Oct. 17, 1939. T. HIROHASHI 2,176,815

CUTTING AND FOLDING MACHINE

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Fig. 1.

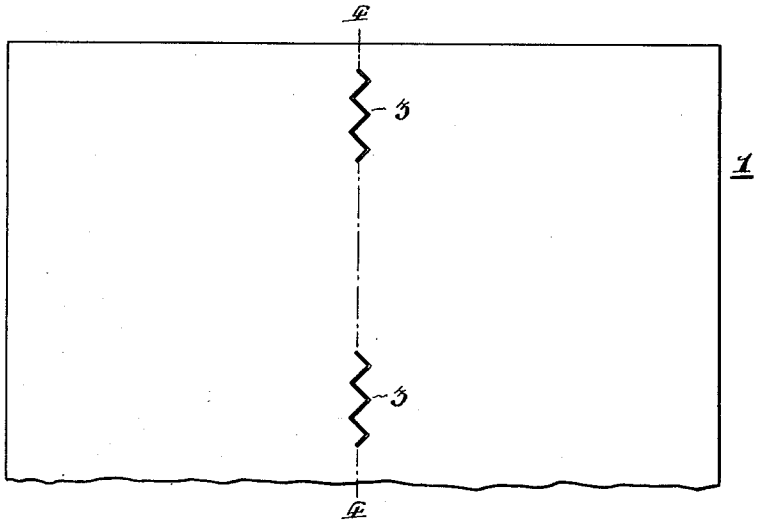


Fig. 2.

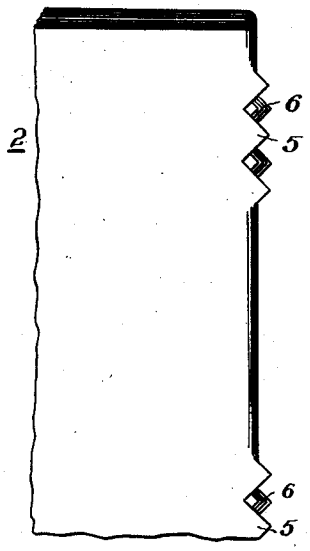
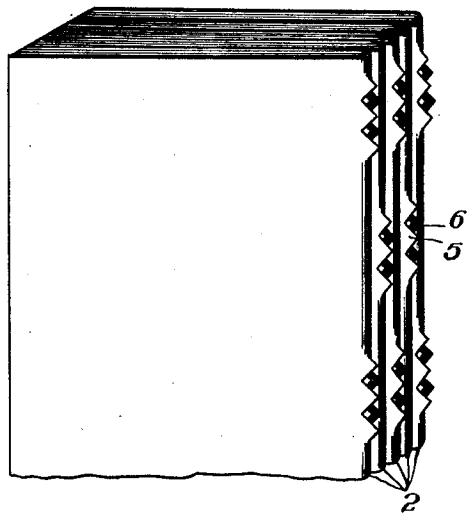


Fig. 3.



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Fig. 4.

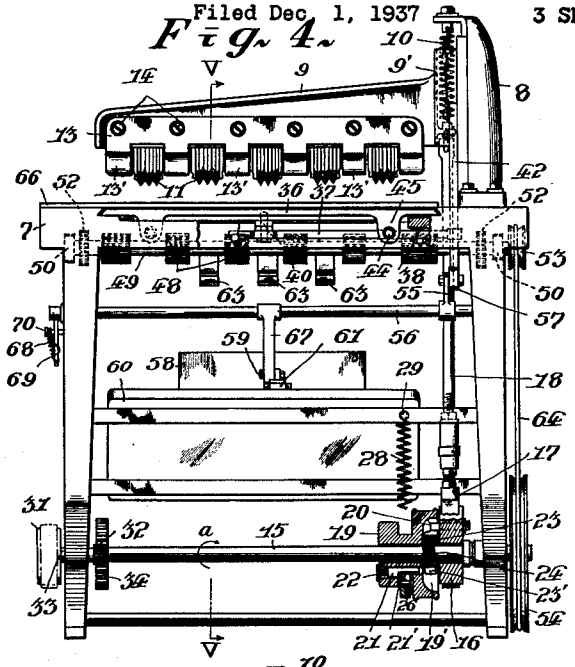
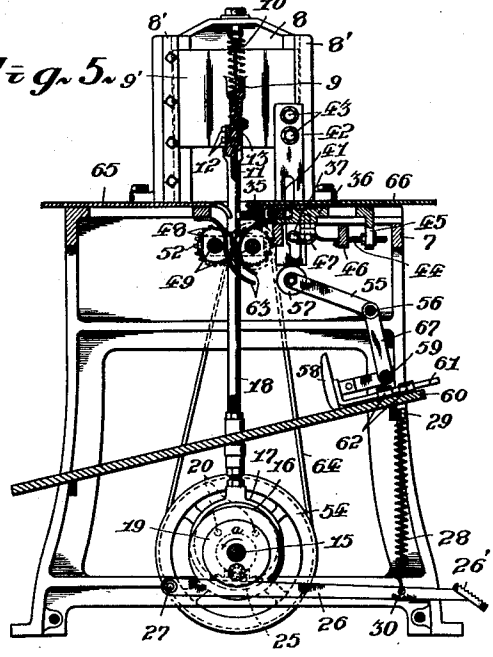


