June 15, 1954 F. BARNEY ET AL 2,681,104

PAPER CUTTER

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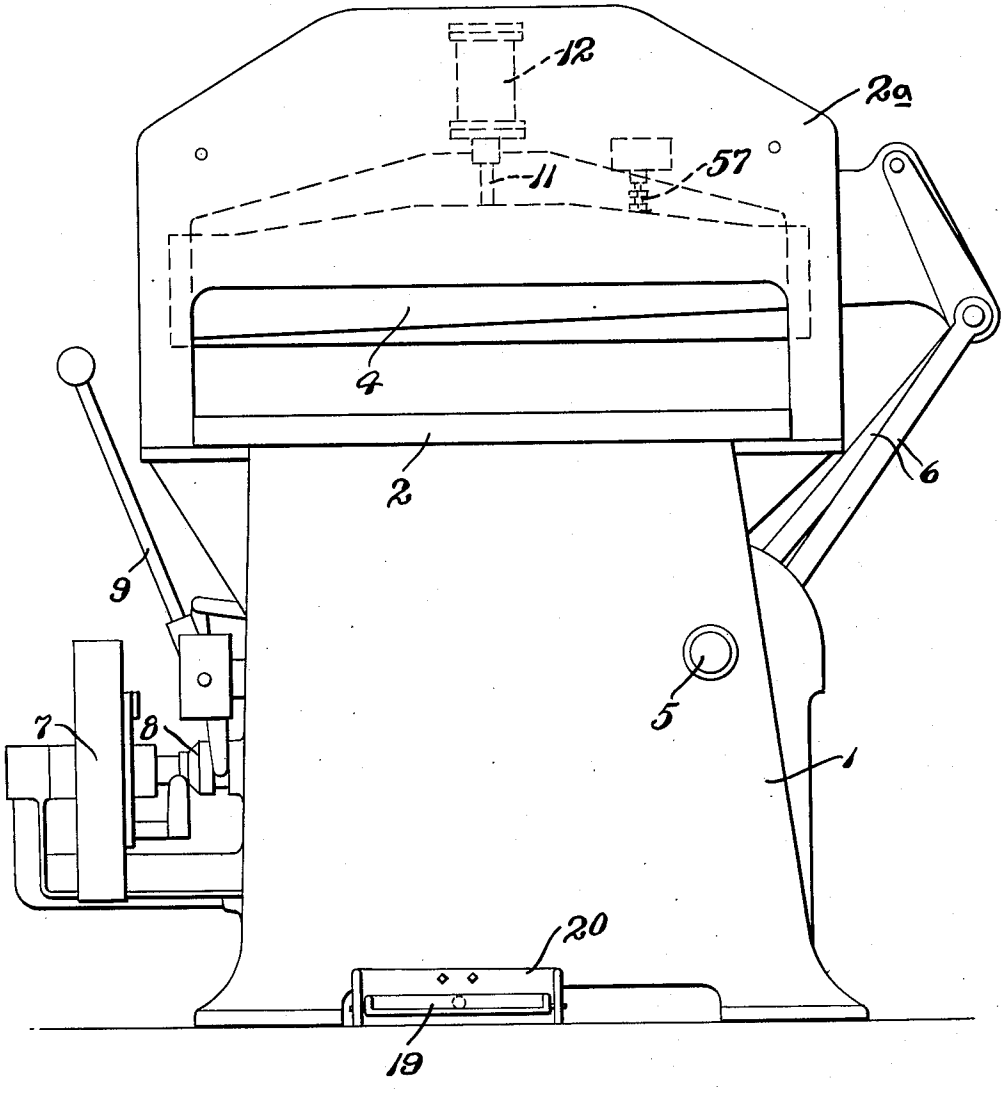


FIG. 1.

