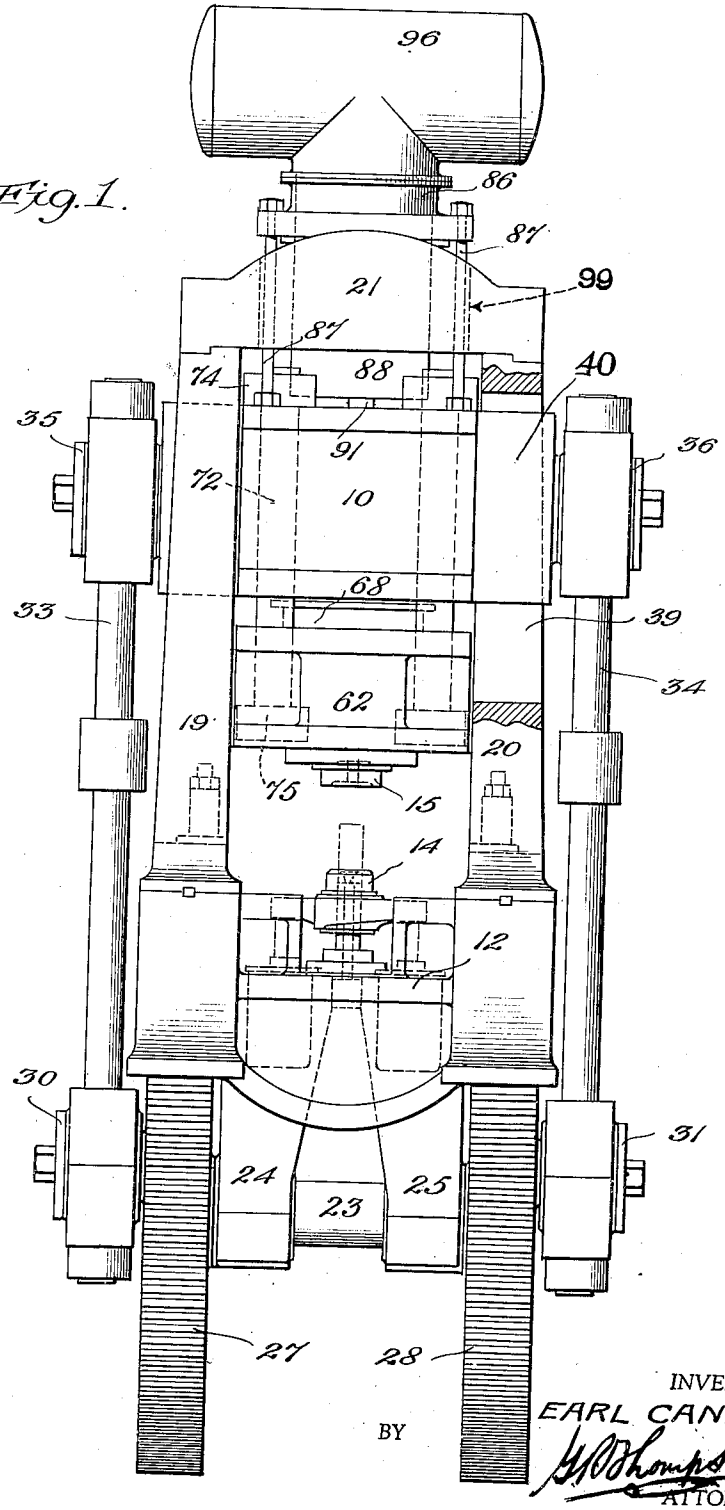
July 4, 1939. E. CANNON 2,164,640

PRESS COMBINATION HAVING MEANS FOR AVOIDING JAMMING

Filed May 6, 1937 4 Sheets-Sheet 1

Fig. 1.



