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PRESSING OR PUNCHING MACHINE

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2 Sheets-Sheet 1

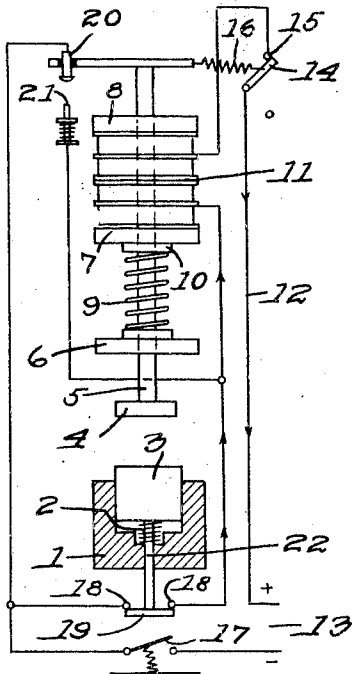


Fig. 1

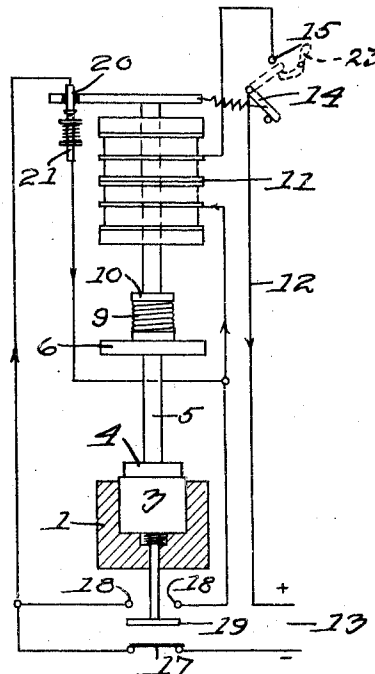


Fig. 2.

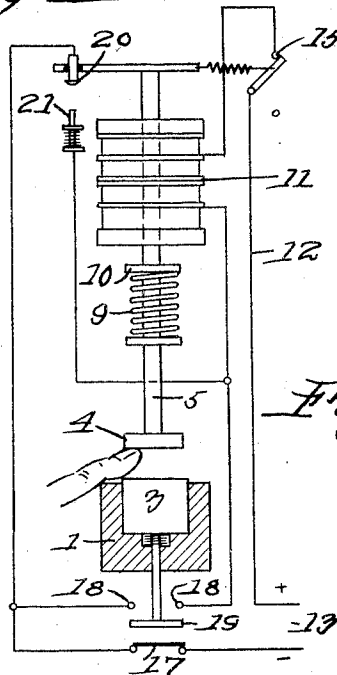


Fig. 3

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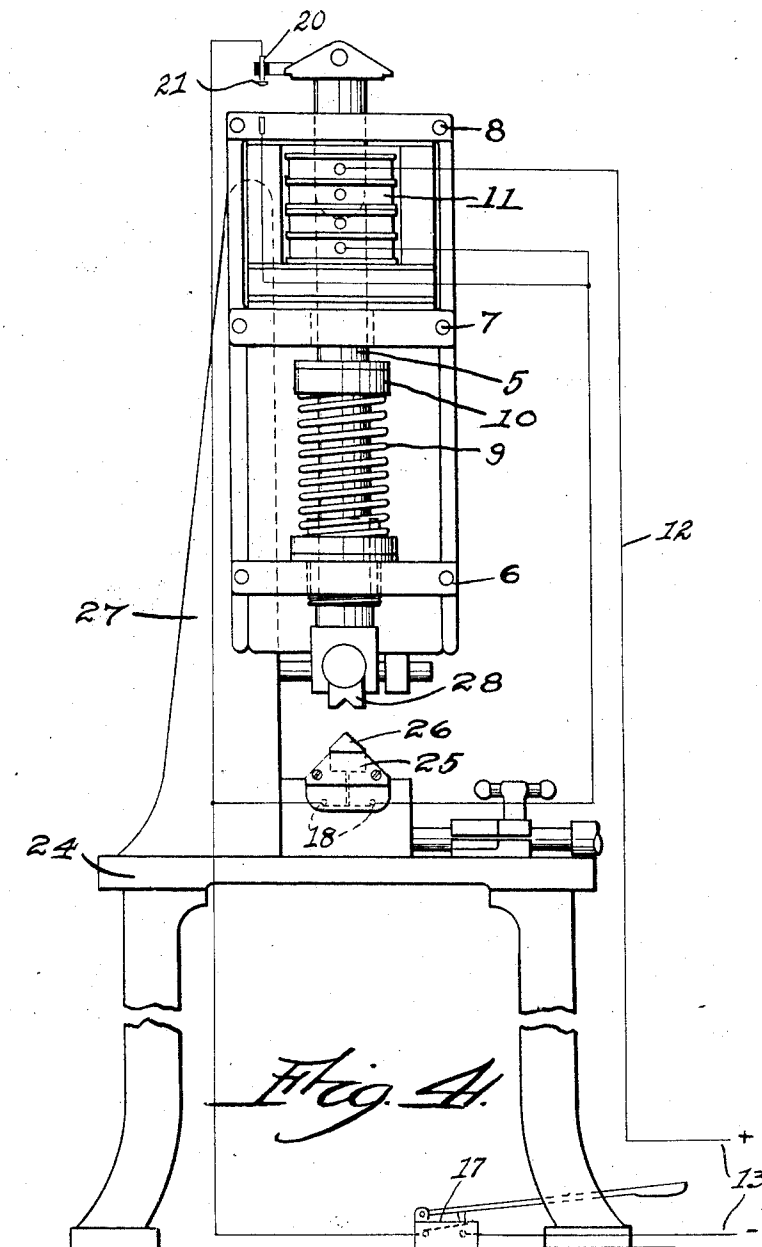
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

