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PHOTOGRAPHIC PAPER PUNCHING MACHINE

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2 Sheets-Sheet 1

FIG. 1.

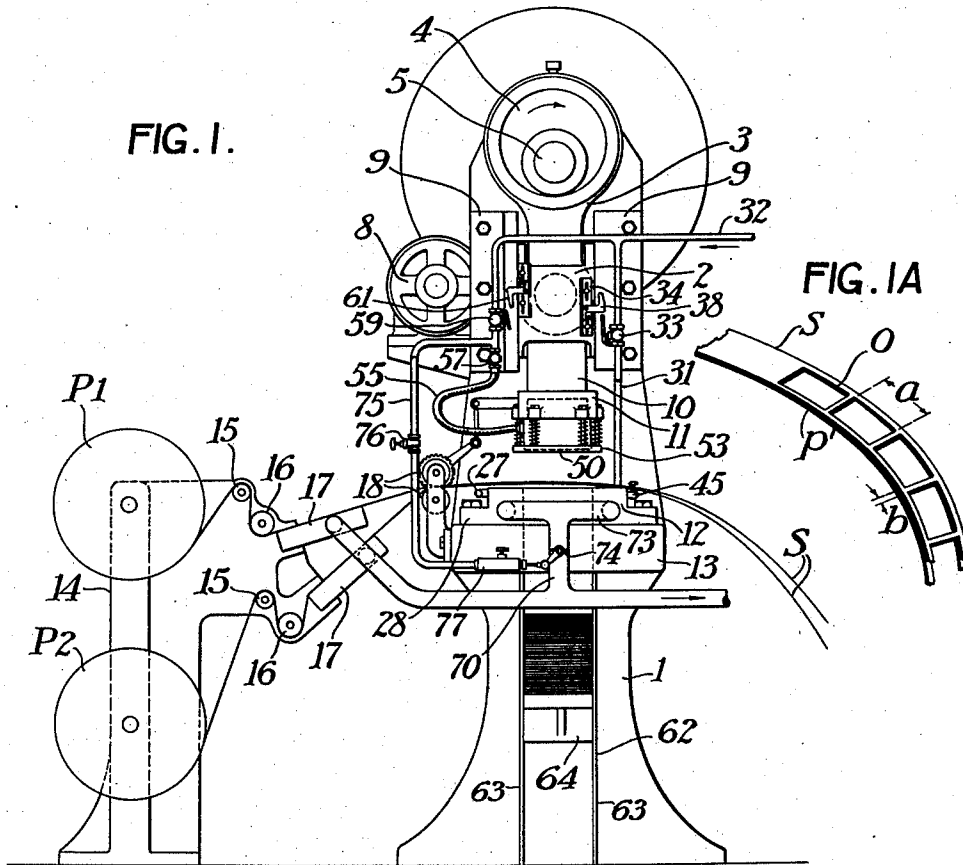


FIG. 3.

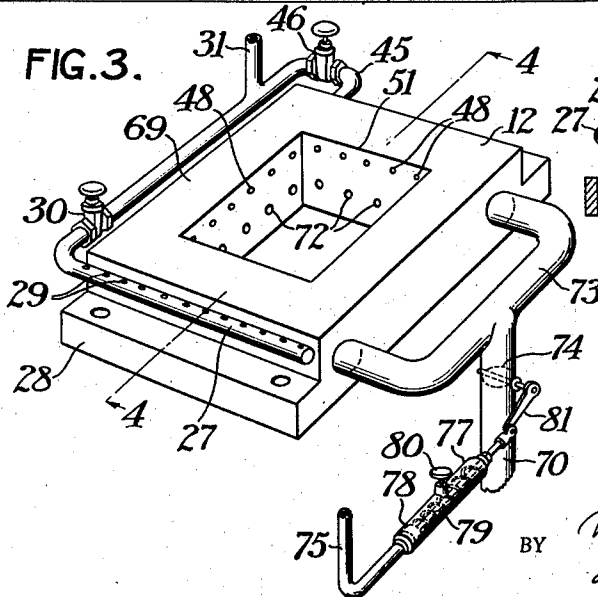
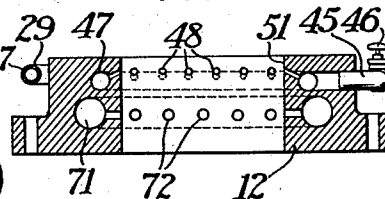


FIG. 4.



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PHOTOGRAPHIC PAPER PUNCHING
MACHINE

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8 Claims. (Cl. 164—22)

This invention relates to a machine for rapidly cutting accurate sized paper blanks from sheet material.