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PRESS COMBINATION HAVING MEANS FOR AVOIDING JAMMING

Filed May 6, 1937 4 Sheets-Sheet 2

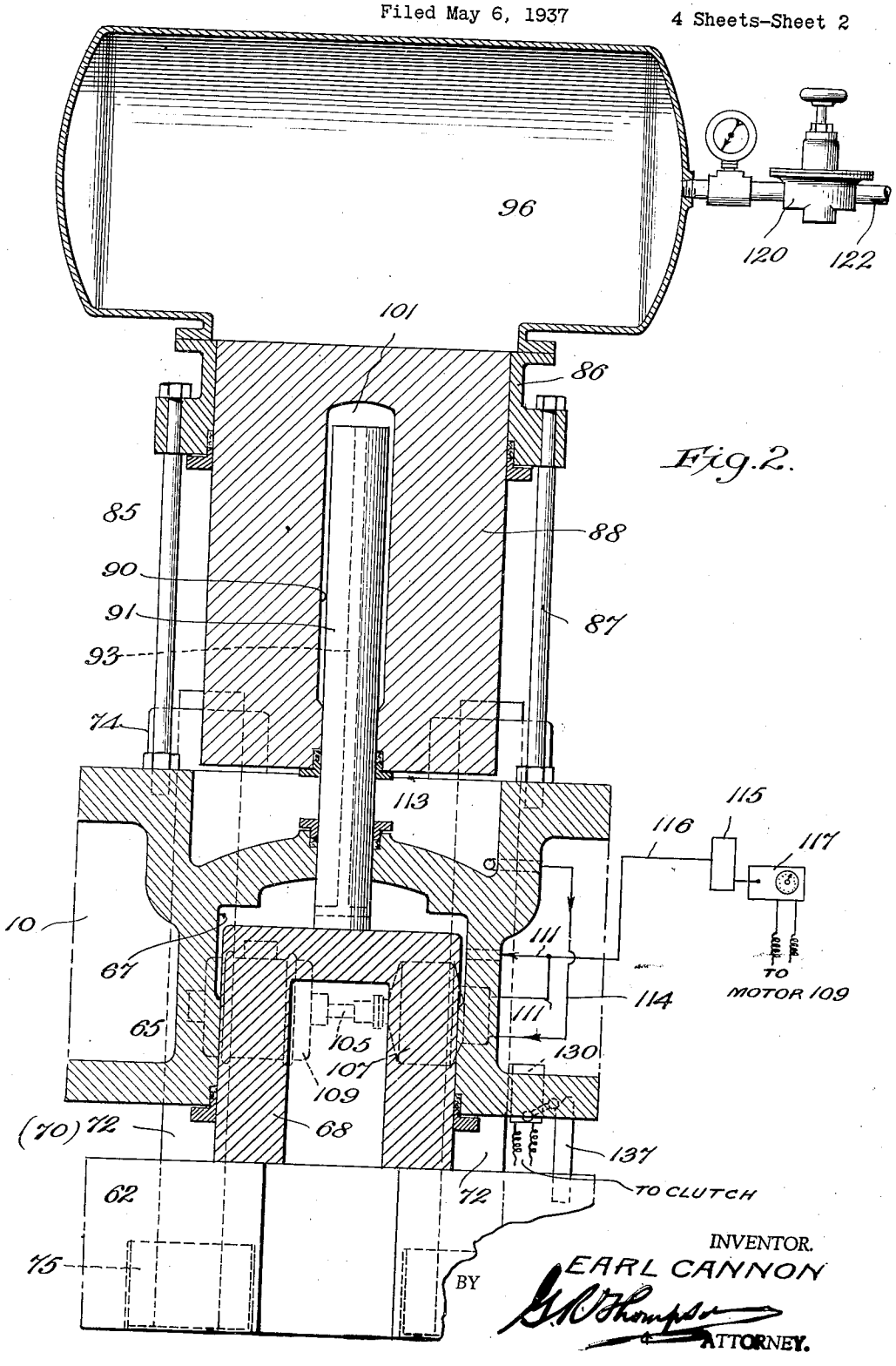


Fig. 2.

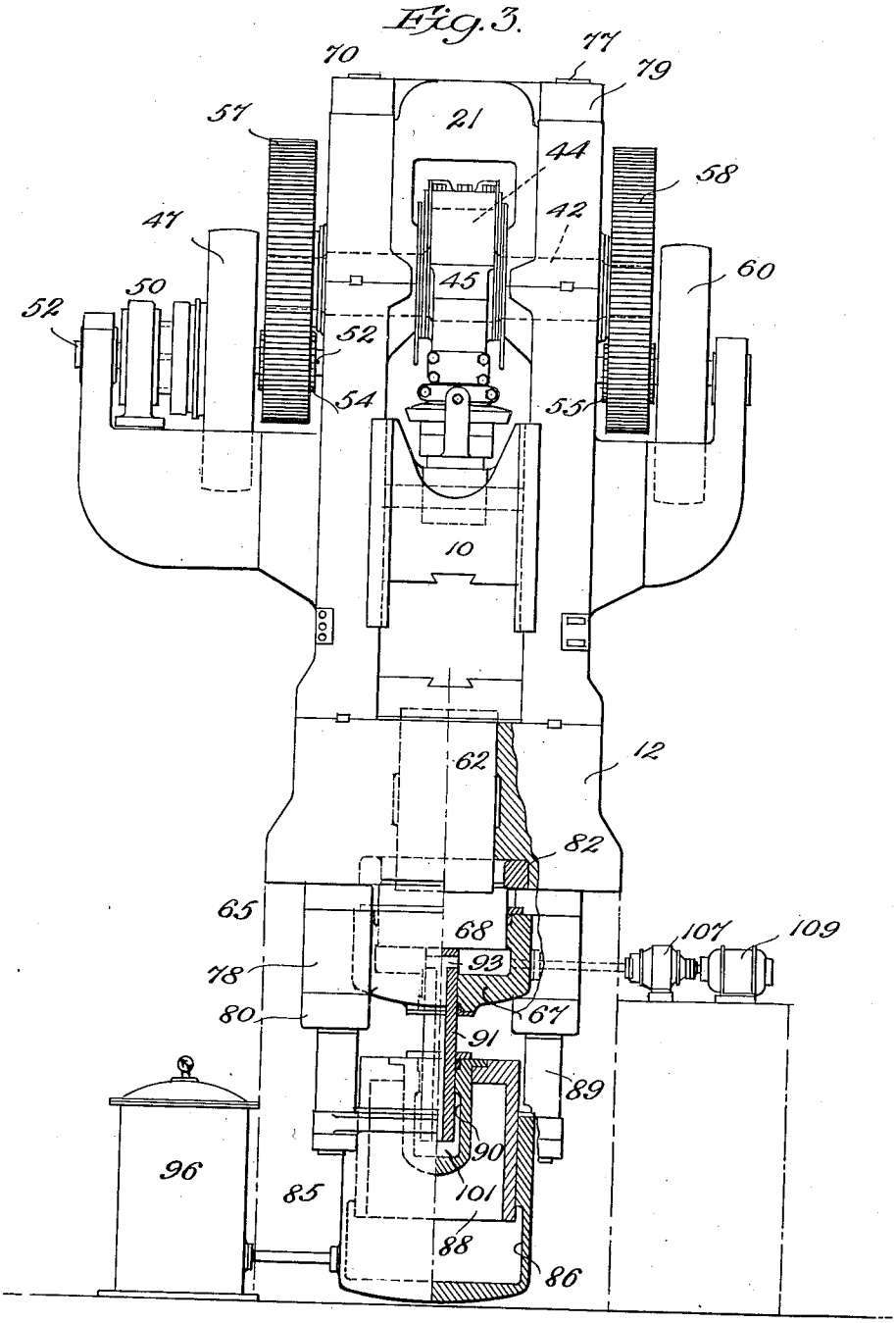
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PRESS COMBINATION HAVING MEANS FOR AVOIDING JAMMING