Fig. 5.



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Fig. 6.

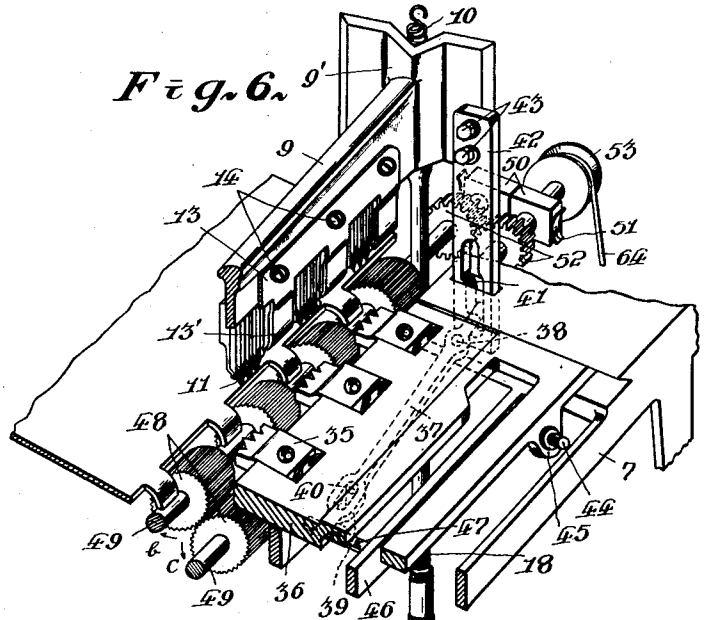


Fig. 7.

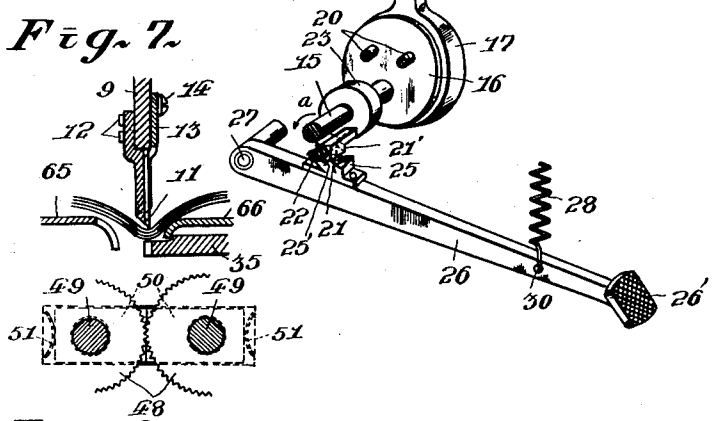
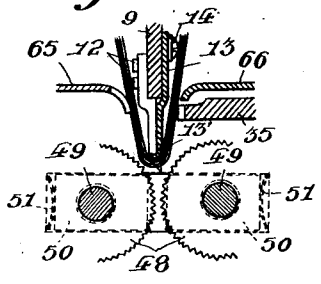


Fig. 8.



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CUTTING AND FOLDING MACHINE

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Application December 1, 1937, Serial No. 177,587

6 Claims. (Cl. 270—83)

This invention relates to improvements in cutting and folding machines and has for its object to provide a cutting and folding machine for a signature for bookbinding without using any binding cord or wire.

In the accompanying drawings:

Fig. 1 is a fragmentary plan view of a number of the sheets of paper adapted to be folded in two into a signature, showing series of serrate cuts therethrough.

Fig. 2 is a fragmentary perspective view on a larger scale of a portion of a signature folded at the center line of the series of serrate cuts.

Fig. 3 is a fragmentary perspective view of a number of the folded signatures as shown in Fig. 2, gathered in a complete book.