One object of our invention is to provide a machine which will rapidly produce a series of accurately sized sheets and stack the sheets into a suitable rack. Another object of our invention is to provide a machine which is satisfactory for handling paper coated with a light sensitive photographic emulsion, and one in which there will be a minimum contact with the sensitized surface of the photographic paper. Another object of our invention is to provide a suitable machine for punching out paper blanks in which the paper is floated into position between the punch and die members, and in which the paper contacts with the punch and die only when the paper is stationary. Another object of our invention is to provide a punch and die with an air stripping and stacking means which is automatically operated in timed relation with the machine. Other objects will appear from the following specification, the novel features being particularly pointed out in the claims at the end thereof.

Cutting sensitized photographic paper is considerably more difficult than cutting uncoated paper because the sensitive emulsion of photographic paper is usually susceptible to abrasion marks which may occur when comparatively light pressure is applied to the sensitized surface. Moreover, in photographic paper it is very desirable to have all the sheets lie flat and to handle these sheets in such a way that the surface of the paper is not bent or twisted any more than is absolutely necessary. When paper is coated with a light-sensitive emulsion, there is always a tendency for the paper to curl in one direction or the other, due to the effect of atmospheric conditions on the emulsion and base. It is therefore more difficult to handle than paper which naturally lies flat.

The machine which we will now describe has been designed particularly to take care of photographic light-sensitive emulsion coated paper, although, of course, it would be equally suitable for ordinary paper, since the paper is floated into position between the dies on air, and since the stacking operation is accomplished by air, paper handling by this machine has a minimum of contact with machine parts before being stacked.

Coming now to the drawings wherein like reference characters denote like parts throughout:

Fig. 1 is a front elevation showing somewhat schematically a punch and die paper cutting

machine arranged to punch two blanks at once from strips of photographic light-sensitive emulsion coated paper.

Fig. 1A is a fragmentary perspective view of a punched paper strip.

Fig. 2 is a side elevation of the punch shown in Fig. 1.

Fig. 3 is a perspective view of the die member removed from the machine shown in the preceding figures.

Fig. 4 is a section through the die member on line 4—4 of Fig. 3.

Fig. 5 is a part section and part elevation of the punch and stripper members used on the machine shown in Figs. 1 and 2.

Fig. 6 is a section on line 6—6 of Fig. 5.

Fig. 7 is a front elevation on somewhat enlarged scale showing the valved air lines and their operating members and the paper moving means.

Fig. 8 is a detail view of one form of valve operating mechanism which may be used with our present machine.

It is our object to float one or more paper strips between the punch and die member of a punch press so that blanks of the desired size may be rapidly cut from the strip material and the remainder of the strip will be held intact as it moves away from the machine. Such paper blanks may be cut with a high degree of accuracy in dimensions, and we automatically stack the cut-out blanks, utilizing air pressure for this stacking operation.

In accordance with our illustrated embodiment of our invention, the punch press may be of any standard type and, as indicated in Figs. 1 and 2, comprises an upright frame member 1, having a ram 2 which may be operated through a pitman 3 from an eccentric 4, mounted on a shaft 5, which may be rotated through a gear 6 and pinion 7, the pinion being operated by a motor 8. The ram 2 may slide on suitable rails 9, so that the plunger 10, which carries the punch member, broadly indicated at 11, will reciprocate this member, causing it to move into and out of the die member, designated broadly as 12, which is carried by the platform 13 of the press.

Paper strips may be fed between the punch and die members, and in the present showing, we contemplate simultaneously punching two strips of paper at a time.

As indicated in Fig. 1, the paper rolls P1 and P2 may be mounted on a suitable support 14 and may be drawn around suitable guide rolls 15 and 16 over vacuum boxes 17 between a pair of

feeding rolls 18, and thence across between the punch and die.

Referring to Fig. 7, the feeding rolls 18 may be operated through the pinion 19 and the gear 20, this latter gear being driven by a shaft 21 to which is attached a ratchet wheel 22 which is engaged by a spring pawl 23 on the arm 24, which is connected by a link 25 to a bracket 26 which operates with the ram 2. Thus, at every upward stroke of the ram, the feed rolls 18 are turned a distance to advance an area of paper equal to the length of the blank indicated by *a*, plus the length of the space left between the blanks indicated at *b* in Fig. 1A.