Filed May 6, 1937 4 Sheets-Sheet 3

Fig. 3.



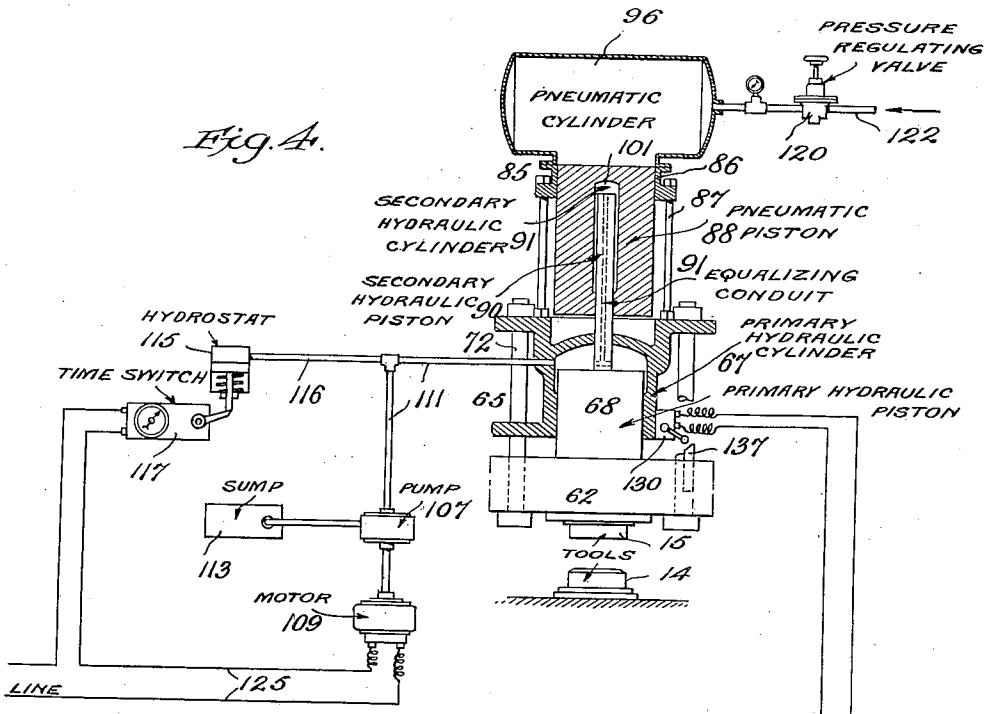
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PRESS COMBINATION HAVING MEANS FOR AVOIDING JAMMING

Filed May 6, 1937 4 Sheets-Sheet 4

Fig. 4.



