July 3, 1945. F. S. SAUNDERS 2,379,658

AUTOMATIC PRESS TOOL FOR STRAIGHTENING OR BENDING

Filed Feb. 15, 1943 2 Sheets-Sheet 1

FIG. 1.

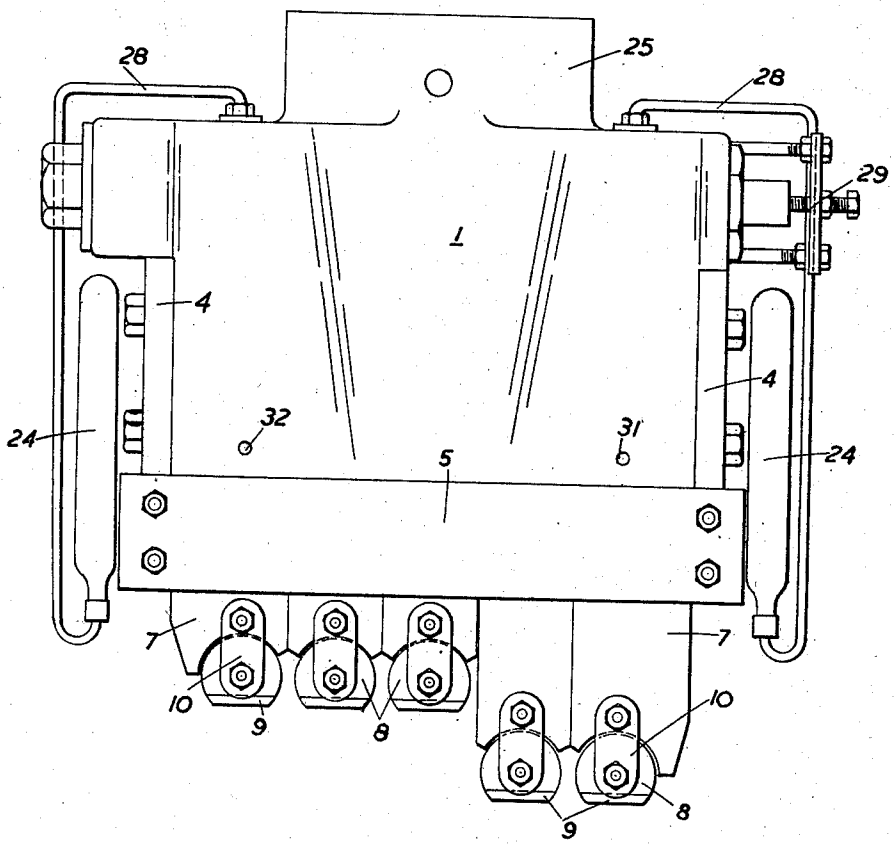
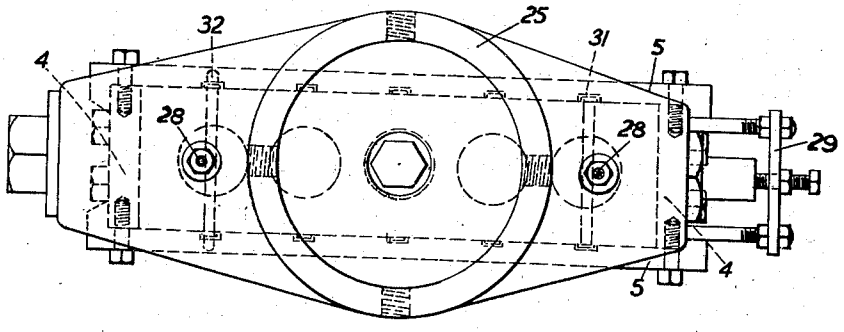


FIG. 2.