The vacuum boxes 17 serve as brakes to retard the movement of the paper strips P1 and P2, so that they will not coast when the paper bands stop for the punching operation. As also indicated in Fig. 1A, the sensitized surface S of the paper strips P1 and P2 are both arranged on the top of the sheet or that side which faces the punch member 11. There are several reasons for this, first, it is desirable to have the emulsion surfaces on the sheets all facing the same direction after they have been punched from the strip material, and second, it is desirable to have as little contact as possible between the sensitized surface of the sheet and parts of the machine. Thus, if for any reason the air pressure which is used for floating the paper into place should not be perfectly constant, only the back or unsensitized surface of the paper would strike the die member 12. Even this is undesirable and need not occur with the proper setting of the machine.

It is desirable to float the paper when moved by the feeding rolls 18 into position between the punch and die. To accomplish this, there is a perforated pipe 27 which extends across the lead-in end 28 of the die member, as indicated in Fig. 3. The perforations 29 of this pipe extend upwardly, and the air admitted to the pipe may be controlled by a valve 30. A pipe 31 leads to the source of compressed air, here shown as being a pipe 32, and a valve 33, best shown in Fig. 7, for controlling the admission of air from the supply to the pipe 27. As will be seen from Figs. 7 and 8, the ram 2 carries an adjustable bracket 34 which can be located by the set screws 35 which pass through slots 36 in the bracket. To this bracket there is pivoted at 37 a bell crank lever 38 having a beveled surface 39 and having a short stop arm 40. This arm is normally pressed by a spring 41 against the upturned edge 42 of the bracket so that the bell-crank lever will be held in the position shown during the upward stroke of the ram. This causes the beveled surface 39 to contact with the arm 43 which controls the spring plunger 44 of the valve 33. As long as the plunger 44 is pressed inwardly, air may pass freely through pipe 31. However, as soon as this arm rides off the end of lever 43, the plunger springs out and the air is cut off.

On a return stroke of the ram, the bell-crank 38 is rocked against the pressure of spring 41, so that it may return without actuating the valve 44.

The operation of the air system described above is as follows: As the ram 2 ascends and the feeding rolls 18 advance the paper strips P1 and P2, valve 33 is operated so that air issues from the apertures 29 to float the advancing paper over the edge of the die 12. At the same time, air also enters the hollow die member 12 through a pipe 45, having a control valve 46 so that air may also enter the hollow chamber or opening 47 ex-

tending around the top of the die member 12, permitting air to issue from the ports 48. These ports preferably extend around all four sides of the die, although satisfactory results may be obtained with less ports than are shown. Thus, during the time the paper strips are advancing, air issuing from the ports 29 and the ports 48 holds the paper strip above the die member and prevents its contact therewith.

By the proper adjustment of the valves 30 and 46, the air pressure can be so regulated that the paper in its movement will remain a comparatively fixed distance above the die member, as, for instance, one-half inch or so.

The relation of the mechanism for advancing the paper to the ram 2 is such that movement of the paper ceases before the ram descends, so that the paper strip may settle down on the die before the punch reaches the die or the die may press the paper down through the stripper 20 in advance of the punching operation, as will be hereinafter described.

After the paper strips have been floated across the die member 12 and the movement of the paper has ceased, the descending ram 2 brings the punch member 11 downwardly towards its operating position. As indicated in Figs. 5 and 6, the punch member 11 may consist of a rectangular cutting edge 50 which is adapted to cooperate with the complementary shaped cutting edge 51 of the die member 12.

The cutting edge 50 is supported by a block 52 which is provided with air recesses 53 from which air passageways 54 extend downwardly inside of the cutting edges 50. The air passage 53 is connected by a flexible hose 55 with a compressed air line 75, there being a valve 57 for regulating the flow of air into the flexible pipe. Air is admitted through the ports or openings 54 by means of a valve 58 which is one of the same type as valve 53 and which includes a spring plunger adapted to be operated by an arm 60 when the valve actuating bell crank lever 61 presses against the arm 60.

Since the rest of the structure of the bell crank lever and adjustable support is identical to the structure described and shown in Fig. 8 except for the position of the parts these will not be further described. However, from the drawings it will appear that as the ram 2 descends the valve 58 will be momentarily opened just as the punch enters the die and severs the paper blank. The effect of this will be that a blast of air will blow the punched out blank of paper downwardly into the stacking device 62 diagrammatically shown in Fig. 1. These stacking devices may consist of a pair of paper guideways 63 and a paper supporting block 64. Since the details of this stacking device are not a part of our present invention, it will not be further described.

Movable with the punch member 11 is a stripper 65 which may be of known construction and which preferably consists of a rectangular member having an opening 66 through which the punch may pass. Rods 67 extend upwardly from the stripper and are encircled by springs 68 which normally hold the stripper in the position shown in Fig. 5.

