximum pressure determined by the adjustment of the resistance valve 103 connected thereto and to also maintain the desired maximum pressures in the several sylphons.

Assuming that the pump 42 is running and that the several rams, pistons and valve plungers are in the positions shown in Fig. 4, the pump will have created a predetermined pressure in the upper ends of the cylinders 21 and 28 and in the lower end of the cylinder 12 and automatically reduced its stroke until it is delivering just sufficient liquid to compensate for leakage and maintain that pressure constant, as fully described in Patent No. 1,798,198 referred to above.

If the lever 93 is then operated to move the plunger 92 of the valve 78 to the position shown in Fig. 8, liquid from the pump 42 will flow through the supply pipe 45, the valve 78 and the pipes 80 to the lower ends of the cylinders 25 and raise the rams 24 which will raise the pressure ring 22 to move the blank 16 into contact with the upper die 7. The plunger 92 is ordinarily retained in this position until sufficient pressure has been created in the several cylinders 25 to open one of the resistance valves 103, thereby causing the margin of the blank 16 to be gripped between the pressure ring 22 and the upper die 7.

At the same time, liquid flows through the shutoff valve 105 which is open and then through the pipes 104 and 107 and the chokes 108 to the sylphons 31 and creates pressure therein to cause the sylphons to exert pressure upon the margin of the blank at different points thereon.

The lever 93 is then operated to move the plunger 92 of the valve 78 to the position shown in Fig. 9 in which position it blocks the ports 81, 82, 83 and 84 and prevents the escape of liquid from the cylinders 25 but leaves the port 88 open to the port 77 to permit liquid to flow from the supply pipe 45 into the pipe 89 and through the chokes 90 and check valves 91 into the several cylinders 25 to maintain or create in each cylinder 25 a pressure sufficient to open the resistance valve 103 connected thereto, thereby maintaining a particular pressure in each cylinder.

At the same time, liquid flows from one of the cylinders 25 through the duct 106, the open shutoff valve 105, the pipes 104 and 107 of the chokes 108 to the several sylphons 31 and creates or maintains in each a predetermined pressure in accordance with the adjustment of the resistance valve 110 connected thereto.

The lever 58 is then operated to move the plunger 57 of the valve 54 to the position shown in Fig. 7 to open the pipe 59 to the drain pipe 52 and open the pipe 60 to the pipe 45, thereby permitting liquid from the pump 42 to flow through the pipe 60 to the lower end of the cylinder 21 and raise the piston 20 and the ram 17, the liquid in the upper end of the cylinder 21 being exhausted through the pipe 59 and the valve 54 into the drain pipe 52 and the ram 17 drawing liquid into its cylinder 18 from the tank 61 through the pipe 65, the valve 63 and the pipe 67 as previously described.

When the plunger 57 of the valve 54 is shifted to open the pipe 60 to the pipe 45, the pressure in the pipes 45 and 89 drops momentarily but the check valves 91 and 109 prevent a material drop in the pressures in the cylinders 25 and in the sylphons 31.

Engagement of the die 15 with the blank 16 retards the upward movement of the piston 20 and causes the pressure in pipes 60 and 69 to rise until liquid breaks through the resistance valve 76 and operates the piston 71 to move the plunger 70 of the valve 63 to the position shown in Fig. 10, thereby closing the pipe 65 to the pipe 67 and opening it to the pipe 60 through the pipe 69.

Liquid from the pump 42 now flows through the valve 63 and the pipe 65 to the cylinder 18 and continues to flow through the pipe 60 to the cylinder 21, thus acting upon the combined effective areas of the ram 17 and the piston 20 and moving the ram upwardly to force the die 15 into the die 7 and draw or form an article from the blank 16. At the same time, a limited volume of liquid is flowing through the chokes 90 to maintain or create the desired pressures in the cylinders 28 and the sylphons 31.

The press is thus operated by liquid supplied from a single pump, pressure is maintained in its blank-holding cylinders and sylphons while the press ram is being operated, and the pressure in each blank-holding cylinder or sylphon is substantially independent of the pressure in any other blank-holding cylinder or sylphon.

After the blank has been formed, the levers 58 and 93 are operated to return the valve plungers 57 and 94 into the positions shown in Fig. 4. Liquid may now flow through the valve 54 to the upper end of the cylinder 21 and through the valve 78 to the upper ends of the cylinders 28 and retract the rams 17 and 24 to their initial positions, as previously described.

The lever 51 is then operated to move the plunger 50 of the valve 47 to the position shown in Fig. 6, thereby permitting liquid from the pump 42 to flow into the upper end of the cylinder 12 to advance the piston 11 and cause the plunger 10 to eject the finished article from the die 7. The lever 51 is then operated to return the plunger 50 to the position shown in Fig. 4 and thereby permit liquid to flow to the lower end of the cylinder 12 and retract the piston 11 to its initial position.