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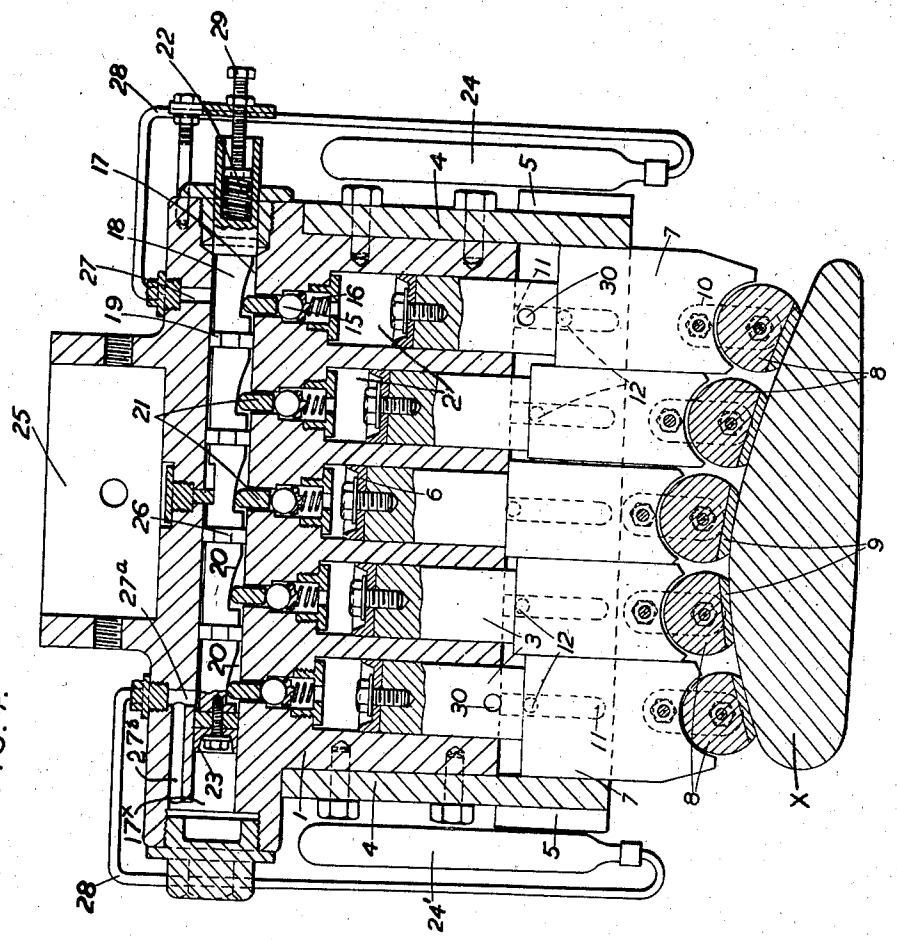


FIG. 4.

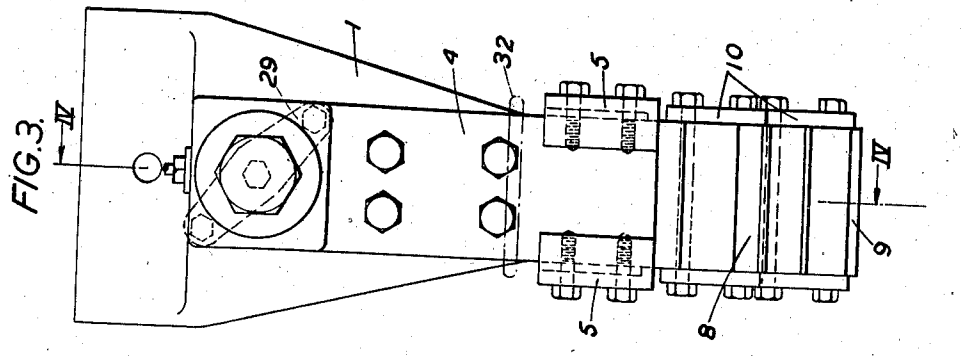


FIG. 3.

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UNITED STATES PATENT OFFICE

2,379,658

AUTOMATIC PRESS TOOL FOR STRAIGHTENING OR BENDING

Frank Stanley Saunders, Cardiff, South Wales

Application February 15, 1943, Serial No. 475,922
In Great Britain May 1, 1941

5 Claims. (Cl. 153—51)

The present invention relates to automatic press tools and it has for its object the provision of a machine capable of being connected to the ram of any existing press for the purpose of straightening or bending to correct form transverse or longitudinal contours.

The invention consists of a block element furnished with a plurality of cylinders, a plurality of pistons slidably mounted therein, a valve at the head of each cylinder, means mechanically actuated for maintaining the valves in the open position, means automatically actuated for maintaining said valves in the closed position and a self-aligning pad on the lower end of each piston, with, or without, means for locking any one or more of the pistons out of operation.

In the accompanying drawings which illustrate an embodiment of this invention—

Figure 1 is a side elevation of the tool.

Figure 2 is a plan.

Figure 3 is an end elevation with certain external parts omitted, and,

Figure 4 is a vertical section on line IV—IV of Figure 3.

