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W. SCHMITT

PRESSES

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2 Sheets-Sheet 1

Fig. 2

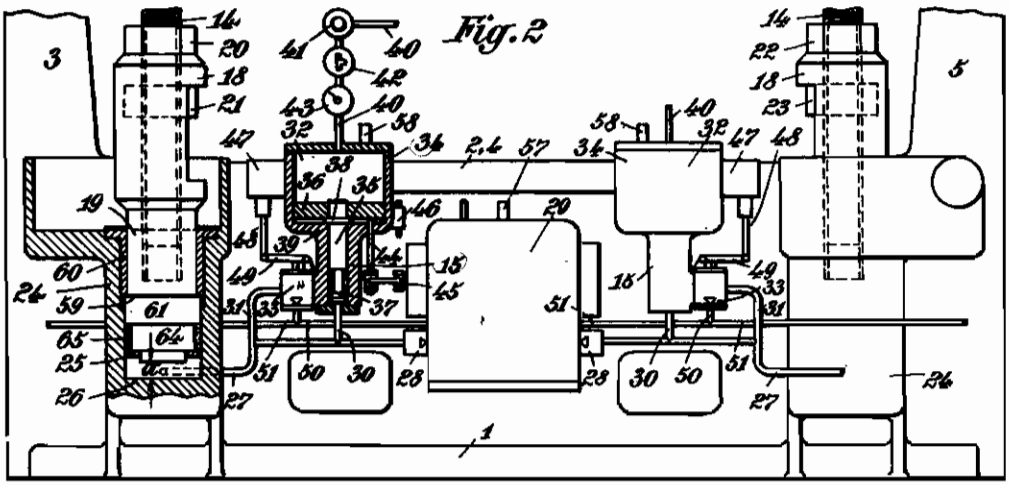