As the punch member 11 descends, the stripper first engages the paper and presses it flat against the upper surface 69 of the die member which serves as a table to support the paper. Continued movement of the ram 2 causes the springs 67 to compress and the punch member 11 to pass through the paper and into the die member 12 75

at which time the blast of air above described is delivered from the ports 54 to move the paper blanks downwardly.

In order to prevent the suction caused by the punch moving upwardly again after the punching operation from preventing the proper movement of the paper and in order to cause the paper to fall rapidly through the die member as the air blast is delivered through the ports 54 of the punch member, we prefer to momentarily withdraw air from the lower part of the die member in the following manner. A pipe 70 leads to a vacuum line so that there is a constant tendency of this pipe to withdraw air from the hollow openings 71 of the die member through the ports 72 therein. The pipe 70 is connected to the opening 71 by means of the header 73 and there is a valve 74 arranged in this pipe which normally closes it.

However, when the valve 59 for directing the air blast through the punch member ports 54 is operated, air likewise passes through the pipe 75 and valve 76 to a valve operating chamber 77. This may consist of a suitable piston 78 held by the spring 79 in the position shown in Fig. 7. When, however, a blast of air is admitted through valve 59, the piston moves to the right as shown in Fig. 7, compressing the spring 79 and opening the valve 74. As soon as this occurs air is withdrawn through the pipe 70 so that, as the paper blank is punched out, there is a positive pressure on the top of the paper and a negative pressure on the bottom of the paper both causing the punched out blanks to fall rapidly into the stacking device 62.

Since the air blast through the vacuum line is continued until the punch leaves the die on its upward stroke, there is no tendency to displace the paper blank through the rapid movement of the punch.

Referring again to the valve operating chamber 77, we prefer to provide a needle valve 80 through which the air may escape after the piston 79 has moved the valve control arm 81 the necessary distance. As soon as the valve 59 snaps closed and the air pressure is relieved, the spring 79 will return the piston to the position shown in Fig. 7 and this movement will again close valve 74.

In Fig. 1A we have shown a strip of paper as it appears after the blanks have been cut out. It is preferable to hold the paper strips intact as this facilitates rapid operation of the punch and disposal of the waste. Thus, as indicated in this figure, after the paper blanks are punched out, there are openings "O" which are spaced apart in the skeleton strip, but there are no small paper particles which have to be separately disposed of.

We prefer to provide a stripper as indicated in Fig. 5, in which the width w of the face of the stripper is no greater than the width b of the paper which extends between the cutout areas of the strip. In this way the small area of the paper which is contacted by the stripper is waste material and does not form a part of the paper blank which is punched out for use so that any abrasions which may occur to the paper through the contact of the stripper are immaterial.

The operation of this device is quite simple. Paper rolls P1 and P2 are placed on a support 14 and each strip is threaded around the guide rollers 15 and 16 and across the vacuum boxes 17 through the paper feeding rollers 18. The machine is then started and as the paper ad-

vances by the feeding rolls 18 it is floated between the punch 11 and the die 12 by means of air issuing from the ports 29 outside of the die and from the ports 48 inside of the die. This air pressure is just sufficient to float the paper and we have found that paper started between the feeding rolls 18 will pass completely across the space between the punch and die without contact with either of these parts if the pressure is properly adjusted. When the upward movement of the ram 2 ceases, the paper will remain stationary while the pawl rides idly over the ratchet wheel 22. As the punch descends, the stripper 65 engages a small unused area of the paper just in advance of the punch 11 entering the die 12. As soon as the cutting operation between the punch and die 50 and 51 takes place, the air valve 59 is opened and a blast of air through the ports 54 of the punch is delivered on top of the paper and simultaneously a negative air pressure is created in the bottom of the die through the port 72. This causes the paper to move downwardly rapidly through the die member so that it may move through the guide 63 into the stack.

It is possible to operate this press at a high speed, such as 200 revolutions per minute and, since two blanks are cut at each operation with the setup we have described, a large number of sheets of very accurate dimension can be readily produced.

It may be possible in some cases to use more than two rolls of paper, but we have found this a satisfactory number, particularly where relatively heavy paper, such as the so-called double weight is used. However, if desired, additional paper supports, guide rollers and vacuum boxes may be used for additional rolls of paper. The vacuum boxes 17 are merely for the purpose of holding back the paper as it is intermittently drawn into position for punching. If desired, some other form of paper tensioning means may be employed.