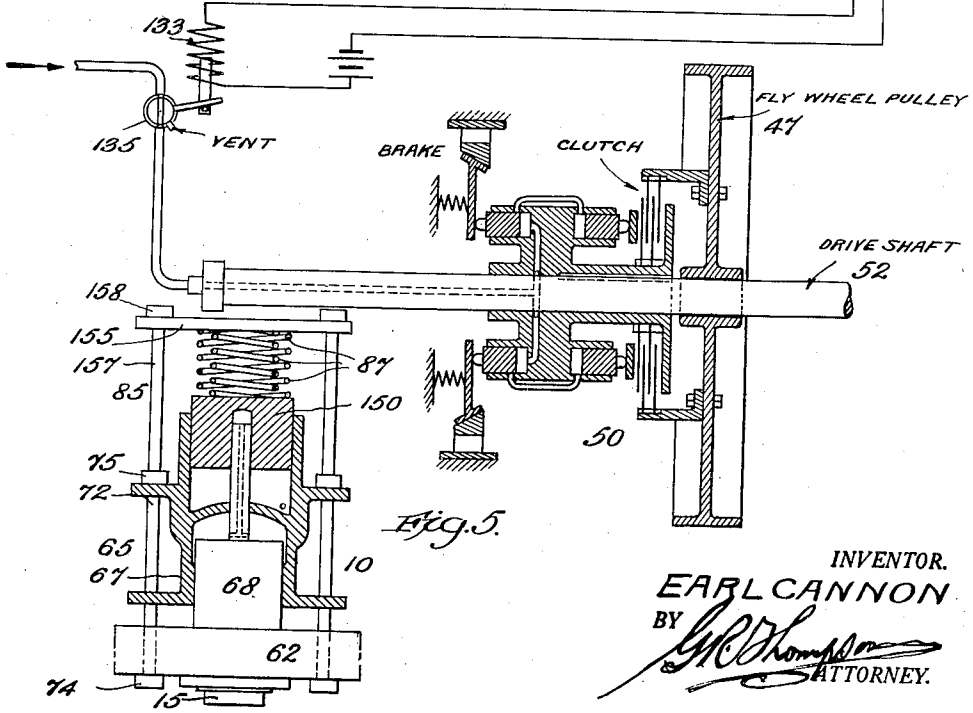


Fig. 5.

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2,164,640

UNITED STATES PATENT OFFICE

2,164,640

PRESS COMBINATION HAVING MEANS FOR AVOIDING JAMMING

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Application May 6, 1937, Serial No. 141,033

11 Claims. (Cl. 207—2)

This invention relates to mechanical presses which include means for preventing jamming or breaking when the resistance encountered by the tool-carrying parts exceeds the rated working force of the press, and provides improvements therein.

Jamming and breaking of presses arise from a number of causes. For example, tools and pieces of metal accidently left between the press tools (dies, or dies and punch) are such causes. In forging presses, the billet or piece to be shaped may have cooled too much before being struck, or have been too large. In extrusion presses, also, the billet may have cooled too much before or during extrusion.

The present invention provides a press combination which avoids jamming or breaking of the press, and which, when the tools of the press encounter a resistance which in ordinary presses would cause jamming or breaking, allows the press to complete its cycle of operation without stopping, or the press-parts to be backed off after stopping. The stopping or not stopping is a matter of the nature of the obstruction and of the design of the press-combination. The invention further provides a press combination which is self-acting to restore the parts to normal operating position or condition after operating to avoid jamming.

There are many practical limitations to overcoming the problem which has been solved by the present invention, especially in presses designed to apply a large working force. Take, for instance, a press designed to deliver a working force of 1200 tons. There are practical limits to the pressures which can be used in hydraulic and pneumatic means. On the other hand high pressures must be used to keep the size of hydraulic and pneumatic elements down to a practical relation to the size of the other press parts.

The present invention takes into account these limitations and provides a press combination incorporating hydraulic and elastic (mechanical or pneumatic) elements, which operates to avoid jamming, is self-acting to restore the parts to normal operating position after operating to avoid jamming, as heretofore stated, and in which the hydraulic and elastic elements are of a size to be readily combined with other parts of a press, without increasing the size of the press-parts over that required for the force to be delivered, and without exceeding practical hydraulic and pneumatic pressures.

The invention also provides advantages not attainable in a purely hydraulic means for the purpose heretofore mentioned. A liquid being substantially incompressible, a hydraulic means could not yield sufficiently except by venting liquid. At pressures of the order of a 1000 pounds per square inch and over, the so-called "wire drawing" effect on, or scoring of, the valves and valve seats would be so great as to impair the effectiveness of the means after a few operations; in fact, it is believed that at pressures of the order of 3000 pounds per square inch the valve would be so greatly impaired after one operation as to be useless. As already stated, the present invention avoids the venting of liquid.

Moreover, the present invention maintains the normal rigidity of the operating parts of the press and avoids the disadvantages of a mechanism comprising hydraulic means which is not pre-stressed by a hydraulic force equaling or approximating the rated working force of the press. By pre-stressing hydraulic means as herein described, much of the "spring" of the bed or slide is overcome when the working force is applied by the press, the cylinder walls are expanded to a degree beyond that which would occur when a working force within the rated working force of the press is applied, and the oil and the air occluded therein is compressed to a degree beyond that which would occur when a working force within the rated working force of the press is applied. Expansion of the cylinder walls and compression of the oil and of the air occluded therein would act to "cushion" the force with which the tools are applied, and is undesirable where a positive action throughout the full working stroke of the press is desired.

The invention further provides a press combination of the character referred to above, in which the hydraulic element and its adjuncts may all be mounted on a moving part of a press, as on the press slide, so as to avoid high-pressure lines running to the press. The hydraulic elements and its adjuncts may also be combined with the stationary parts of the press.

The invention further provides a press combination of the character referred to above, in which means for making up losses of liquid and gas from the hydraulic and pneumatic elements are readily and practically combined with the other parts of the press combination.

The invention further provides novel and useful combinations of press elements hereinafter set forth and defined in the claims.

Three embodiments of the invention are illustrated in the accompanying drawings, wherein:

Fig. 1 is a front elevation, partly in section,

of one embodiment, the press being of the type employed for extrusion.

Fig. 2 is an enlarged vertical section of parts of the press illustrated in Fig. 1.

Fig. 3 is a front elevation, partly in section, of a second embodiment, the press being of the type used for forging.

Fig. 4 is a diagrammatic view of the press combination according to the invention.