Fig. 1

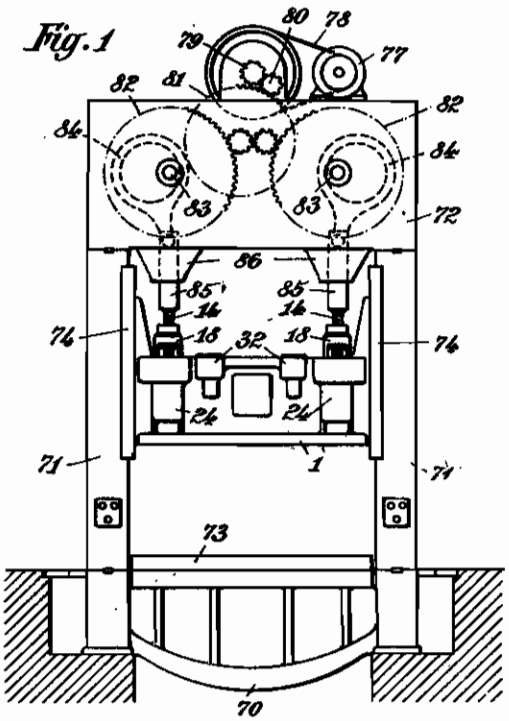

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Fig. 3

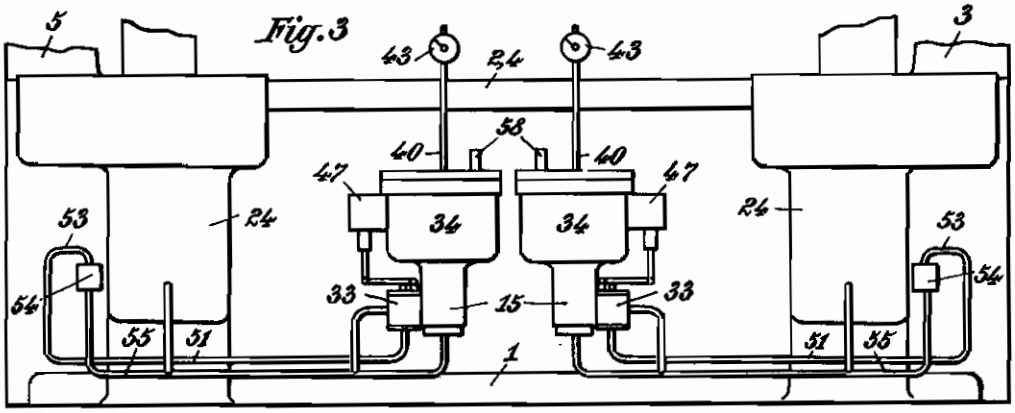
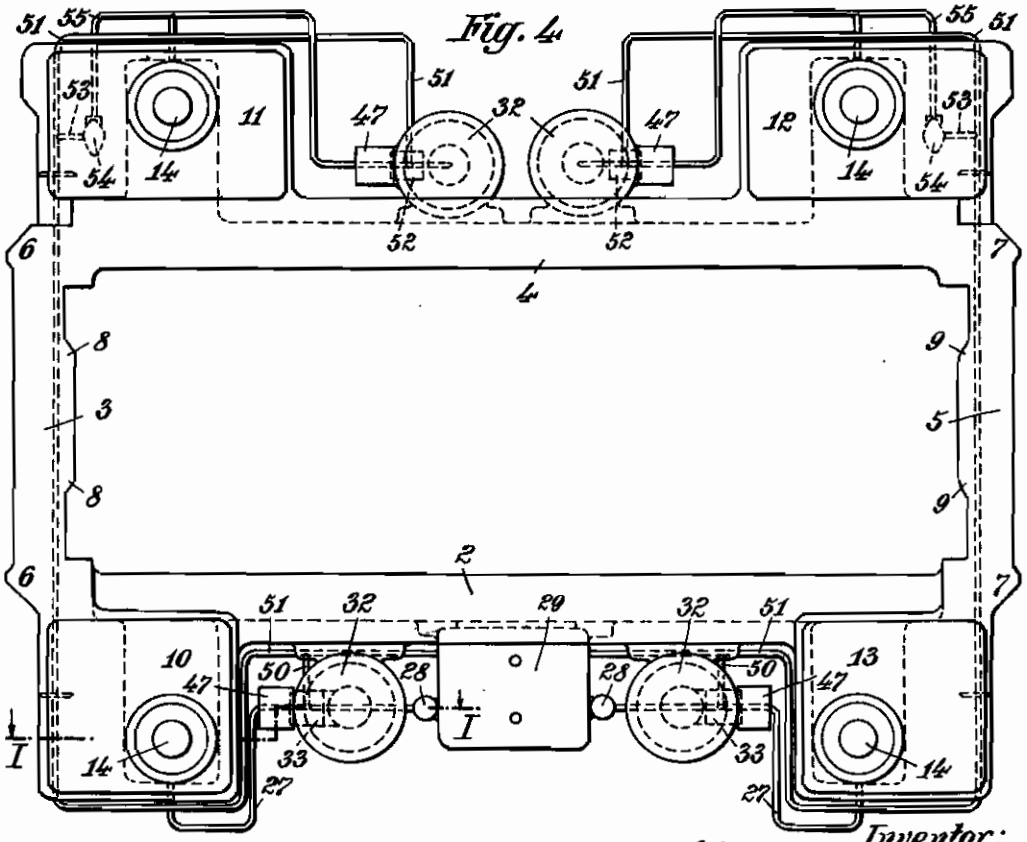