Fig. 4 is a front view of a machine for making series of serrate cuts on a number of the sheets of paper and for folding the sheets to a signature.

Fig. 5 is a vertical sectional view taken on the line V—V of Fig. 4.

Fig. 6 is a fragmentary perspective view on larger scale of the machine.

Figs. 7 and 8 are enlarged fragmentary side views of a cutter, a cutter die and delivery rollers, in different positions in a stroke of their operation respectively.

Referring to Figs. 1, 2 and 3, the sheets 1 of paper, which are to be folded once into a signature 2 containing four, eight, sixteen, thirty-two or other suitable number of pages, are formed with spaced several series of serrate cuts 3 therethrough on the folding line 4—4 of the sheets as the center-line of said series of the cuts, as shown in Fig. 1, and then the sheets are together folded in two on said folding line 4—4 into a signature 2. It will be apparent that the serrations 5 of one half side of the sheets folded in two into a signature and the serrations 6 of the other half side of them are arranged alternately, and that the edges of the superposing serrations are not naturally in registration, but are in a slipped relation toward inner side from outer side due to the fold of a number of the sheets of paper, as clearly seen in Fig. 2.

Now, a desired number of the signatures thus prepared is gathered in a comp'ete book, as shown in Fig. 3 and then is glued at the serrations on the back of the signatures. This process may take the place of the process of the sewing and stitching in usual bookbinding. The all other process or operation necessary for bookbinding may be performed in usual manner. It will be seen from Fig. 3 that each series of the serrations of each even signature is preferably formed in the position corresponding to the blank space between corresponding two adjacent series of the serrations of each odd signature, when the signatures are gathered in a complete book.

Figs. 4 and 5 illustrate a cutting and folding machine devised to make several spaced series of the serrate cuts through the sheets of paper and to make one fold of the sheets into a signature for a process of bookbinding according to the invention. 7 represents a frame whereon a guide frame 8 is securely mounted. A cutter carrier 9 having a guide shoe 9' (Fig. 6) is movable in the guides 8', 8' provided in the guide frame 8. A spring 10 is connected to the top of the guide frame 8 and the guide shoe 9' for the purpose of balancing with the weight of the cutter carrier 9 and attachments thereon as will be just described. The cutters 11 are attached in spaced relation to the cutter carrier 9 by means of screws 12 (Fig. 7). A folder 13 is also attached to the cutter carrier by means of screws 14 with the spaced folding blades 13' interposed between the spaced cutters 11.

The cutter carrier 9 is arranged to be reciprocated by a drive shaft 15 journalled on the frame 7 through an eccentric sheave 16 movably mounted on said drive shaft, an eccentric strap 17 and an eccentric rod 18 connecting the guide shoe 9' of the cutter carrier 9 to said eccentric strap.

The eccentric sheave 16 is connected by means of pins 20 with a block 19 movably mounted on the drive shaft 15. A sliding key 21 with a shoulder 21' is disposed in the cavity provided in the block 19 and always tends to be forced to the right with reference to in Fig. 4 by means of a spring 22. In the block 19, there is a depression 19' which receives a circular disc 23 secured on the drive shaft 15 by suitable means, such as screw threads 24, and has a notch 23' for receiving one end of the sliding key 21. A stationary wedge-shaped cam 25 with its inclined plane 25' on the front side in Fig. 6 is fixed on a lever 26, which is at one end pivoted to the frame 7 at 27, and at other end is provided with a pedal 26' and supported by means of a spring 28, the ends of which are connected with the frame 7 and the lever 26 at 29 and 30 respectively, so as to normally hold the cam 25 in engagement with the sliding key 21. In Fig. 6, the sliding key 21 is there shown as forced into engagement with the notch 23' of the circular disc 23 by the action of the spring 22, the shoulder 21' of said sliding key being caused to disengage with the inclined plane 25' of the cam 25 due to the depression of