Fig. 5 is a diagrammatic view of a third embodiment.

Referring to said drawings, numerals 10 and 12 designate the tool-carrying parts of the press, on which are mounted the forming-tools 14 and 15, shown in Fig. 1 as an extrusion die and punch, respectively. The extrusion features are more fully disclosed in an application of William Klocke, Serial No. 136,764. In presses, one of the tool-carrying parts is usually a stationary bed located at the lower part of the press, and the other tool-carrying part is a slide which reciprocates toward and from the bed, but the position of the bed and slide are sometimes reversed, the press is sometimes horizontal and sometimes inclined, and sometimes the bed is reciprocated, as well as the slide. The press illustrated is a vertical press having a stationary bed 12 and a reciprocatory slide 10. The elements which yield so as to avoid jamming may be mounted on the slide or on the bed, and may be combined with the press-parts of any of the types of presses referred to above. For the sake of simplicity, the description which follows will ordinarily refer to a vertical type of press with stationary bed and reciprocatory slide.

The press frame may also have various forms usual in presses; as here shown the frame comprises side-pieces 19, 20 and a crown 21, tied to the bed 12.

Any of the usual, or suitable, mechanical means for driving or reciprocating the slide may be provided. As shown in Fig. 1, the driving means comprises a crank-shaft 23, journaled in hangers 24, 25, and driven by gears 27, 28. The crank-shaft 23 may have double cranks 30, 31, which transmit the crank-motion to the slide 10 as reciprocating motion through the long connecting rods 33, 34 and trunnions 35, 36 on the slide. The slide 10 is guided by suitable means. As shown in Fig. 1 the side-pieces 19, 20 are slotted as indicated by numeral 39, and reduced portions 40 of the slide 10, slide in the slots. As shown in Fig. 3, the mechanical means for driving the slide 10 is an overhead crank shaft 42 journaled in the crown 21, having a single crank 44, connected to the slide 10 by a connecting rod 45. The crank-shaft 42 may be driven by a fly-wheel pulley 47 transmitting motion through a clutch 50 to a back-shaft 52 having pinions 54, 55 thereon meshing with gears 57, 58 on the crank-shaft 42. Symmetry of motion is aided by a second fly-wheel 60 on back-shaft 52. The gears 27 and 28, Fig. 1 may be driven by a similar arrangement of fly-wheel pulley, clutch, back-shaft and pinions.

One or the other of the tool-carrying parts 10, 12, has a tool-support 62 mounted thereon, which is movable with relation thereto in a manner hereinafter described. In Fig. 1 the tool-support 62 is mounted on the slide 10; in Fig. 3 on the bed 12.

Numeral 65 designates a hydraulic means for exerting a force on tool-support 62 sufficiently great to prevent movement of said tool support by the normal forces (opposite to the hydraulic force) exerted by the driving means on the tool-carrying parts 10 and 12, and the tools thereon, in performing the normal work of the press. For example, if the press had a rated working force of 1200 tons, the hydraulic means 65 would act with a force of 1200 tons plus a safe overload in opposing motion of the tool-support 62. To conform to dimensions of the slide 10 or bed 12 which are normal or usual for a design of press based on the ordinary factors of design, high pressures are required in the hydraulic means to enable it to exert a force on the tool-support 62 approximating the rated working force exerted by the driving mechanism. Such design will often call for pressures of 3000 pounds per square inch or thereabout, which approaches the limit imposed by engineering considerations. As shown, the hydraulic means 65 comprises a cylinder 67 and a piston 68. The cylinder 67, in Figs. 2 and 5, is formed as a part of slide 10.

A means 70 is also provided for sustaining the action of the force of said hydraulic means 65 (piston 68) on the tool-support 62 in the normal position of the latter, so that said hydraulic means cannot move said tool-support 62, in its normal position, in the direction of the action of the hydraulic force on the piston 68. In Figs. 1, 2 and 5 the means 70 are strong tie-rods 72 which pass through the tool-support 62 and through the slide 10 (in which the cylinder 67 is formed) and have nuts or heads 74, 75 (or other suitable means) which sustain the force exerted by the hydraulic pressure against the cylinder 67 and the piston 68. In Fig. 3, the means 70 are the tie rods 77 which pass through the bed 12, crown 21, and lugs 78 on the cylinder 67, and have nuts or heads 79, 80 (or other suitable means) which sustain the force exerted by the hydraulic pressure against the cylinder 67 and the piston 68 and by piston 68 against a shoulder 82 on the bed 12 (in the absence of stress on tool-support 62), and transferred to the tool-support 62 when the force or resistance on the tool and on the tool support exceeds the force exerted by the hydraulic pressure against the piston 68. The tie-rods permit movement of the piston 68 against the hydraulic pressure in the cylinder 67, when the force or resistance on the tool on the tool-support 62 exceeds the force exerted by the hydraulic pressure within the cylinder against the piston 68.