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PRESSING OR PUNCHING MACHINE.

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My invention relates to a machine adapted by its operation to exert pressure, or to deliver a blow on work supported between relatively movable members, the machine being particularly characterized by the fact that the pressing or punching effect is obtained as a result of electromagnetic forces acting on either one, or both of the members.

One object of my invention is to provide an improved machine in which the energization of the members to exert pressure is always directly under the control of the operator, whereby the pressure on work, or any other object between the members, may be exerted or released, either automatically or manually at any desired stage in the operation of the machine.

Another object of my invention is to provide an improved pressing or punching machine in which the movable work performing member will be automatically arrested in its movement toward the work supporting member and immediately withdrawn to an inoperative position should the moving member encounter an obstruction, such as a finger or hand, extraneous to the work supported between the members, whereby actual injury to the operator will be effectively prevented. The above and other advantageous features of my invention will hereinafter more fully appear, with reference to the accompanying drawings, in which—

Fig. 1 is a diagrammatic view illustrating the principle of my invention, the pressing members being shown in an inoperative position.

Fig. 2 is a diagrammatic view similar to Fig. 1, showing the members in position for exerting pressure therebetween.

Fig. 3 is a diagrammatic view illustrating the functioning of my machine to prevent injury to an operator.

Fig. 4 is a view in front elevation of a box making machine embodying my invention.

Like reference characters refer to like parts in the different figures.

Referring first to Figs. 1, 2 and 3, the principle of my invention will first be described with reference only to the essential elements of a pressing machine which generally comprises an anvil block 1 providing a recess 2 in which is yieldably supported an anvil, or work supporting die 3. An upper die, or work performing member 4 is carried by a plunger 5 supported for sliding movement

in vertically spaced guides 6, 7 and 8. The plunger 5 is surrounded by a spring 9 between the lower guide 6 and a collar 10 carried by the plunger, whereby the pressing member 4 is maintained away from the work supporting die 3 a sufficient distance to permit the positioning of a piece of work between the dies 3 and 4. The upper portion of the plunger 5 is surrounded by a solenoid 11 supported between the guides 7 and 8, and when the solenoid 11 is energized it will draw the plunger 5 downwardly to cause the pressing member 4 to engage the die 3, or the work supported thereon.

One terminal of the solenoid 11 is connected through a conductor 12 to a suitable source of electrical energy, indicated at 13, which source may be either direct or alternating current. The normal circuit of the conductor 12 includes a pivoted contact arm 14 maintained in engagement with a contact 15 by a spring 16 movable with the plunger 5. With this arrangement, one terminal of the solenoid 11 is connected to the source 13 practically all the time, the only break in this circuit occurring when the pressing member 4 has reached the extreme lower end of its downward stroke, as will be hereinafter described.

The other terminal of the solenoid 11 is adapted to be connected to the source 13 by means of a treadle switch 17 conveniently located for foot operation, which switch is maintained open except when pressure is applied thereto. The circuit from the switch 17 to the solenoid 11 is adapted to be completed by two different current paths, one of which is between spaced contact members 18 adapted to be connected by a bridging member 19 carried by the work supporting die 3. The other current path from the switch 17 to the solenoid 11 includes a contact member 20 movable with the plunger 5 and a relatively stationary, though yieldable, contact member 21, the arrangement of the circuit being such that current can be supplied to the solenoid 11 either through the contacts 18 and bridging member 19, or through contacts 20 and 21, in accordance with the position occupied by the plunger 5.