Fig. 4



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ALIEN PROPERTY CUSTODIAN

PRESSES

Wilhelm Schmitt, Goppingen, Germany; vested in the Alien Property Custodian

Application filed October 24, 1940

My invention relates to improvements in presses such as metal working presses, and more particularly in presses of the type comprising a frame, a blank holder, a slide or ram movable on the said frame for exerting pressure on a blank placed on said holder, positive driving mechanism such as a crank or cam for moving said slide or ram, and a fluid pressure cushioning device interposed between said positive driving mechanism and slide. As is known in the art the objects of such cushioning devices are, first, to permit the pressure transmitted to the slide or ram to be varied, and, second, to prevent excessive pressure to be exerted when the slide or ram meets an accidental obstruction or the resistance rises for other reasons. The driving mechanism is constructed so as to be capable of a certain movement relatively to the slide after the slide has engaged the blank for exerting pressure. This construction acts as a safety device preventing destruction of the press or its driving mechanism by excessive pressure. Further it is valuable in such presses in which the slide remains under pressure for a certain length of time after it has arrived at the end of its working stroke. In such presses the operation of the driving mechanism can not easily be interrupted exactly in the end position of the slide, and by providing the cushioning device the driving mechanism may continue its working stroke after the slide has arrived at the end of its working stroke.

One of the objects of the improvements is to provide a pressure-fluid cushioning device which may be operated by fluid under comparatively low pressure such as is ordinarily at hand in the work shop, and with this object in view my invention consists in associating a pressure increasing device with the said cushioning device which has a supply of a fluid of comparatively low pressure, and which is adapted to build up high pressure within the cushioning device.

Another object of the improvements is to provide a cushioning device in which the fluid is normally under low pressure, and the said pressure is immediately increased so far as is needed for transmitting the power from the driving mechanism to the slide, when the slide engages the blank.

Another object of the improvements is to provide a cushioning device in which the fluid pressure is automatically released when it rises to an upper limit, and with this object in view my invention consists in providing a safety valve in connection with the cushioning device which is adapted to be opened by the said pressure transmitting device, the pressure fluid being preferably conducted into a storage tank from which it may be returned into the cushioning device.

In a press in which a plurality of driving members and cushioning devices are associated with the slide I provide pressure transmitting and cushioning devices for each driving member, all the cushioning devices being connected with the same storage tank.

Other objects of the improvements will appear from the following description.

For the purpose of explaining the invention an example embodying the same has been shown in the accompanying drawings in which the same reference characters have been used in all the views to indicate corresponding parts. In said drawings,

Fig. 1 is an elevation showing a press,

Fig. 2 is an elevation partly in section and on an enlarged scale showing the reciprocating slide and the cushioning device associated therewith,

Fig. 3 is a rear elevation of the said slide, and

Fig. 4 is a top plan view of the slide.

For the purpose of explaining the invention I shall describe the same as embodied in a press used for stamping or shaping sheet metal, and more particularly in the slide forming a part of the blank holder. But I wish it to be understood that my invention is not limited to the embodiment in the press shown in the drawings, and that it may be used in presses of any type. As is known in the art, the driving mechanism for the said slide can not be adjusted with such accuracy that its operating members arrive in the lower dead center when the slide is in position for holding the blank, and the said driving mechanism will be arrested either before or after its lower dead center. If the driving mechanism is rigidly connected with the slide or blank holder, the blank is correctly clamped in position only when the blank holder is arrested exactly in the lower dead center of the driving mechanism. If, however, the blank holder is in position for engaging the blank before or after the driving mechanism has passed its lower dead center, the blank is not rigidly held in position and therefore it is crumpled during the drawing operation. Further, the parts of the machine are endangered by excessive pressure. For this purpose cushioning means have been provided in connection with the blank holder, so that it is not necessary to throw the driving mechanism out of operation exactly in the lower dead center.

Referring now to Fig. 1, the frame of the press comprises a bed 70, uprights 71 and a head 72. On the bed 70 a bolster plate 73 is mounted, and in guide ways 74 a slide 76 is mounted, which, as shown, cooperates with a blank holder placed on the bed or bolster plate for gripping the blank of sheet metal. The slide 76 is in the form of a rectangular frame as will be described hereinafter and internally it is provided with guide ways in which a ram or punch has reciprocating movement. This ram or punch and the die

placed on the bolster plate do not form a part of my invention and therefore I have not illustrated the same in the drawings.