While we have described a preferred form of our invention, and have by way of illustration shown a well-known type of high speed press for operating the punching mechanism, it is obvious that many changes may be made from the particular type of press and structure shown without departing from our invention. We consider as within the scope of our invention all such forms as may come within the scope of the appended claims.

Having described our invention what we claim as new and desire to secure by Letters Patent of the United States is:

1. In a machine for cutting photosensitive paper to a predetermined size, the combination with a ram, of a punch and die adapted to be moved relatively to each other thereby, a source of compressed air, and means operable in timed relation to the ram for directing air beneath the paper to hold the paper out of contact with the punch and die as the paper is moved therebetween for punching.

2. In a machine for cutting photosensitive paper to a predetermined size, the combination with a ram, of a punch and die adapted to be moved relatively to each other thereby, a source of compressed air, a paper moving device, means for operating said device in timed relation to the ram, and means operable in timed relation to the ram for directing air beneath paper moved by the moving device into punching position between the punch and die.

3. In a machine for cutting photosensitive

paper to a predetermined size, the combination with a ram, of a punch and die adapted to be moved relatively to each other thereby, a source of compressed air, a paper moving device, means for operating said device in timed relation to the ram, and a perforated pipe across an edge of the die connected through a valve and operable in timed relation with the ram for blowing air upwardly against a paper sheet advanced by the paper moving device for floating the sheet over the die and between the punch and die.

4. In a machine for cutting photosensitive paper to a predetermined size, the combination with a ram, of a punch and die adapted to be moved relatively to each other thereby, a source of compressed air, a valved connection between the source of compressed air and punch operable in timed relation with the ram for delivering air to the punch for forcing the paper cut thereby downwardly into the die, a vacuum line, valved connections between the vacuum line and die operable in timed relation with the ram for withdrawing air from the die beneath the paper punched out by the punch for drawing the paper blank downwardly in the die, and a receptacle into which the cut paper blanks are stacked.

5. In a machine for cutting photosensitive paper to a predetermined shape and size, the combination with a ram, of a punch and die adapted to be moved relatively to each other thereby, a source of compressed air, a perforated hollow die member connected by a valved connection with the source of compressed air, a perforated pipe extending across an end of the die member, means for operating the valve in timed relation to the ram for intermittently blowing air from the perforated die and pipe, and a paper moving mechanism operable in timed relation with the ram for advancing the paper through the air streams from the perforated pipe die whereby the paper may be floated into position for punching.

6. In a machine for cutting photosensitive paper to a predetermined shape and size, the combination with a ram, of a punch and die adapted to be moved relatively to each other thereby, a source of compressed air, a perforated hollow die member connected by a valved connection with the source of compressed air, a perforated pipe extruding across an end of the die member, means for operating the valve in timed relation to the ram, for intermittently blowing air from the perforated die and pipe, and a paper moving mechanism operable in timed relation with the ram for advancing the paper through the air streams from the perforated pipe die whereby the

paper may be floated into position for punching, said valve operating means being adjusted to cut off the air before the ram moves said punch into said die.

7. In a machine for cutting photosensitive paper to a predetermined shape and size, the combination with a ram, of a punch and die adapted to be moved relatively to each other thereby, a source of compressed air, a perforated hollow die member connected by a valved connection with the source of compressed air, a perforated pipe extending across an end of the die member, means for operating the valve in timed relation to the ram for intermittently blowing air from the perforated die and pipe, and a paper moving mechanism operable in timed relation with the ram for advancing the paper through the air streams from the perforated pipe die whereby the paper may be floated into position for punching, a perforated punch member, a valved connection to the punch and compressed air source, and means operable in timed relation with the ram for delivering an air blast through said punch as said punch enters said die to move the cut out pipe blank from said punch.

8. In a machine for cutting photosensitive paper to a predetermined shape and size, the combination with a ram, of a punch and die adapted to be moved relatively to each other thereby, a source of compressed air, a perforated hollow die member connected by a valved connection with the source of compressed air, a perforated pipe extending across an end of the die member, means for operating the valve in timed relation to the ram for intermittently blowing air from the perforated die and pipe, and a paper moving mechanism operable in timed relation with the ram for advancing the paper through the air streams from the perforated pipe die whereby the paper may be floated into position for punching, a source of negative air pressure, a second set of hollow passageways in the die member, with perforations therefrom leading to the interior of the die, a valve for controlling negative air pressure in a pipe connecting the second hollow passageways to the source of negative air pressure, and means for operating said valve in timed relation to the ram and valve controlling the compressed air passing therethrough whereby positive and negative air pressures are simultaneously applied to different sides of a paper blank punched out by the punch and die.

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