Assuming the parts to occupy the position shown in Fig. 1, it will be apparent that when the treadle switch 17 is closed, current will flow through the solenoid 11, as indicated by the arrows, and the plunger 5, with the

pressing member 4, will start to descend by reason of the energization of the solenoid 11. When the descending pressing member 4 engages the die 3, or the work supported therebetween, the die 3 will be depressed by reason of its yieldable support on a spring 22 within the recess 2 in the anvil block 1, and as the bridging member 19 is carried by the die 3, the pressure thereof causes the circuit from the switch 17 to the solenoid 11 to be broken between the contacts 18. This interruption of the circuit between the contacts 18 would cause deenergization of the solenoid 11 and permit the spring 9 to retract the pressing member 4 were it not for the fact that just as the member 4 engages the die 3, or the work supported therebetween, the plunger-carried contact 20 engages the yieldable contact 21. This engagement of the contacts 20 and 21 maintains the circuit between the switch 17 and the solenoid 11, as indicated in dotted lines in Fig. 2, so that the member 4 completes its downward stroke, and pressure is exerted between the dies 3 and 4 as the die 3 bottoms in the recess 2 in the block 1.

As the die 3 and member 4 reach the pressure exerting position shown in Fig. 2, the spring 16, movable with the plunger 5, swings to a point below the pivot of the contact arm 14, thereby exerting a force which separates the arm 14 from the contact 15 and breaks the circuit of the solenoid at this point. The solenoid 11 being thus deenergized, the spring 9 immediately raises the pressing member 4 to the position shown in Fig. 1, whereupon the spring 16 acting on the arm 14 reestablishes the circuit from one terminal of the solenoid 11. It will be obvious, however, that as the plunger 5 moves upwardly, the contacts 20 and 21 will be separated, while the bridging member 19 will reengage the contacts 18. Consequently the solenoid 11 is again adapted to be energized by closing the treadle switch 17, it being also apparent that the circuit of the solenoid 11 can be broken at any time by releasing the treadle switch 17. Furthermore, the automatic raising of the plunger 5, following the engagement of the dies 3 and 4, can be dispensed with by locking the contact arm 14 and the contact 15 together, as by means of a lever 23, see Fig. 2, in which event release of the treadle switch 17 causes the plunger 5 to be raised.

Referring now to Fig. 3, there is illustrated the functioning of the machine when the descending pressing member 4 engages an object extraneous to the work supported on the anvil 3, such as the finger or hand of an operator. When the descending member 4 thus encounters an obstruction, the force of the descending member 4 is momentarily transmitted through the finger to the yieldable die 3, the immediate depression of which causes the bridging member 19 to leave the

contacts 18, thus de-energizing the solenoid 11. When the circuit of the solenoid is thus broken, it is obvious that the plunger-carried contact 20 has not at that time engaged the contact 21, so that the spring 9 immediately withdraws the pressing member 4 from the die 3 without any appreciable pressure having been exerted on the finger. Upon the release of the die 3 by the finger of the operator, the circuit between the contacts 18 is reestablished and the machine is again in a position to perform a pressing operation, as illustrated in Fig. 1.

From the above description of the functioning of the machine, particularly from the standpoint of safety, it is obvious that my invention may be advantageously employed in connection with many different kinds of machines for performing pressing and punching operations. In so far as I am aware most pressing and punching machines, as heretofore constructed, have been operated from a mechanical source of power, such as a rotating shaft, from which one of the relatively movable pressing members derives a reciprocatory movement. An inherent defect of all of such power driven machines, however, arises from the fact that when the reciprocatory plunger or head is connected to the source of power, that member invariably makes one complete downward stroke toward the work before the operator has an opportunity to disconnect the machine from the source of power. In my improved machine, however, the reciprocatory plunger is adapted to be moved toward the work only when the solenoid 11 is energized, and as previously pointed out, the energization of the solenoid may be interrupted at any time by the operator's release of the treadle switch 17. Furthermore, the energization of the solenoid 11 is adapted to be automatically interrupted, either immediately following pressure between the dies 3 and 4, or upon the engagement of the descending die 4 with an object extraneous to the work between the dies.