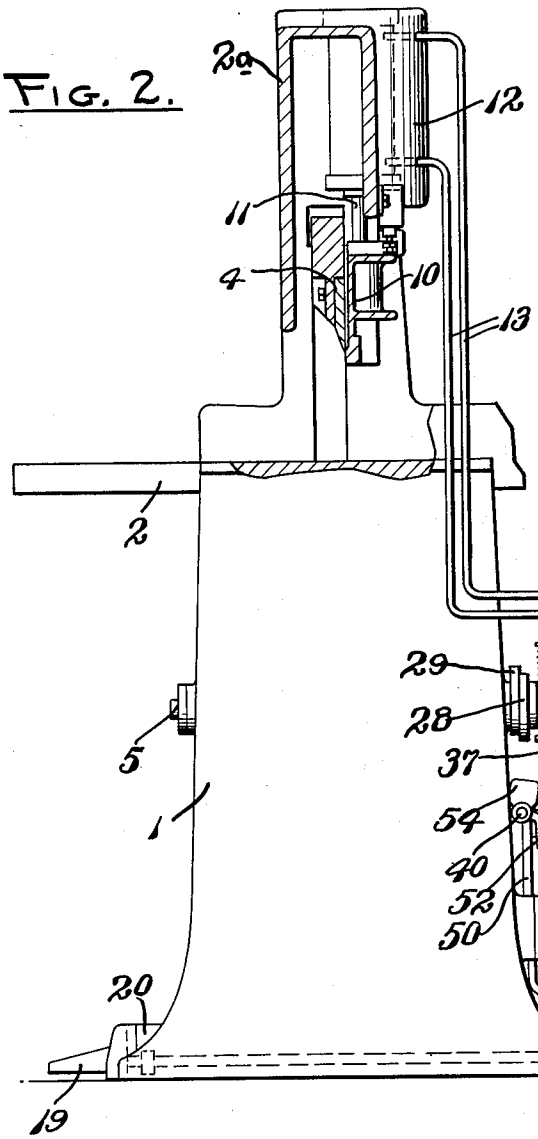
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FIG. 2.



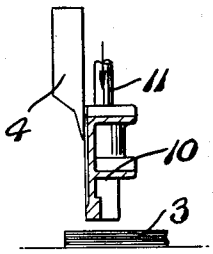


FIG. 3.

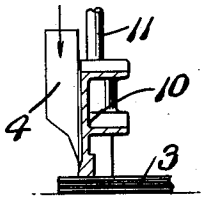


FIG. 4.

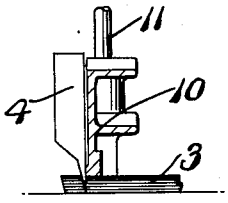


FIG. 5.

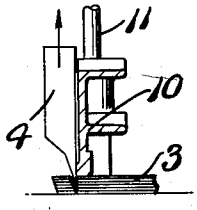


FIG. 6.

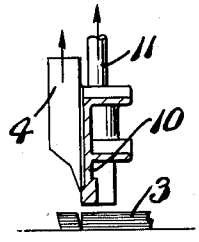


FIG. 7.

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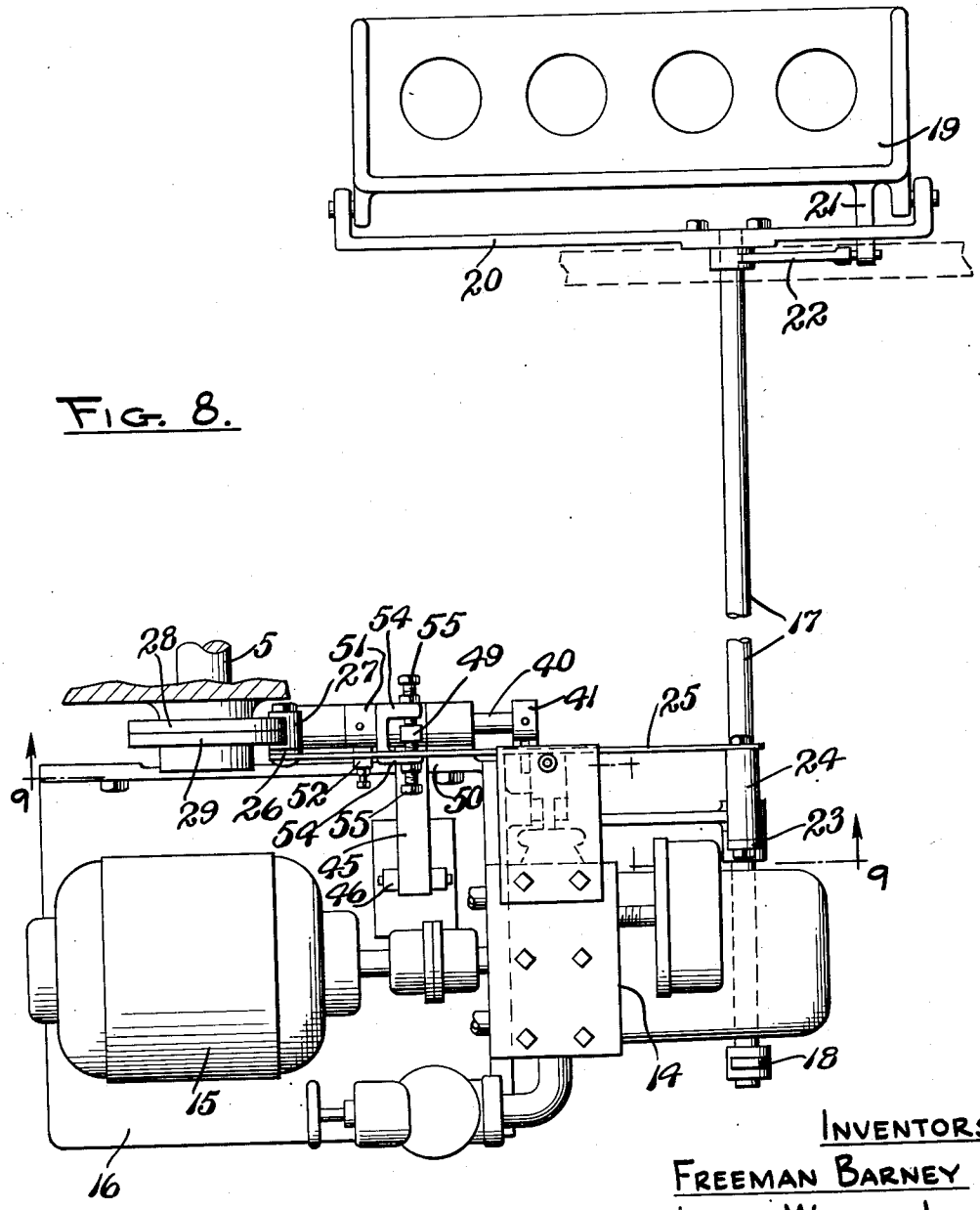