The invention herein set forth is susceptible of various modifications and adaptations without departing from the scope thereof as hereafter claimed.

The invention is hereby claimed as follows:

1. The combination, with a source of pressure fluid, of a holding cylinder, a power cylinder having a plunger fitted therein, means for delivering fluid freely from said source to each of said cylinders selectively to create a predetermined pressure in said holding cylinder and to operate said plunger, and means connected between said source and said holding cylinder to enable said

source to maintain said predetermined pressure substantially constant while delivering fluid freely to said power cylinder.

2. The combination, with a pump, of two cylinders, means for delivering fluid freely from said source to the first of said cylinders and then to the second cylinder to create pressure therein, and additional means connected between said pump and the first of said cylinders to enable said pump to deliver a limited volume of fluid to that cylinder while delivering fluid freely to the second cylinder.

3. The combination, with a holding cylinder and a power cylinder, of a pump for supplying fluid to said cylinders, means for delivering fluid from said pump to said power cylinder freely, and means for simultaneously delivering fluid from said pump to said holding cylinder and including a choke for limiting the flow of fluid thereto and a check valve for preventing the free escape of fluid therefrom.

4. The combination, with a power cylinder and a holding cylinder, of a pump for supplying fluid to said cylinders, fluid channels for connecting said holding cylinder to said pump, valve means for directing fluid from said pump through said channels to said holding cylinder to create pressure therein and operable to block said channels between said holding cylinder and said pump, means for directing fluid from said pump to said power cylinder, and a choke connected between said cylinders to enable said pump to deliver a limited volume of fluid to said holding cylinder while delivering fluid to said power cylinder.

5. The combination, with a source of pressure fluid, of a plurality of holding cylinders, a power cylinder having a plunger fitted therein, means for delivering fluid freely from said source to each of said cylinders to create pressure in said holding cylinders and to operate said plunger, and means connected between said source and said holding cylinders to enable said source to maintain pressure in said holding cylinders while delivering fluid freely to said power cylinder, and means for regulating the pressure in one holding cylinder independently of the pressure in another holding cylinder.

6. The combination, with a plurality of holding cylinders and a power cylinder, of a pump for supplying fluid to said cylinders, means for delivering fluid from said pump to said power cylinder freely, means for simultaneously delivering fluid from said pump to said holding cylinders and including a choke for limiting the flow of fluid to each holding cylinder and a check valve for preventing the free escape of fluid therefrom, and means for regulating the pressure in one holding cylinder independently of the pressure in another holding cylinder.

7. The combination, with a power cylinder and a plurality of holding cylinders, of a pump for supplying fluid to said cylinders, fluid channels for connecting said holding cylinders to said pump, valve means for directing fluid from said pump through said channels to said holding cylinders to create pressure therein and operable to block said channels between said holding cylinders and said pump, means for directing fluid from said pump to said power cylinder, and a choke connected between said power cylinder and each of said holding cylinders to enable said pump to deliver limited volumes of fluid to said holding cylinders while delivering fluid to said power cylinder, and means for regulating the pressure in one holding cylinder independently of the pressure in another holding cylinder.

8. A draw press, comprising a frame having a stationary die and a movable die for operating upon a blank, a cylinder arranged in said frame and having a ram fitted therein for advancing said movable die toward said stationary die and retracting it therefrom, a blank holder having a pressure ring to grip the blank between it and said stationary die and means for advancing said pressure ring toward said stationary die and retracting it therefrom, a pump, means for delivering fluid from said pump to said cylinder to operate said ram, a plurality of fluid actuated pressure units carried by said pressure ring to exert pressure upon different parts of the blank, means for delivering fluid to said units to operate the same, and means for varying the pressure exerted by each unit upon the blank.

9. A draw press, comprising a frame having a stationary die and a movable die for operating upon a blank, a cylinder arranged in said frame and having a ram fitted therein for advancing said movable die toward said stationary die and retracting it therefrom, a blank holder having a pressure ring to grip the blank between it and said stationary die and means for advancing said pressure ring toward said stationary die and retracting it therefrom, a pump, means for delivering fluid from said pump to said cylinder to operate said ram, a plurality of fluid actuated pressure units connected in parallel and carried by said pressure ring to exert pressure upon different parts of the blank, means for delivering fluid to said units to operate the same including a choke and a check valve connected to each unit in parallel with each other, and means for varying the pressure exerted by each unit upon the blank.

10. A draw press, comprising a frame having a stationary die and a movable die for operating upon a blank, a cylinder arranged in said frame and having a ram fitted therein for advancing said movable die toward said stationary die and retracting it therefrom, a blank holder having a pressure ring to grip the blank between it and said stationary die and a plurality of fluid motors for advancing said pressure ring toward said stationary die and retracting it therefrom, a pump, means for delivering fluid from said pump to said motors to operate the same and create pressure therein, means for delivering fluid to said ram cylinder to operate said ram, a plurality of pressure units carried by said pressure ring to exert pressure upon different parts of the blank, and means for connecting said pressure units in circuit with said motors.