the pedal end of the pivoted lever 26, and said sliding key being at its under side in engagement with the top side of the cam 25 due to the release of said lever. The arrangement is such that when the sliding key 21 makes from its position in Fig. 6 one complete circular movement around the axis of the drive shaft 15 with the circular disc 23, with the notch 23' of which said sliding key is in engagement, in counterclockwise direction, the shoulder 21' of said sliding key will come into engagement with the descending end of the inclined plane 25' of the cam 25 towards end of one complete circular movement of the sliding key, and on the continuance of its movement the sliding key will be forced against the spring 22 by the inclined plane 25', the shoulder 21' riding on said plane towards its ascending end until the sliding key is brought into disengagement with the notch 23' of the circular disc 23 to discontinue the circular movement of the sliding key. Thus the sliding key 21 is normally held in its receded position against the spring 22 by the inclined plane 25' of the cam 25 with the shoulder 21' in engagement with the ascending end, or nearly ascending end of the incline plane 25'. With this arrangement, it will be seen that when the drive shaft 15 is continually driven by a belting from a driving motor (not shown) through a pulley 31 and pinion 32, which are secured on a shaft 33 journalled on the frame 7, and a gear wheel 34 secured on the drive shaft 15, the circular disc 23 will continually rotate with the drive shaft 15, and if the pedal end of the pivoted lever 26 is depressed against the action of the spring 28 and then released, first upon the disengagement of the cam 25 with the sliding key 21 due to the depression of said lever, said sliding key is forced by the spring 22 into engagement with the notch 23' of the circular disc 23 secured on the drive shaft 15 to connect the block 19 and hence the eccentric sheave 16 with said circular disc, whereby said eccentric sheave is caused to rotate, and towards end of one revolution of the block 19 carrying the sliding key 21, the shoulder 21' of the sliding key will come into engagement with the descending end of the inclined plane 25' of the cam 25, as said cam is previously returned to its normal position upon the release of said lever, and the sliding key will be forced to the left with reference to Fig. 4 towards the ascending end of the inclined plane 25' of the cam 25 as the revolution continues, until it is brought into disengagement with the notch 23' of the circular disc 23 at end of complete one revolution of the block 19, as described above, whereby the block 19 and hence the eccentric sheave 16 will discontinue their revolution upon completion of one revolution.

The cutter dies 35 are secured in spaced relation to co-operate with the cutters 11 on a die carrier 36 movably mounted on the frame 7. The die carrier 36 is operatively connected with the guide shoe 9' of the cutter carrier 9 through a lever 37 pivoted to the frame 7 at 38, and having a slotted end 39 engaging with a stud 40 fixed on the die carrier 36 and the other end engaging a stepped slot 41 provided in a member 42 secured on the guide shoe 9' of the cutter carrier 9, for example by means of screws 43. The carrier 36 is normally held in the position, where the cutter dies 35 are positioned to co-operate with the cutter 11, as shown in the drawings, one end of the lever 37 being in engagement with the lower part of the stepped slot 41. As the member 42 moves downward with the cutter carrier 9, one end of the lever 37 will come into engagement with the upper part of the stepped slot 41, whereupon said lever 37 will be rocked about the pivot 38 in the counterclockwise direction (Fig. 6), whereby the die carrier 36 will be displaced to withdraw the cutter dies 35 from the position co-operating with the cutters 11. The normal or operating position of the cutter dies 35 is defined by an adjustable screw 44 provided in a projection 45 of the die carrier 36 and striking against a stop 46 on the frame 7, and a spring 47 fixed on said stop ensures a firm holding of the lever 37 in position to firmly hold the die carrier in normal or operating position.

Under the spaces between the cutter dies 35, there are arranged delivery rollers 48 for a folded signature, shafts 49 of which are supported at either ends by a pair of blocks 50 mounted in juxta-position but in yielding abutment by aid of springs 51 on the frame 7, so that a folded signature may pass therethrough. The delivery rollers 48 will be rotated in the directions indicated by arrows *b* and *c*, when the drive shaft 15 is rotated, through means of gearings 52 fixed on the shafts 49 of said delivery rollers, a pulley 53 fixed on one of said shafts 49, a pulley 54 fixed on the drive shaft 15 and a belt 64 on these pulleys. A shaft 56 is journalled on the frame 7 and is restrained against its free movement by means of a spring 68, the ends of which are connected to the studs 69 and 70 fixed on the shaft 56 and the frame respectively, and has arms 55 and 67 connected therewith. The arm 55 carries at its free end a roller 57 engaging with the under side of the member 42, and the arm 67 carries a pusher 58 pivotally connected at 59 thereto, which is placed on a runner plate 60 fixed on the frame 7 and is guided by a guide rod 61 fixed thereon and passing through guides 62 fixed on runner plate so as to be moved therealong. The guide plates 63 are fixed on the frame 7 to extend down beyond the delivery rollers 48. The plates 65 and 66 are securely mounted on the frame 7.