FIG. 8.

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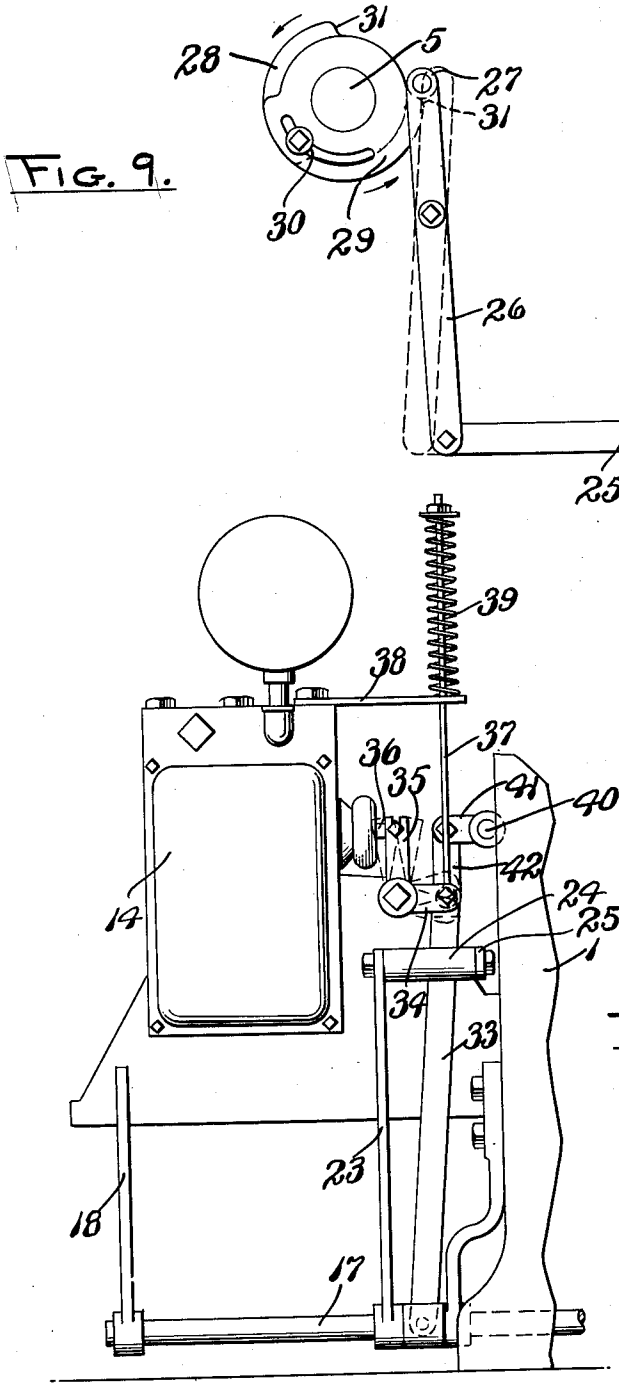


FIG. 9.