In the drawings the machine comprises an oblong shaped block 1 provided in the lower part thereof with a plurality of cylinders 2 arranged side-by-side in the same plane, each cylinder containing a piston 3. The lower part of the block 1 is extended below the lower end of the cylinders by means of end plates 4 and side plates 5 for the purpose hereafter described. The upper end of each piston is provided with a cup leather 6 and approximately half the length of each piston at its lower end is of rectangular form as shown at 7, two of the sides being arranged to bear against the side plates 5 while the other two faces are adapted to bear against the corresponding parts of adjacent pistons with the exception of the two pistons at the extreme ends of the block where the flat faces bear against the end plates 4. The lower end of each of the rectangular portions of the pistons 3 is provided with an arcuate recess adapted to receive and form the seat for a self-aligning element 8 provided with a flat surface to which is secured a pad of aluminium or the like 9, said elements being supported in position against their respective seats by links 10, provided at each end of the element so that they may turn freely on their respective seatings as hereafter described. For the purpose of limiting the rise and fall of the pistons the side plate 5 may be furnished with vertically disposed slots 11 and the rectangular lower portion 7 of the pistons with projections 12 slidably arranged in said slots.

The upper ends of the cylinders 2 are each provided with a valve comprising a ball 15 pressed upwardly against its seating by a spring 16. The cylinder block is furnished directly above the series of valves with a horizontally disposed bore 17 adapted to receive a non-rotatable sliding valve operating element 18 of smaller diameter than the bore 17 but concentrically supported therein by means of a plurality of equally spaced circumferentially disposed collars 19. The under part of the element 18 between the collars 19 is provided with equally spaced cam surfaces 20 with which the upper ends of a corresponding number of fluted pins 21, the lower ends of which rest on the ball valves 15, are adapted to coact, the arrangement being such that when the element 18 is in one position all the ball valves are in the closed position, but when moved into the other position all said valves are forced off their seats by the consequent depression of the pins 21. The movement of the sliding element 18 to open the valves is effected mechanically by means of a spring 22 arranged at one end of said element whereas said valves are maintained in the closed position automatically by fluid pressure acting on a cup leather 23 secured to the opposite end of said sliding element 18, set up by the oil displaced from the cylinders 2 increasing the fluid pressure in the bore 17, part 17^x, passages 27, 27^b and pipes 28.

When the tool is not in use the pistons 3 will be in their lowermost or extended position, the valve operating element 18 will be forced by the spring 22 to the left and all the valve pins 21 will be depressed by the cam surfaces 20 to open the valves.

For use the tool is secured by the part 25 to the lower end of the ram of a press and the work, which may consist of the bent blade of an air screw indicated in cross-section at X in Figure 4, is set up and suitably supported at the tip and boss beneath the tool so that the plungers are disposed transversely of the blade. When the parts are thus disposed, the operator depresses the pedal of the press which brings the pads 9 on the self-aligning elements 8 into contact with the upper surface of the blade to be bent, as the first pad makes contact its piston is forced up the oil displaced from the cylinder above the piston actuated passes through the ball valve into the bore 17 and the fluid pressure in the bore and bottles 24, 24^1 is thereby slightly increased and this operation continues as the tool is grad-

ually lowered and the several pads make contact with the surface of the blade. When all the pads **8** are in contact with the work and lowering of the ram and thereby the tool continues the pistons will remain stationary, whereas the block, being carried on the end of the ram continues to move downwards thus causing the cylinders to move downwardly over the pistons thereby causing further oil to pass through the ball valves **15** into the bore **17** and past flutings **26** in the collars **19** and through the passages **27**, **27a** into pipes **28** and bottles **24**, **24¹**. At the same time the oil from passage **27a** also passes along channel **27b** into the end **17x** of the bore **17** which end **17x** is thus through the passage **27b** open to the pressure in the bottle **24¹**, this causes a pressure to be built up on cup leather **23** which corresponds with the pressure created in the bottles **24**, **24¹** by oil being forced into them against the existing atmosphere pressure.

When the pressure in the part **17x** and associated parts has risen to such an extent as to exceed the pressure of the spring **22**, the element **18** is forced to the right thereby permitting the pins **21** to rise and the ball valves to close thus preventing the further passage of oil from the cylinders **2**. At this point independent movement of the pistons ceases and said pistons, the body of the tool and the ram become a rigid whole and descend together the pads **9** all pressing evenly against the surface of the blade being bent or straightened. When the operator has decided that sufficient bending has been performed, the operating pedal or lever of the press is released and the ram commences to rise. Immediately the load is off the tool, the pressure within the cylinder **2** is relieved and this allows the pressures build up in the bottle **24**, **24¹**, bore **17**, **17x**, passages **27** and **27b** to overcome the ball valves **15** which open, the load acting against the cup leather **23** is reduced and the element **18** is forced to the left by the spring **22** and the air pressure in the bottles **24** returns the displaced oil into the several cylinders **2** until the pistons are once again in the lowermost position. It will thus be seen that the tool is entirely automatic in its operation.