In operation, the drive shaft 15 is first set in continuous operation, the sheets 1 of paper (Fig. 1) are placed in position on the plates 65 and 66 and the lever 26 is depressed about the pivot 27 against the action of the spring 28 and then is released, whereby one complete revolution is imparted from the drive shaft 15 to the eccentric sheave 16, as described hereinabove. During the one revolution of the eccentric sheave 16, the cutter carrier 9 makes one complete reciprocating motion through means of the eccentric strap 17 and the eccentric rod 18. On the down stroke of the cutter carrier 9, the sheets of paper on the plates 65 and 66 are formed with spaced several series of the serrate cuts 3 as shown in Fig. 1, when the cutters 11 press the sheets of paper against the corresponding cutter dies 35, and when the cutters pass over the cutter dies the cutter dies are receded from its normal position out of the way of the folded signature of the sheets of paper due to the cutter die carrier 45 being moved to the right with reference to Figs. 5 and 6 by the pivoted lever 37 with its one end in engagement with the upper part of the stepped groove 41 of the member 42 moving downward with the cutter carrier 9. On further continuation of the down-stroke of the cutter carrier 9, the sheets of paper are folded together in two into a folded signature 2 as shown in Fig. 2 by means of the folding blades 13' of the folder 13 on the cutter carrier and are delivered into the delivery rollers 48, and then the cutter carrier will begin its up-stroke. On

the down-stroke of the cutter carrier, the shaft 56 is rotated against the tension of the spring 68 in a counterclockwise direction with reference to Fig. 5 by the arm 55 with the roller 57 being moved downward by the member 42 engaging with said roller, and consequently the pusher 58 is moved to the right with reference to Fig. 5 on the runner plate 60 by means of the arm 67 on the shaft 56. The folded signature is dropped on the runner plate 60 by means of the delivery rollers 48 through the guide plates 63, and during the up-stroke of the cutter carrier 9 the arm 55 on the shaft 56 and hence the shaft are released from their position rotated in the counterclockwise direction, whereupon the shaft 56 is restored to its normal position in a clockwise direction by action of the spring 68 to move the pusher 58 to the left with reference to Fig. 5 on the runner plate 60, and the folded signature dropped on the runner plate 60 is pushed by said pusher to run away along the runner plate. Such a cycle of operation is to be repeated.

I claim:

1. A paper folding and cutting machine including in combination a main frame, spaced supporting and guiding plates thereon for sheets of paper, a retractible cutting die member mounted on the frame and normally arranged beneath the space between the supporting plates, a vertically reciprocable member arranged above the frame and over the space between the plates, cutting and folding members carried by the reciprocable member for cooperating at times with the cutting die member, drawing rollers operably mounted on the frame beneath the space between the supporting plates, an operable connection between the reciprocable member and the retractible cutting die member for retracting the said cutting member in timed relation with the operation of the cutting and folding members so that the cut and folded sheets may be delivered to the drawing rollers.

2. A paper folding and cutting machine as claimed in claim 1, in which the retractible cutting die member includes a carrier slidable horizontally in the frame and having a series of spaced cutting dies thereon and in which the operable connection for retracting the carrier includes a horizontally disposed lever pivoted to the frame, one end of which is operably connected to the carrier, another member carried with the reciprocable member and provided with an offset slot in which the opposite end of the horizontal lever is mounted.

3. A paper folding and cutting machine as claimed in claim 1, in which an inclined runner plate is mounted in the lower part of the frame, spaced guide plates arranged adjacent the drawing rollers for guiding the folded sheets on to the runner plate, and a pusher member mounted for reciprocation on the runner plate and operable by the operable connection between the reciprocable member and the cutting die member.

4. A paper folding and cutting machine as claimed in claim 1, in which means are provided for reciprocating the reciprocable member and include a continuously rotating shaft, an eccentric thereon, an eccentric strap about the eccentric and a connecting rod between the strap and the reciprocable member, manually controlled clutch means between the shaft and the eccentric, and resilient means tending to normally return the reciprocable member to its uppermost position.

5. A paper folding and cutting machine as claimed in claim 1, in which the reciprocable member includes a horizontally disposed arm, an upright guide on the frame for receiving and guiding the inner end of the arm, a spring between the arm and the top of the guide to normally maintain the arm in an elevated position and in which the cutting and folding members include a series of spaced serrated cutters fixed along one side of the arm, and a folding member fixed to the other side and including a plurality of spaced blades positioned between the cutters.

6. A paper folding and cutting machine as claimed in claim 1, in which adjustable stop means are mounted on the frame for setting and determining the normal position of the retractible cutting die member.

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