11. A draw press, comprising a frame having a stationary die and a movable die for operating upon a blank, a cylinder arranged in said frame and having a ram fitted therein for advancing said movable die toward said stationary die and retracting it therefrom, a blank holder having a pressure ring to grip the blank between it and said stationary die and a plurality of fluid motors for advancing said pressure ring toward said stationary die and retracting it therefrom, a pump, means for delivering fluid from said pump to said motors to operate the same and create pressure therein, means for limiting the pressure in each motor, means for delivering fluid to said ram cylinder to operate said ram, a plurality of pressure units carried by said pressure ring to exert pressure upon different parts of the blank, means for connecting said pressure units to each

of said motors for the flow of fluid therebetween, and a shutoff valve connected between said pressure units and each motor.

12. A draw press, comprising a frame having a stationary die and a movable die for operating upon a blank, a cylinder arranged in said frame and having a ram fitted therein for advancing said movable die toward said stationary die and retracting it therefrom, a blank holder having a pressure ring to grip the blank between it and said stationary die and a plurality of fluid motors for advancing said pressure ring toward said stationary die and retracting it therefrom, a pump, means for delivering fluid from said pump to said motors to operate the same and create pressure therein, means for delivering fluid to said ram cylinder to operate said ram, a plurality of pressure units carried by said pressure ring to exert pressure upon different parts of the blank, means for connecting said pressure units in circuit with said motors, and means for limiting the pressure in one pressure unit independently of the pressure in another pressure unit.

13. A draw press, comprising a frame having a stationary die and a movable die for operating upon a blank, a cylinder arranged in said frame and having a ram fitted therein for advancing said movable die toward said stationary die and retracting it therefrom, a blank holder having a pressure ring to grip the blank between it and said stationary die and a plurality of fluid motors for advancing said pressure ring toward said stationary die and retracting it therefrom, a pump, means for delivering fluid from said pump to said motors to operate the same and create pressure therein, means for limiting the pressure in each motor, means for delivering fluid to said ram cylinder to operate said ram, a plurality of pressure units carried by said pressure ring to exert pressure upon different parts of the blank, means for connecting said pressure units to each of said motors for the flow of fluid therebetween, a shutoff valve connected between said pressure units and each motor, and means for limiting the pressure in one pressure unit independently of the pressure in another pressure unit.

14. A draw press, comprising a frame having a stationary die and a movable die for operating upon a blank, a cylinder arranged in said frame and having a ram fitted therein for advancing said movable die toward said stationary die and retracting it therefrom, a blank holder having a pressure ring to grip the blank between it and said stationary die and a plurality of fluid motors for advancing said pressure ring toward said stationary die and retracting it therefrom, a pump, means for delivering fluid from said pump to said motors to operate the same and create pressure therein, means for diverting said delivery of fluid from said motors to said ram cylinder to operate said ram, a choke connected between each of said motors and said ram cylinder for enabling said pump to deliver a limited volume of fluid to each motor to maintain pressure therein while delivering fluid freely to said ram cylinder to operate said ram, and a check valve connected in series with said choke for preventing the flow of fluid therethrough in the opposite direction.

15. A draw press, comprising a frame having a stationary die and a movable die for operating upon a blank, a cylinder arranged in said frame and having a ram fitted therein for advancing said movable die toward said stationary die and retracting it therefrom, a blank holder having a pressure ring to grip the blank between it and said stationary die and a plurality of fluid motors for advancing said pressure ring toward said stationary die and retracting it therefrom, a pump, means for delivering fluid from said pump to said motors to operate the same and create pressure therein, means for diverting said delivery of fluid from said motors to said ram cylinder to operate said ram, a choke connected between each of said motors and said ram cylinder for enabling said pump to deliver a limited volume of fluid to each motor to maintain pressure therein while delivering fluid freely to said ram cylinder to operate said ram, a check valve connected in series with said choke for preventing the flow of fluid therethrough in the opposite direction, and means for regulating the pressure in one motor independently of the pressure in another motor.

16. A draw press, comprising a frame having a stationary die and a movable die for operating upon a blank, a cylinder arranged in said frame and having a ram fitted therein for advancing said movable die toward said stationary die and retracting it therefrom, a blank holder having a pressure ring to grip the blank between it and said stationary die and a plurality of fluid motors for advancing said pressure ring toward said stationary die and retracting it therefrom, a pump, means for delivering fluid from said pump to said motors to operate the same and create pressure therein, means for diverting said delivery of fluid from said motors to said ram cylinder to operate said ram, a choke connected between each of said motors and said ram cylinder for enabling said pump to deliver a limited volume of fluid to each motor to maintain pressure therein while delivering fluid freely to said ram cylinder to operate said ram, a check valve connected in series with said choke for preventing the flow of fluid therethrough in the opposite direction, a plurality of pressure units carried by said blank holder to exert pressure upon the blank, and means for delivering fluid to said pressure units to operate the same.