FIG. 10.

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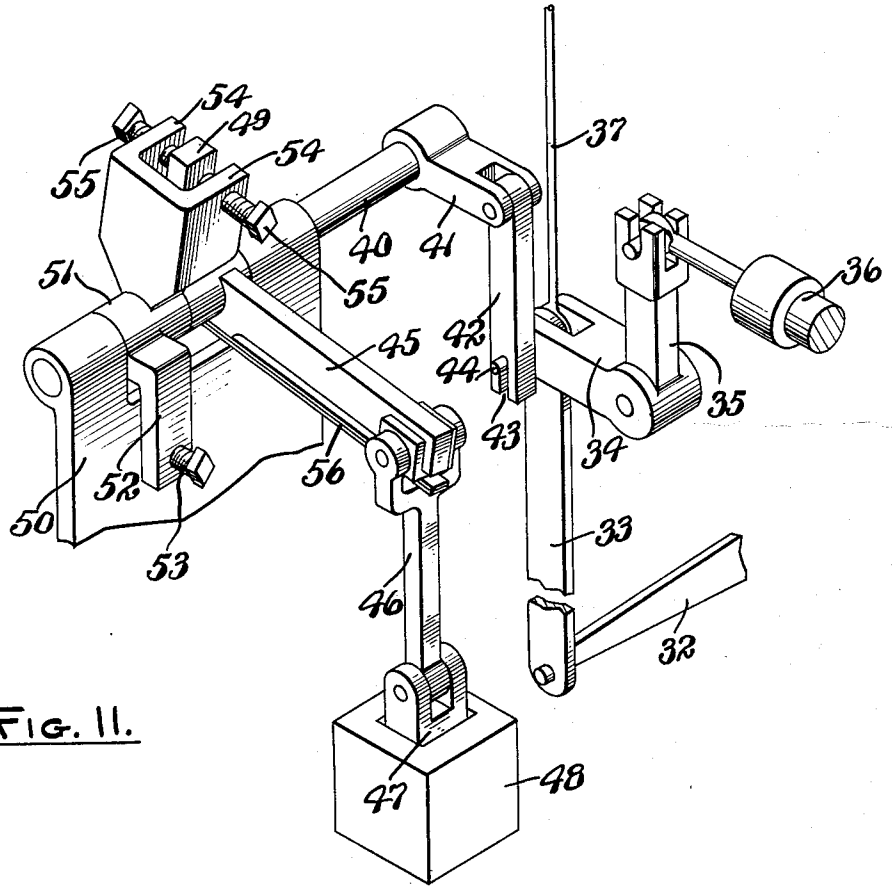


FIG. 11.

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UNITED STATES PATENT OFFICE

2,681,104

PAPER CUTTER

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Application October 9, 1950, Serial No. 189,243

2 Claims. (Cl. 164—54)

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This invention relates to paper cutters, and is more particularly concerned with a paper cutter for simultaneously cutting a large number of sheets of paper in a pack of such sheets, superimposed one upon the other so as to be of considerable thickness. More particularly, the invention is directed to a novel mechanism for clamping and holding the sheet pack under heavy pressure, which is constant from a short time before until a short time after the sheet cutting operation has been performed, and with the clamping bar which extends across the sheet pack moved downwardly ahead of the cutting operation to firmly and securely hold the sheet pack during the time that cutting or severing takes place until after the cutting knife has been lifted above the upper side of the pack, after which the clamping bar is elevated.

It is an object and purpose of the present invention to provide a power clamp and mechanism for operating and controlling it in paper cutting machines for the more effective and efficient cutting of the sheets of a sheet pack so that perfection of cutting is substantially attained. Many novel structures and arrangement of parts for attaining the object stated will appear and be understood from the following description, taken in connection with the accompanying drawings, showing a preferred embodiment of our invention, in which,

Fig. 1 is a front elevation of the paper cutter to which our invention is applied.