The slide 76 is adapted to be reciprocated by crank mechanism mounted in the head and engaging the slide at four points 10, 11, 12 and 13. The said crank mechanism comprises a motor 77, a belt gearing 78, and gear wheels 79, 80, 81 and 82, two gear wheels 82 being fixed to two shafts 83. On the said shafts 83 eccentrics 84 are mounted which are operatively connected with four rods 85 slidable in bearings 86 mounted on the head 72.

The slide 76 consists of four side members 2, 3, 4 and 5 cast integral, and the side members 3 and 5 are provided externally with guide members 6 and 7 by means of which the slide is guided in the uprights 71. Internally the frame members 3 and 5 are provided with guide members 8 and 9 in which the ram is guided.

For transmitting the reciprocating movement of the crank mechanism to the slide 76 four liquid pressure cushioning members have been provided which are similar in construction and only one of which has been shown in detail in Fig. 2. As shown in the said figure the said cushioning member comprises a cylinder 24 cast integral with the side member 2 of the slide 76 and a piston or plunger 19 reciprocating therein. The said plunger is formed with a tubular extension 18 which is engaged by a screw-threaded rod 14, the said rod being adjustably fixed in position within the tubular extension 18 by means of nuts 20 and 21. It will be understood that four rods 14 are provided which are fixed to the rods 85. The plunger 19 is formed with a collar 61 forming a shoulder 59; and within the cylinder 24 there is a sleeve 60 which is held in position by means of screws (not shown). The lower end 64 of the plunger is provided with packing material 65 held in position by means of a ring 25. By the said sleeve 60 and collar 61 the reciprocating movement of the plunger within the cylinder is limited, the extent of the reciprocating movement being indicated in Fig. 2 by the letter *a*.

To the bottom part of the cylinder 24 located between the ring 25 and the bottom 26 of the cylinder a suitable liquid under low pressure is supplied through a pipe 27 which is connected with a storage tank 29 fixed to the member 2, a check valve 28 being provided between the said tank and the cylinder permitting the flow of the liquid from the said tank to the cylinder and preventing the back flow of the said liquid.

The cylinder is connected with a device 32 for building up pressure within the liquid supplied thereto, and the said device consists of two cylinders 34 and 15 of different diameters cast integral with each other, and having pistons 36 and 37 reciprocating therein, the said pistons being rigidly connected with each other by a piston rod 35 formed with a collar 38 adapted to be seated on the wall 39 of the cylinders 34 and 15 for limiting the downward movement of the pistons. The bottom part of the cylinder 15 is connected with the pipe 27 by a branch pipe 30, and the upper cylinder 34 is connected with a suitable elastic low pressure fluid supply through a pipe 40, the said pipe including a reducing valve 41, a two-way cock 42 and a pressure gage 43, so that the fluid pressure acting on the piston 36 may be adjusted as desired by means of the reducing valve 41. While the collar 38 bears on the wall 39 no pressure is exerted by the piston 37 on the liquid within the pipes 27, 30 and the cylinder 24, and therefore there is only low liquid pressure within the said parts which is equal to the low pressure within the tank 29. To the tank 29 the liquid is supplied through a pipe 57 from a suitable low pressure liquid supply provided in the work shop.

The pipe 27 is connected by a pipe 31 with a safety valve 33 the stem of which is connected by a pivotally mounted lever 49 and a connecting rod 48 with an electromagnet 47 which, as shown, is fixed to the wall of the cylinder 34. The safety valve normally closes a pipe 50, 51 connected with the tank 29 and permitting, when open, the escape of the pressure liquid from the cylinder 24 and the pipe 27 to the tank 29.

To the piston 36 a rod 44 is fixed which carries an operating member 45 in position for acting on a switch 46, the said switch being electrically connected with a source of electric energy and the electromagnet 47.