17. A draw press, comprising a frame having a stationary die and a movable die for operating upon a blank, a cylinder arranged in said frame and having a ram fitted therein for advancing said movable die toward said stationary die and retracting it therefrom, a blank holder having a pressure ring to grip the blank between it and said stationary die and a plurality of fluid motors for advancing said pressure ring toward said stationary die and retracting it therefrom, a pump, means for delivering fluid from said pump to said motors to operate the same and create pressure therein, means for diverting said delivery of fluid from said motors to said ram cylinder to operate said ram, a choke connected between each of said motors and said ram cylinder for enabling said pump to deliver a limited volume of fluid to each motor to maintain pressure therein while delivering fluid freely to said ram cylinder to operate said ram, a check valve connected in series with said choke for preventing the flow of fluid therethrough in the opposite direction, means for regulating the pressure in one motor independently of the pressure in another motor, a plurality of pressure units carried by said blank holder to exert pressure upon the blank, and means for delivering fluid to said pressure units to operate the same.

18. A draw press, comprising a frame having a stationary die and a movable die for operating

upon a blank, a cylinder arranged in said frame and having a ram fitted therein for advancing said movable die toward said stationary die and retracting it therefrom, a blank holder having a pressure ring to grip the blank between it and said stationary die and a plurality of fluid motors for advancing said pressure ring toward said stationary die and retracting it therefrom, a pump, means for delivering fluid from said pump to said motors to operate the same and create pressure therein, means for diverting said delivery of fluid from said motors to said ram cylinder to operate said ram, a choke connected between each of said motors and said ram cylinder for enabling said pump to deliver a limited volume of fluid to each motor to maintain pressure therein while delivering fluid freely to said ram cylinder to operate said ram, a check valve connected in series with said choke for preventing the flow of fluid therethrough in the opposite direction, a plurality of pressure units carried by said blank holder to exert pressure upon the blank, means for delivering fluid to said pressure units to operate the same, and means for limiting the pressure in one pressure unit independently of the pressure in another pressure unit.

19. A draw press, comprising a frame having a stationary die and a movable die for operating upon a blank, a cylinder arranged in said frame and having a ram fitted therein for advancing said movable die toward said stationary die and retracting it therefrom, a blank holder having a pressure ring to grip the blank between it and said stationary die and a plurality of fluid motors for advancing said pressure ring toward said stationary die and retracting it therefrom, a pump, means for delivering fluid from said pump to said motors to operate the same and create pressure therein, means for diverting said delivery of fluid from said motors to said ram cylinder to operate said ram, a choke connected between each of said motors and said ram cylinder for enabling said pump to deliver a limited volume of fluid to each motor to maintain pressure therein while delivering fluid freely to said ram cylinder to operate said ram, a check valve connected in series with said choke for preventing the flow of fluid therethrough in the opposite direction, means for regulating the pressure in one motor independently of the pressure in another motor, a plurality of pressure units carried by said blank holder to exert pressure upon the blank, means for delivering fluid to said pressure units to operate the same, and means for limiting the pressure in one pressure unit independently of the pressure in another pressure unit.

20. A draw press, comprising a frame having a stationary die and a movable die for operating upon a blank, a cylinder arranged in said frame and having a ram fitted therein for advancing said movable die toward said stationary die and retracting it therefrom, a blank holder having a pressure ring to grip the blank between it and said stationary die and a plurality of fluid motors for advancing said pressure ring toward said stationary die and retracting it therefrom, a pump, means for delivering fluid from said pump to said motors to operate the same and create pressure therein, means for diverting said delivery of fluid from said motors to said ram cylinder to operate said ram, a choke connected between each of said motors and said ram cylinder for enabling said pump to deliver a limited volume of fluid to each motor to maintain pressure therein while delivering fluid freely to said ram cylinder to operate said ram, a check valve connected in series with said choke for preventing the flow of fluid therethrough in the opposite direction, means for regulating the pressure in one motor independently of the pressure in another motor, a plurality of pressure units connected in parallel with each other and carried by said pressure ring to exert pressure upon different parts of the blank, a relief valve connected to each pressure unit for limiting the pressure therein, and means for connecting said pressure units to each of said motors for the flow of fluid therebetween and including a shutoff valve connected between each motor and said pressure units and a choke and a check valve connected to each pressure unit in parallel with each other.

WALTER FERRIS.