A yieldable or elastic means 85 is provided for counterbalancing the hydraulic means 65. The counterbalancing means 85, may, as shown in Figs. 1–4, comprise a pneumatic cylinder 86 and a pneumatic piston 88, or, as shown in Fig. 5, comprise springs 87. The cylinder 86 is held by suitable means. As shown in Figs. 1 and 2 the cylinder 86 is fastened to the slide 10 by tie-bolts 87, and as shown in Fig. 3 is fastened to (or with relation to) the bed 12 by means of nuts on extensions 89 of the tie-rods 77. Inasmuch as good engineering practice and technical design is against the use of high pneumatic or gas pressures (against pressures which are in excess of 100 lbs./sq. inch), the area of the piston 88 would be comparatively large if the hydraulic pressure in the cylinder 67 was directly counterbalanced by the pneumatic pressure in the cylinder 86 acting on the pneumatic piston 88. In order to reduce the size of the cylinder and piston of the pneumatic device to a size conformable to the size of the other parts of the press combination made according to the ordinary considerations of design, the hydraulic device 65 may advantageously comprise a sec-

ondary cylinder and piston 90 and 91, of considerably less cross sectional area than the area of the primary cylinder and piston 67, 68. The secondary cylinder 90 is conveniently formed in, or as a part of the pneumatic piston 88, and a conduit 93 is provided for connecting the cylinder 67 with the cylinder 90, so that the hydraulic pressure within the cylinder 67 and 90 is equalized. The conduit 93 is conveniently formed as a bore in the secondary piston 91, with a lateral branch or branches as shown. With a hydraulic pressure of 3000 lbs. to the square inch in the cylinder 67, and a pressure at 100 lbs./sq. inch in the pneumatic cylinder 86, a counterbalancing pressure of 3000 lbs./square inch would be maintained in the cylinder 90, by giving the pneumatic piston 88 thirty times the area of the secondary hydraulic piston 91. With a pressure of 3000 lbs. to the square inch in the secondary cylinder 90, the pressure in hydraulic cylinder 67 would likewise be 3000 lbs./sq. inch, because of the communication between the cylinders 67 and 90 through the conduit 93. The function and operation of the pneumatic cylinder and piston 86, 88 is to allow movement of the hydraulic piston 68 (when a resistance is encountered by a tool on the tool-support 62 in excess of that which the press is designed to overcome), without the necessity of venting liquid from the hydraulic device. The advantage of avoiding venting of liquid from the hydraulic device is manifest, when it is realized that a venting device would be so scored by liquid flowing out at 3000 lbs./sq. inch as to make it useless or greatly impaired after one operation.

Moreover, the capacity of the cylinder 86 does not need to be excessive, inasmuch as the design of the hydraulic and pneumatic means may be such as to allow sufficient yielding of the tool-support 62 to avoid jamming or breaking of the press, by a movement of the pneumatic piston 88 such as will reduce the capacity of the cylinder 86 by about 1%. The cylinder 86, may, as here shown, consist in part of a drum 96.

By the present invention the hydraulic and elastic or pneumatic devices may be so compact as to be readily mounted on a moving part of the press, as the slide 10, as illustrated in Figs. 1 and 2 of the drawings. To reduce the height of the frame, a central opening may be provided in the crown 21, as indicated at 99 in Fig. 1.

In the hydraulic means 65, it is expected that there should be some leakage. A limited amount of leakage will not affect the pressure within the hydraulic device because the designated pressure will be maintained by the action of the pneumatic piston 88 (or equivalent elastic device). The secondary hydraulic cylinder 90 is so designed that there is a clearance 101 between the end of the cylinder and the end of piston 91 when the parts are in normal position, which allows a limited amount of movement of the piston 88 to compensate for loss of liquid from the hydraulic cylinder 67, before the end of piston 91 abuts against the end of cylinder 90. If the end of cylinder 90 abuts against the end of piston 91, the pneumatic piston 88 would no longer act to maintain the pressure following loss of liquid from the hydraulic cylinder 67. To avoid the result just referred to, a make-up device 105 may be provided, which, as here shown, may comprise a pump 107 and an electric motor 109 for driving it. When the hydraulic means 65 is mounted on the slide 10, the pump 107 and motor 109 are advantageously also mounted on the slide, so that a rigid pipe line 111 may be provided between the pump 107 and cylinder 67. The intake to the pump 107 may be connected to a sump 113 through a rigid pipe line 114. The pump 107 will require to be operated only at infrequent intervals, and then only for short periods in order to lift the end of cylinder 90 off of the end of piston 91 to provide the normal clearance 101. For this purpose, a pressure-responsive means 115 connected by a pipe 116 to the line 111, and operative to close a time-switch 117 in the circuit to the motor 109, upon a fall in pressure in the hydraulic cylinder 67, may be provided. The time-switch 117 breaks the circuit to the motor after the pump 107 has been driven thereby for a time predetermined for making up the volume of liquid in cylinder 67, and 90 to provide the desired clearance at 101.

An automatic valve 120 in a conduit 122 connected with a source of compressed air, may be provided for making up losses of air from the pneumatic means 85. When the hydraulic means 65 and the pneumatic means 85 are mounted on the slide 10, the conduit 122 may be a flexible tube, and in this form of the invention, the only connections between the reciprocatory slide 110 and appliances off the press are flexible air-tube 122 and a cable 125 containing the electrical conductors which lead to the motor 109, which present no mechanical difficulties.