Similar means, viz. the cylinder 24 and its piston 19, the cylinders 34, 15 and their pistons 36 and 37, and a safety valve 33 and its electromagnet 47 are provided at the right hand side of the member 2 of the slide in connection with the part 13 thereof, and the same reference characters have been used to indicate corresponding parts. However, the controlling switch 45, 46 may be dispensed with, and it has been shown only in connection with the cylinder 34, 15 and the pistons 36, 37 shown at the left hand side of Fig. 2, and the pipe 51 connected with the safety valve 33 through the branch pipe 50 communicates with the same tank 29.

In connection with the rear parts 11 and 12 of the slide rods 14, connecting members 18, plungers 19 and cylinders 24, and also devices 32 for building up pressure have been provided, as is shown in Figs. 3 and 4. The said parts are connected with the pipe 51. These devices and associated parts are alike in structure at both sides of the member 4, and the same letters of reference have been used to indicate corresponding parts, so that only one of the sets of devices need be described.

The pipe 51 is connected with a safety valve 52 which is controlled by one of the electromagnets 47. Further, it is connected by a branch pipe 53 including a check valve 54 and by a pipe 55 to the cylinders 15 and 24. It appears therefore, that at the rear side of the slide shown in Fig. 3 the cylinder 24, the device 34, 15 for building up pressure and the safety valve 33 are connected through the pressure pipe 55 with the check valve 54, and further, the safety valve 33 is connected through the pressure pipe 51 with the storage tank 29 located at the front side of the press.

The storage tank 29 has a supply of a suitable low pressure liquid such for example as oil, and its object is to supply any liquid to the pipes 27, 30, 31, 50, 51, 53, and 55 and the cylinders and valves connected therewith, which may be lost by leakage or otherwise in the course of the operation of the press, and further, the said tank is adapted to take up any liquid which may be pressed from the cylinders 24 through the pipe 51.

The storage tank 29 and the devices 32 are provided with safety valves 57 and 58.

The operation of the slide is as follows:

The cylinders 24 are filled with low pressure liquid from the tank 29 respectively through the check valves 28, the pipes 27, the check valves 54 and the pipes 51 and 55. Low pressure fluid is supplied to the cylinders 34 through the supply

pipes 40. While the slide 76 is in retracted position and no pressure is exerted thereby on the blank holder, the pressure within the cylinders 24 is small, the pistons 36 and 37 being relieved of the pressure within the cylinders 34 by the collar 38 being seated on the wall 39. The plunger 19 is in the position shown in Fig. 2, in which the shoulder 59 of the collar 61 engages the sleeve 60. The same conditions are maintained while the slide descends, and afterwards while it is moved upwardly by the crank mechanism, the said slide being positively retracted by the collar 61 engaging the sleeve 60.

At the end of the downward stroke the slide 76 bears on the blank and presses the same on the blank holder.

The spindles 14 have been set in the connecting members 18 so that after engaging the blank slide 76 continues its downward stroke a slight distance of say 1 or 2 millimeters. Thereby pressure is built up within the liquid contained in the cylinders 24, because the said liquid can not escape into the tank 29 by reason of the check valves 28 and 54, and the pistons 37 are pressed downwardly by the fluid pressure within the cylinders 34. While this fluid pressure is small it is transformed into high pressure within the cylinders 15 when the reaction of the blank holder on the slide 76 is transmitted through the liquid within the cylinders 24 and to the cylinders 15, and the collar 38 is raised from its seat on the wall 39. The pressure within the cylinders 34 is set by means of the reducing valves 41 so that, considering the diameters of the pistons 36, 37 and 19, the pressure within the cylinders 24 and on the plungers 19 is equal to the pressure to be exerted by the rods 14 on the blank. However, this high pressure is built up only when the slide 76 exerts pressure on the blank and the plungers 19 are moved downwardly within the cylinders 24, because only by such downward movement of the plungers the pistons 37 and 36 are elevated with the collars 38 away from the walls 39. While by the upward movement of the pistons 36 within the cylinders 34 the pressure of the fluid within the said cylinders and therefore the pressure built up within the cylinders 24 is slightly increased, yet this increase of pressure is practically small and immaterial, by reason of the large height of the column of fluid within the cylinders 34 and the pipes 40.