Fig. 2 is an end elevation looking at the right hand end of the front elevation shown in Fig. 1, with the upper portion of the supporting frame shown partly in vertical section.

Figs. 3, 4, 5, 6 and 7 are fragmentary transverse vertical sections through the clamping bar in its successive positions which it takes in a cycle of cutting.

Fig. 8 is a partial plan view of the mechanism embodying our invention, the supporting base, cutting knife and clamping bar and their support being removed.

Fig. 9 is an elevation of a portion of the control mechanism of our invention substantially on the plane indicated by the line 9 in Fig. 8, looking in the direction indicated.

Fig. 10 is a fragmentary end elevation of the clamping bar operating mechanism from the opposite end to that shown in Fig. 2, and

Fig. 11 is a view in perspective of the control mechanism for starting and reversing the operation of the movements of the paper clamping bar.

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

In paper cutting machines of the type to which our invention is applied, a heavy base support 1 has at its upper portion a horizontal table 2 located at proper height upon which the sheet pack 3 which is to be cut is placed. The knife 4, mounted upon a carrying bar therefor, and having a sharpened lower edge is mounted at its ends for vertical up and down bodily movements in guides therefor in an overhead frame 2a.

The operation of the knife in its vertical reciprocation and the mechanism for power operating such knife is old and well known and includes a one revolution shaft 5, mounted upon and extending from front to rear on the base 1, with link connections 6 between it and one end of the bar which carries the cutting knife 4. The shaft 5 is connected by suitable gearing (not shown) with a counter shaft driven by a pulley 7 in which is a clutch manually engaged by a hand lever 9 connected to an operating member 8. The clutch is of the one rotation type automatically releasing after one revolution and a belt passes around the pulley 7 and is connected with a driving motor. These parts are conventional and form no part of this invention.

The clamping bar shown at 10 has a piston rod 11 secured at its upper side substantially midway between its ends, which extends upwardly into a vertical cylinder 12 carried by the frame 2a, entering the lower end thereof and connected with a piston (not shown) within the cylinder. Fluid pressure, preferably of the hydraulic type, is entered into the cylinder 12 adjacent opposite ends through the pipes 13, one of said pipes carrying liquid pumped under pressure into the cylinder above the piston and the other below it. The unit 14 for pumping liquid under pressure is a well known commercial unit, the pump being driven by an electric motor 15 with a valve for reversing the direction of pumping to the cylinder 12, with a by-pass for the liquid pumped when the valve is at neutral position and with control mechanism for maintaining pressure at a preselected or predetermined amount, with a by-passing of the liquid pumped after such predetermined amount of pressure has been reached. The detail of structure of this pumping unit is not in itself a part of our invention as it is a commercial product known to those skilled in the art. Such unit is mounted on a bracket 16 at the back of the base 1.

A horizontal rock shaft 17 extends from front to rear and back of the base 1 close to its lower

end, mounted in suitable bearings on such base for rocking movement. At its rear end, where it extends back of the base 1, it is equipped with a handle 18 for manual operation if wanted. At its front it is rocked by a foot pedal 19 pivotally mounted on a supporting bracket 20 permanently secured at the front lower end portion of the base 1. The pedal has an arm 21 extending to the rear, offset a distance from the rock shaft 17 (Fig. 8), and an arm 22 fixed to said shaft 17 extends to and is operatively connected to the free end portion of the arm 21. A downward pressure causes a downward movement of the foot pedal 19 to lift the arms 21 and 22 at their point of connection and rocks the shaft 17 in a counterclockwise direction (Fig. 8).

A generally vertical lever 23 is secured at its lower end to the rock shaft 17 a short distance back of the base 1 and extends upwardly, at the upper end of which is a spacer 24, one end of the spacer being attached to a horizontal link 25, suitable means being provided to connect the members 23, 25 and the spacer between them and to permit relative pivotal movement of said members one with respect to the other. Such horizontal link 25 (Figs. 8 and 9) extends back of the base 1 to and is connected with the lower end of a lever 26 at its front end. The lever 26 is pivotally mounted between its ends and extends upwardly to substantially the height of the one revolution shaft 5. It is equipped at its upper end with a roller 27 which (Figs. 8 and 9) rides upon the edges of cam disks 28 and 29 secured to the shaft 5 and rotatable therewith. One of the disks is adjustable about the axis of the shaft 25 with respect to the other through the arcuate slot and set screw adjusting connection shown at 30. Such disks 28 and 29 have shoulders 31 spaced from each other and providing two arcuate edges or surfaces upon which the roller 27 rides, one at a greater radial distance from the center of the shaft 5 than the other. The distance between the shoulders 31 is adjustable by the disk adjustment described.