It may be desirable to stop the running of the press following the yielding of the piston 68 heretofore described. For this purpose a means may be provided for disengaging the clutch 50. The clutch 50 may be a fluid-operated clutch construction disclosed in the patent to Klocke and Carter #2,023,597, and the aforesaid means for disengaging the clutch may comprise a switch 130 in an electric circuit with a solenoid 133 for actuating a valve 135 controlling the flow of fluid to the clutch 50. The switch 130 may be mounted on the same part as that on which the hydraulic means 65 is mounted (for example, in Figs. 1 and 2, the slide 10) in such manner as to be operated to close the circuit upon relative movement between the tool-support 62 and the tool carrying part 10 or 12 on which it is mounted. As shown in Fig. 2, the tool-support 62 may have a projection or finger 137 thereon projecting into the path of an arm of switch 130 so as to operate the latter to close the circuit through the switch upon the relative movement between the parts 10 and 62.

A third embodiment of the invention is diagrammatically illustrated in Fig. 5. Here heavy springs 87 are substituted for the pneumatic means. Numeral 150 designates a slide, in which is formed the secondary hydraulic cylinder 90 in which the secondary hydraulic piston 91 works. The slide 150 is acted on by an elastic device (springs 87) equivalent to that of the pneumatic device: that is, the force of springs 87 is such as to create a pressure in the hydraulic cylinder 90 equal to the pressure required in the hydraulic means 65 to develop a force on the tool support 62 equal or somewhat greater than the rated working force applied by the driving means of the press. The springs 87 may be stressed between a face of slide 150 and an abutment plate 155 connected to the slide 10 (or other tool carrying part of the press) by bolts 157 and nuts 158. The structure of the embodiment of Fig. 5 may be otherwise the same as shown in Figs. 1 and 2, and may also be incorporated in the bed of the

press similar to the arrangement shown in Fig. 3. The operation of the embodiment shown in Fig. 5 is similar to the operation of the embodiments of Figs. 1–4.

Résumé of operation

If and when the tools 14, 15 on the tool-carrying parts 10 and 12 meet a resistance exceeding the rated working force of the press, applied by the driving mechanism (as for example when a billet between an extrusion punch and die has cooled to such an extent that the resistance offered by the billet to the advance of the punch near the end of the extrusion operation becomes so great, that in a press without means for preventing jamming, the driving mechanism would exert such a force on the stalled tools as to either jam the press, or to break the bed or crown), the tool-support 62 acting through the piston 68 increases the pressure of the liquid in the cylinder 67, which increase of pressure in the cylinder 67 is transmitted through the conduit 93 to the cylinder 90. The increased hydraulic pressure acting on the pneumatic piston 88 (or equivalent elastic device such as springs 87), causes the piston 88 to move and compress the air in the cylinder 86 (and drum 96). In this way the driven tool-carrying part 10 can continue to move under the force of the driving mechanism against the hydraulic and pneumatic pressures in the hydraulic and pneumatic devices 65 and 85, even though the tools 14 and 15 are stalled. The movement of the slide 10 with relation to the tool-support 62, in the manner aforesaid, may be sufficient to enable the cranks 30, 31, Fig. 1 and 45, Fig. 3, to pass through the dead center, thereby avoiding jamming or breaking of the press. However, the design of the hydraulic means 65 and of the elastic or pneumatic means 85 or 87 may be such as to only allow such a limited amount of movement between the tool carrying slide 10 and the tool support 62 as to make it desirable to stop the press before the dead center position of the cranks 30, 31 and 45 is reached. Accordingly, after the driven slide 10 has moved a predetermined amount with relation to the tool-support 62, the finger or projection 137 operates the electric switch at 130 to energize the solenoid 133 to turn the valve 135 to position to vent fluid from the clutch 50, and thereby bring about the disengaging of the clutch through which the crank shaft 23, (Fig. 1, or 42, Fig. 3, is driven. Thereafter the direction of the rotation of the crank shaft may be reversed, the tools 14, 15 backed off from the obstruction, and the obstruction removed.

After the cranks 30, 31, Fig. 1, or 45, Fig. 3, have either passed through their dead center position, or have been backed off from their dead center position, following an obstruction to the movement of the tools 14, and 15, as heretofore explained, the hydraulic means 65 and the pneumatic means 85 (or springs 87) act to restore the parts to normal operating position. That is, the pressure of the air in the cylinder 86 (or of springs 87) which has been increased when the obstruction to the tools 14, 15 was encountered, acts on the pneumatic piston 88 (or slide 150) which latter acts on the liquid in the cylinders 90 and 67 and moves the hydraulic piston 68 until further movement thereof is stopped by the abutment of the tool-support 62 against the nuts on the tie-pieces 72, Figs. 1 and 2, or against shoulder 82, Fig. 3.

Incidental loss of air in the pneumatic cylinder 86 is made up from the source of compressed air through the tube 122 and automatic valve 120.