While the slide is thus in clamping engagement with the blank the driving mechanisms and the plungers continue their downward stroke through a distance of 1 or 2 millimeters and thereafter they are arrested, while the ram performs its drawing stroke and is retracted from the blank. Now the spindles 14 are retracted and they carry along the plunger 19, which first engages the sleeve 60 with its collar 61 and thereafter is positively moved upwardly. Thereby the pressure within the cylinders 24 and 15 falls off to the low pressure of the liquid within the storage tank 29, the collar 38 engaging the wall 39 and relieving the pressure of the piston 36 on the liquid within the cylinders 24.

If in the course of the downward stroke the slide 76 meets a high resistance, for example by reason of a tool being accidentally left on the blank holder or two blanks being placed on the said blank holder, the slide 76 is prematurely arrested, and the plungers 19 are forced downwardly by the driving mechanism more than 1 or 2 millimeters and so far that by the liquid expelled from the cylinder 24 the pistons 36 and 37 are forced upwardly to such an extent that the part 45 operates the switch 46. Thereby all the electromagnets 47 are energized, and the safety valves 39 and 52 are opened by means of the rods 48 and the levers 49. Therefore the liquid within the pipes 27, 30, 31, 51 and 55 and within the cylinders 24 and 15 partly escapes through the pipes 50 and 51, and it is returned into the storage tank 29. The pistons 36 are pressed with the collars 38 on the walls 39, so that the fluid pressure within the cylinders 34 is not transmitted anymore to the liquid within the pipes 27, 30, 31 and 55. Therefore, even if the driving mechanism and the pistons 19 continue their downward movement, the pressure within the said pipes does not exceed the pressure within the storage tank, and the liquid is further expelled from the cylinders 24 and into the storage tank. Thus injury to the driving mechanism or other parts of the press is avoided.

When the driving mechanism and the spindles 14 are moved upwardly the plungers 19 are first lifted within the cylinders 24 with the collars 61 into engagement with the sleeves 60, and during such relative upward movement they draw liquid from the storage tank 29, so that the cylinders 24 and 15 are again filled with low pressure liquid. In the meantime the safety valves 33, 52 remain in open position, and therefore also below the plungers 19 there is the low pressure within the storage tank 29. Finally the switch 46 is opened by hand, and the safety valves 33 and 52 are closed.

As appears from the above description, all the electromagnets 47 are controlled by the same switch 46, and therefore all the safety valves are simultaneously opened for permitting the liquid to escape from the cylinders 24 and relieving the pressure of the said liquid. The pressure transmitting devices 32 are charged with pressure fluid through the pipes 40, and the liquid is supplied to the plungers 19 and 37 at the points 11 and 12 through the pipe 51 and the check valves 54.

For each pressure transmitting device 32 a separate supply 40 for low pressure fluid and reducing valve 41 are provided, and therefore the pressure acting on the pistons 36 may be independently regulated according to the pressure needed at each point 10, 11, 12 or 13.

From the foregoing description it will be understood that the cushioning device for the slide is simple in construction and reliable in operation, and that it may be operated with pressure fluid which will be found in any work shop. When the press is installed in a work shop it is only necessary to connect the storage tank 29 to a suitable low pressure liquid supply and the pressure transmitting devices 32 to a suitable air pressure supply. Thereafter the operation of the cushioning device is automatic and after the safety valves 33, 52 have once been opened the liquid is automatically supplied to the cushioning devices. The cushioning device is also constructed so as to provide a safety device by means of which the liquid pressure within the cylinders 24 is immediately relieved whenever the slide meets an excessive resistance. Thus injury to the slide and its driving mechanism is avoided.

While in describing the invention reference has been made to a blank holder for sheet metal blanks I wish it to be understood that my invention is not limited to such use, and that my improved cushioning system may be used in presses or machine tools of any type.

WILHELM SCHMITT.