Also connected to the rock shaft 17 is a generally horizontally extending arm 32 which, at its free end, has an operative connection to the lower end portion of a vertical bar 33, and at its upper end, having a pivotal connection to a horizontal arm 34 of a bell crank lever mounted for rocking movements on the unit 14. A vertical arm 35 of the bell crank lever extends upwardly and at its upper end has the connection, shown in Fig. 11, with a valve control rod 36 which extends into a valve housing of the unit 14, the longitudinal movement of the rod 36 moving the valve from one position to the other, in one of which positions liquid under pressure is pumped through a pipe 13 to the upper end of the piston 12, and in the other position through the other pipe 13 to the lower end of the cylinder 12. At an intermediate position of the valve no liquid is pumped through either pipe 13, but there is a by-passing of the pump liquid from the reservoir of the unit 14 through the pump back to the reservoir. When the arm 35 is vertical as shown in Fig. 10 the valve is at neutral. There is a pumping of the liquid to the cylinder 12 only when the arm is in one of the inclined positions shown in dash lines in Fig. 10.

A rod 37 is connected at its lower end with the free end portion of the bell crank lever arm 34. It extends upwardly through a plate 38 mounted on the pumping unit 14. A coiled compression spring 39 is around the rod 37 above said plate 38. At the upper end of the spring a covering washer and a nut on the rod 37 are located so that on downward movement of the rod 37 spring 39 is compressed. This spring 39, acting through its connecting parts, tends to hold the valve in clamp raising position.

At the back of the base 1 and between it and the pumping unit is a short rock shaft 40, to one end of which an arm 41 is permanently secured which extends horizontally to the rear and to which the upper end of a bar 42 with a short vertical slot 43 open at its lower end is pivotally connected. A pin 44 carried at the free end of the arm 34 and on which the lower end of the rod 37 is mounted extends into the slot 43 (Fig. 11). An arm 45 has a sleeve at one end through which the shaft 40 passes. The arm 45 extends from the shaft 40 to the rear and at its free end has a pivotal connection to a vertical bar 46, at the lower end of which an armature 47 of a solenoid is pivotally connected, the armature extending into the solenoid winding 48.

The sleeve to which the arm 45 is connected or with which it is integrally formed also has an upwardly extending short arm 49. The shaft 40 is mounted for rocking movement on a supporting plate 50 which is fastened securely to the base 1 or to a bracket carried by said base, such plate at its upper end being divided between its side edges for the reception of the sleeve to which arm 45 is connected and for a second sleeve 51 against the sleeve of the arm 45. From the sleeve 51 a laterally offset and downwardly extending arm 52 extends having an adjusting screw 53 through its lower end, the end of the screw coming against the carrying plate 50. From the upper side of the sleeve 51 a U-shaped fixture, having spaced legs 54, extends, the bar 49 being between the legs 54. An adjusting screw 55 passes through each leg 54 one against each side of the bar 49. Member 56 is the usual and well known safety control element used in connection with solenoid armatures under similar conditions.

The winding 48 of the solenoid is energized by the closing of an electric circuit when a normally open switch 57 therefor (Fig. 1) is closed by the clamping bar 10 upon reaching its uppermost position.

In the operation, by pressing downwardly on the foot pedal 19 after a pack of sheets of paper has been arranged by an operator upon the table 2, the valve controlled by part 36 will be operated to a position such that the oil pumped goes to the top of the cylinder 12, forcing the clamp 10 downwardly against the paper, the knife remaining stationary. This is at times desirable for the purpose of pressing air out of the sheet pack before any cutting is done, or at other times, to see where the clamp bar will engage the paper and determine the line of cutting where the knife will reach the pack of paper sheets, any rearrangement of the sheet pack, if it seems desirable, then being done. The downward movement of the clamp bar 11 will continue so long as the pedal 19 is held depressed or until it reaches the sheet pack and clamps it under a predetermined pressure, pumping continuing after the bar is stopped when it reaches such predetermined pressure on the pack, the oil pump being by-passed to the pumping unit reservoir. Releasing the pedal causes the spring 39 to pull the valve control 36 back and the oil pumped goes to the bottom of the cylinder 12 and the

clamp bar 10 is raised up. When such bar strikes the switch 57 on the frame of the machine, the solenoid winding at 48 is energized and the armature 47 pulled downwardly into said winding, overcoming the spring 39 and pulling the valve 36 to center or neutral position, the oil pumped being by-passed in the power unit 14, and no further pumping to the cylinder 12.