It will be appreciated that the curve of the surface of the article being worked on determines the final position of the pistons and the amount of oil displaced from the cylinders **2** to the bottles **24**, **24¹** and this in turn controls the air pressure in the bottles and affects the amount of tension on the spring **22** and this spring must be suitably adjusted according to the conditions by the tensioning device **29** or by any other suitable means.

To enable wide and narrow surfaces to be pressed, the two end pistons can be locked out of action by pushing same upwardly into the highest position in their respective cylinders to bring a hole **30** (Figure 4) in the pistons into coincidence with a hole **31** (Figure 1) provided in the cylinder walls and inserting a pin **32**.

Care must be taken to see that the pressure in the bottles **24**, **24¹** does not exceed atmospheric pressure when all the pistons are in the lowermost position and that the correct quantity of oil is inserted into the tool, in the first place to enable the pistons to take up the correct contour of the work and secondly to enable the two end pistons to be raised and retained in their highest position if desired, without creating a pressure sufficient to operate the element **18**. Should this latter condition be created it may be readily overcome by adjusting the screw **29** to increase the pressure of the spring **22**. From the foregoing it will be understood that there is a direct relation between the pressure exerted by the spring **22** and the fluid pressure within the system and that this relation may be varied by the adjustment of the screw **29** or alternatively by varying the quantity of oil in the tool.

What I claim is:

1. An automatic press tool for connection to the ram of a hydraulic press for straightening and bending, comprising a block element furnished with a plurality of cylinders, a piston slidably mounted in each cylinder each of said pistons being free to take up a position in its cylinder according to the contour of the surface being acted on, a valve at the head of each cylinder, means mechanically actuated for simultaneously opening and maintaining all said valves in the open position and means automatically actuated for simultaneously closing and maintaining all said valves in the closed position, the pistons being thereby locked against further independent movement.

2. An automatic press tool for straightening and bending as claimed in claim 1, in which the lower part of the block element is provided with side and end plates and in which the upper ends of the pistons sliding in the cylinders formed in the block are of cylindrical form, the lower parts of said pistons being of rectangular form fitting closely against each other and against said side and end plates, arcuate recesses provided in the lower end of each rectangular part and a self-aligning work-engaging pad rotatively mounted in each of said recesses.

3. An automatic press tool for straightening and bending, comprising a block element furnished with a plurality of cylinders, a piston slidably mounted in each cylinder, a ball valve at the upper end of each cylinder, a valve controlling element slidably arranged in said block element above said ball valves, fluted pins interposed between and coacting with said valve controlling element and ball valves, mechanical means comprising an adjustable spring for actuating the valve controlling element for maintaining the valves in the open position, fluid pressure means opposing the adjustable spring for actuating the valve controlling element for maintaining said valves in the closed position, and a self-aligning work-engaging pad on the lower end of each piston.

4. An automatic press tool for straightening and bending, comprising a block element furnished with a plurality of cylinders, a piston slidably mounted in each cylinder, a spring controlled ball valve provided at the upper end of each cylinder, a non-rotating horizontally disposed valve controlling element slidably arranged in said block element above said ball valves, a plurality of cam surfaces provided on said valve controlling element, fluted pins interposed between and coacting with said cam surfaces and ball valves, mechanically actuated means comprising an adjustable spring for maintaining the valves in the open position, fluid pressure actuated means opposing the adjustable spring for maintaining said valves in the closed position, a self-aligning work-engaging pad on the lower end of each piston and means for locking certain of the pistons out of action.

5. An automatic press tool for straightening and bending, comprising a block element furnished with a plurality of cylinders, a piston slidably mounted in each cylinder, a spring con-

trolled ball valve provided at the upper end of each cylinder, a horizontally disposed bore provided in said block element above said ball valves, a non-rotating valve controlling element slidably arranged in said bore, a plurality of cam surfaces provided on said valve controlling element, fluted pins interposed between and coacting with said cam surfaces and ball valves, mechanically actuated means comprising an adjustable spring for maintaining the valves in the open position, fluid pressure actuated means opposing the adjustable spring for maintaining said valves in the closed position, a self-aligning work-engaging pad on the lower end of each piston and means for locking certain of the pistons out of action.

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