For the above reasons, my improved machine is believed to be much safer than any pressing or punching machines heretofore constructed, in which the question of safety has always been complicated by the utilization of a positive and continuous source of power. In such prior machines, the source of power once connected to the head or plunger, imparts a positive movement thereto, irrespective of the subsequent operation of any auxiliary safety device designed to render the work performing member ineffective. Whereas in my improved machine, the movable unitary member carrying the work performing die is subjected only to the action of magnetic forces for causing its working stroke, so that the die 4 is incapable of exerting pressure as soon as the magnetic forces cease to be set up by the solenoid. It is by

reason of the fact that the energization of the solenoid 11 is always jointly under the manual control of the operator and the automatic control of both work performing members themselves that my machine can be operated with a maximum degree of safety. Furthermore, the amount and duration of the pressure exerted between the dies 3 and 4 can be controlled within a wide range by adjusting the pull of the solenoid 11 and by altering the relation between the various contacts in the control circuits thereof.

Referring now to Fig. 4, my invention is shown embodied in a machine for attaching stay strips to the corners of boxes, the machine providing a suitable table or base 24, upon which is mounted a longitudinally adjustable anvil block 25 carrying a yieldably supported die 26 which is angular in form to support the corner of a box. A plunger 5 corresponding in all respects to the plunger shown in Fig. 1, is slidably supported on guides 6, 7 and 8 provided by an upward extension 27 of the base 24, and is adapted to be operated by a solenoid 11 controlled as in Fig. 1. The lower end of the plunger 5 carries a die 28 having a recess corresponding in form to the stationary die 26, it being evident that pressure between the dies 26 and 28 is adapted to attach a stay strip to a corner of a box supported on the lower die 26. Staying machines employing cooperating dies of the form illustrated are in common use, and it is obvious that any suitable means may be employed for inserting the stay strips between the dies, such as is shown, for example, in my copending application Serial No. 91,544, filed March 1, 1926.

In the operation of a corner staying machine it is necessary for the operator to hold the corners of the box together on opposite sides of the apex of the lower die 26, and it frequently happens that one or more fingers are accidentally left within the path of the descending die 28. When a finger is left in this position, the depression of the die 26 and de-energization of the solenoid 11 occurs almost simultaneously with the engagement of the finger by the die 28, so that no crushing of the finger results. It is also evident that should the operator depress the die 26 by his fingers before closing the treadle switch 17, the machine will not function until the operator shifts his fingers out of the danger zone, thereby releasing the die 3.

When, however, the path below the descending die 28 is free, the depression of the die 26 will not occur until the pressing die 28 has actually engaged the box, at which time, of course, it will be absolutely impossible for the operator to get even a portion of a finger between the engaged dies. In other words, the change over from the drawing-down circuit, indicated by arrows in Fig. 1, to the pressing circuit, indicated by arrows

in Fig. 2, does not occur until after the pressing member 4 has actually engaged the work.

It is obvious that my invention may be incorporated in many other types of pressing and punching machines, in addition to corner stayers, without in any way departing from the principles underlying my invention. Furthermore, the circuit arrangements for controlling the energization of the plunger are susceptible of modification while still retaining the operating characteristics of the machine.

I claim:

1. In a machine of the class described, a safety device comprising relatively movable members, one of which is yieldable with respect to the other, an electromagnet for causing one of said members to approach the other, means for energizing said magnet to cause the approach of said members, means for automatically deenergizing said magnet upon the depression of the yieldable member, and means for automatically reenergizing said magnet when said members reach a predetermined relative position.
2. In a machine of the class described, a safety device comprising relatively movable members, one of which is yieldable with respect to the other, an electromagnet for causing one of said members to approach the other, means for energizing said magnet to cause the approach of said members, means for automatically deenergizing said magnet upon the depression of the yieldable member, and means controlled by the other member for automatically reenergizing said magnet when said members reach a predetermined relative position.
3. In a machine of the class described, a safety device comprising relatively movable members, one of which is yieldable with respect to the other, an electromagnet for causing one of said members to approach the other, means for energizing said magnet to cause the approach of said members, means for automatically deenergizing said magnet upon the depression of the yieldable member, and means controlled by the moving member for automatically reenergizing said magnet when said members reach a predetermined relative position.
4. In a machine of the class described, the combination with a pair of relatively movable members, and electromagnetic means to bring said members together, of a pair of electrical circuits to cause energization of said electromagnetic means, a switch under the control of an operator to close one of said circuits and thereby cause the approach of said members, automatic means operated by the said approach of the members to open the operator controlled circuit, and automatic means to close the other of said circuits.
5. In a machine of the class described, the

combination with a pair of relatively movable members, and electromagnetic means to bring said members together, of a pair of electrical circuits to cause energization of said electromagnetic means, a switch under the control of an operator to close one of said circuits, a switch controlled by one of said members to open said last named circuit, and another switch controlled by the other of said members to close the other of said circuits, where-¹⁰ by said members are brought together to perform work when obstructed, but cannot be brought together if the movement of the member that controls the last named circuit is obstructed because of the failure to com-¹⁵ plete the said last named circuit.

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