Incidental loss of liquid in the hydraulic cylinders 67 and 90 is made up by means of a motor driven pump 107. The pump 107 is connected to a pump 113 on its intake side, and to the cylinder 67 on its output side. The make up of loss of liquid is ordinarily at infrequent intervals, and the electric motor 109 for driving the pump 107 is automatically started and stopped through a time switch 117. The time switch may be actuated to close the circuit by a pressure responsive device 115 which is in communication with the hydraulic cylinder 67 through the pipes 116 and 111. When the end of the cylinder 90 comes to rest on the end of the secondary hydraulic piston 91, further loss of liquid will bring about a drop of pressure in the hydraulic cylinder 67, and this drop of pressure in the cylinder 67 will cause the pressure responsive device 115 to close the circuit to motor 109 through switch 117 and start the time mechanism to run. After the time mechanism of switch 117 has run for a predetermined time, which may be about five seconds, the time switch 117 breaks the circuit to motor 109, stops the motor, and ends for the time being the make-up of liquid to the cylinder 67.

The invention may receive other embodiments than those herein specifically illustrated and described.

What is claimed is:

1. A press comprising tool-carrying parts, one a reciprocatory slide, mechanical means for reciprocating said slide with a definite stroke, and means for preventing the jamming or breaking of the press when the resistance encountered by the tool-carrying parts exceeds the rated working force of the press, said means comprising a tool support on one of said tool-carrying parts and movable relative thereto, hydraulic means between said tool-support and tool-carrying part for exerting hydraulic force on said tool support sufficiently great to prevent movement of said tool support by opposite forces exerted in performing the normal work of the press approximating the rated working force of the press, means for sustaining the action of the force of said hydraulic means on said tool-support in its normal position, and means for counter-balancing the hydraulic force acting upon the said hydraulic means, said counterbalancing means comprising an elastic means and a slide or piston acted on in opposite directions by said elastic means and by hydraulic pressure within said hydraulic means, said elastic means, upon an increase of hydraulic pressure, yielding until the increased pressure thereof, counterbalances the increased hydraulic pressure, said slide or piston which is oppositely acted on by said elastic means and hydraulic pressure moving when said elastic means yields so that liquid within said hydraulic means is displaced without venting or loss thereof, and said tool support may yield when it encounters a resistance approximately the rated working force of the press, said elastic means expanding after the abnormal resistance exerted on the tool-support has passed, to re-establish the parts in normal counterbalanced position.

2. A press according to claim 1, wherein said hydraulic means and said elastic means are mounted on and move with the slide.

3. A press according to claim 1, wherein said hydraulic means and said elastic means are mounted on and move with the slide, and further comprising a motor-driven pump for mak-

ing up loss of liquid in said hydraulic means, also mounted on said slide.

4. A press according to claim 1, further including a clutch in said mechanical means for reciprocating the slide, and means operable upon relative movement between said tool-support and the tool-carrying part on which it is mounted, to disengage said clutch.

5. A press according to claim 1, wherein said slide or piston has a hydraulic cylinder therein, and wherein said hydraulic means comprises a primary cylinder and piston and a secondary piston of smaller diameter than the primary, said secondary hydraulic piston working in said hydraulic cylinder in said slide or piston of said elastic means, and a conduit connecting said primary hydraulic cylinder and the hydraulic cylinder in said slide or piston of said elastic means, so as to equalize the hydraulic pressure in said cylinders.

6. A press comprising tool-carrying parts, one a reciprocatory slide, mechanical means for reciprocating said slide with a definite stroke, and means for preventing the jamming or breaking of the press when the resistance encountered by the tool-carrying parts exceeds the rated working force of the press, said means comprising a tool support on one of said tool-carrying parts and movable relative thereto, hydraulic means between said tool-support and tool-carrying part for exerting hydraulic force on said tool support sufficiently great to prevent movement of said tool support by opposite forces exerted in performing the normal work of the press approximating the rated working force of the press, means for sustaining the action of the force of said hydraulic means on said tool-support in its normal position, and means for counterbalancing the hydraulic force acting upon the said hydraulic means, said counterbalancing means comprising pneumatic means, and a slide or piston acted on in opposite directions by said pneumatic means and by hydraulic pressure within said hydraulic means, said pneumatic means, upon an increase of hydraulic pressure, yielding until the increased pressure thereof, counterbalances the increased hydraulic pressure, said slide or piston which is oppositely acted on by said pneumatic means and hydraulic pressure moving when said pneumatic means yields so that liquid within said hydraulic means is displaced without venting or loss thereof, and said tool support may yield when it encounters a resistance aproximating the rated working force of the press, said pneumatic means expanding after the abnormal resistance exerted on the tool support has passed, to re-establish the parts in normal counterbalanced position.

7. A press according to claim 6, wherein said hydraulic means and said pneumatic means are mounted on and move with the slide.

8. A press according to claim 6, wherein said hydraulic means and said pneumatic means are mounted on and move with the slide, and further comprising a motor-driven pump for making up loss of liquid in said hydraulic means, also mounted on said slide.

9. A press according to claim 6, further including means for making up loss of liquid in said hydraulic means, and means for making up loss of gas in said pneumatic means.

10. A press according to claim 6, wherein said pneumatic means comprises a piston having a hydraulic cylinder therein, and said hydraulic means comprises a primary cylinder and piston and a secondary piston of smaller diameter than the primary, said secondary hydraulic piston working in said hydraulic cylinder in said pneumatic piston, and a conduit connecting said primary hydraulic cylinder and the hydraulic cylinder in said pneumatic piston, so as to equalize the hydraulic pressure in said cylinders.

11. A press according to claim 1, wherein said elastic means comprises a spring or the like.

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