The switch 57 is a conventional normally open switch and is wired in conventional way in an electric circuit to close the circuit to the solenoid winding 48 when closed by pressure of the clamp bar 10 at the end of its upward stroke.

The knife is started by operating the starting lever 9 which will cause shaft 5 to be driven and turn the cam disks 28 and 29. Upon turning the shaft in the direction indicated by the arrow in Fig. 9 lever 26 is moved from the full line to the dotted line position, compressing spring 39 and moving the valve controlled by the rod 36 for passage of the oil to the upper end of the cylinder 12. The roller 27 riding over the shoulder 31 on the cam disk 29 will cause the operation described, and the parts will be maintained in the position to which moved until the shoulder at 31 on the disk 28 is reached, for the roller 27 to drop into the short radius depression of the cam provided by the two disks 28 and 29. The rotation of the shaft 5 operates the cutting knife 4 through the links 6, and as such knife operation will start slowly, the clamping bar 10 will move ahead of the knife, until the bar is stopped after reaching its predetermined pressure against the sheet pack 3 as in Fig. 5. The knife will then cut through the sheet pack 3 and start back toward its upper position (as in Fig. 6). In practice the cam shoulder 31 on the disk 29 and the large radius portion of the disks locks the valve 36 in the position that the oil is pumped into the upper end of the cylinder 12 until the knife has cut through the sheet pack and has started back upwardly for a distance. Thereupon the roller 27 drops into the shorter radius portion of the cam disk 29 and spring 39 pulls the valve controlled by the rod 36 back for upward movement of the clamp.

The cam disk 29 and its shoulder 31 are fixed on the shaft 5 so that the clamp will be started downward at the same time the knife begins to move. By adjusting the cam disk 28 its shoulder 31 may be arranged to start the clamp upwardly at varying points of the cycle depending upon the thickness of the paper pack. Thus the clamp may be caused to rise quicker from a thin pack permitting the paper to be removed sooner and speeding the operation. But the raised portion of the cam 29, being at least 180° of the circumference, always insures the knife rising ahead of the clamp so that it does not at any time project below the clamp to endanger the fingers of the operator.

With our invention the certainty of a heavy pressure of continuous uniform amount of the clamping bar against the sheet pack is attained. Such pressure does not change but remains constant in accordance with the by-passing of liquid pumped after a predetermined pressure has been reached in the pumping unit. The cycle of movement of the cutting knife is started slightly after that of the clamping bar. The timing of the movements of the knife and the clamping bar is made possible by our invention such that the cutting edge of the knife is never free of the protection of the clamping bar except at those times when the knife is moving downwardly into the sheet pack to cut it and back to a position in which the cutting edge of the knife is above the lower side of the clamping bar. The structure described is very practical and has proved substantially perfect in operation.

Although the hydraulic power mechanism has been illustrated and described as being located above the clamping bar and pushing down upon it, it is conceived that this hydraulic mechanism may be otherwise located in the machine as for example, so as to pull down on the clamping bar with the same effect.

The invention is defined in the appended claims and is to be considered comprehensive of all forms of structure coming within their scope.

We claim:

1. A paper cutting machine comprising a frame, a table, a cutting knife vertically reciprocal above the table, manually controlled mechanical means for reciprocating the knife, a clamping bar closely adjacent the knife and vertically reciprocable above the table, fluid pressure means including a valve for reciprocating the clamping bar, automatic means actuated by said knife reciprocating means acting to move said valve to positions to lower the clamping bar on lowering of the knife and to raise the clamping bar on raising of the knife, said automatic means being adjustable to raise the clamping bar at variable positions of the upward movement of the knife and said automatic means including a shaft rotating in synchronism with the knife, said shaft rotating 180° during each upward and downward movement of the knife, a cam mounted on said shaft and having a portion fixed to the shaft and a portion adjustable relative to the fixed portion, said fixed cam portion acting upon said valve to lower the clamping bar and said adjustable portion acting upon said valve to raise the clamping bar.

2. The elements of claim 1 in which said cam holds said valve in clamping bar lowering position during at least 180° rotation of said shaft.

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