An automatic pleating machine is disclosed comprising two main rollers which are driven continuously in one direction, a jockey roller mounted at the ends of a pair of pivoted levers and two guide channels for the pleated material. The jockey roller is so mounted on the levers that it can rest on either one or the other of the main rollers to form a path to either one or the other of the guide channels for material passing between the main rollers. Photocells are located near the ends of the guide channels to detect the approach of the material being folded to cause the pivoted levers to move so that the jockey roller commutes from one roller to the other thereby forming a pleat and guiding the pleated material into the other guide channel where the same process is repeated until the sheet of material is used up.

4 Claims, 2 Drawing Figures
AUTOMATIC PLEATING MACHINES

BACKGROUND OF THE INVENTION

The present invention relates to automatic pleating machines for pleating sheets of material such as paper or the like, with alternating folds having a predetermined pitch.

One type of known pleating machine for this purpose uses groups of cylinders operating in pairs in which a first pair of cylinders thrusts the sheet to be pleated into a guide until it meets a stop, so as to form a loop which is then gripped by a second pair of rollers and thrust into a second guide, thus forming a pleat; this procedure is repeated for succeeding pleats.

In another known type of pleating machine fewer rollers are used, but these are arranged in pairs the rotation of which is reversed periodically by means of a drive controlled by a programming device which establishes the pitch of each fold.

In both types of machine there are nevertheless a relatively large number of rollers, and this makes the machines rather cumbersome. Moreover, the machines in which all the rollers periodically reverse their direction of rotation, strong dynamic stresses are set up as the direction reversal takes place. This makes such machines noisy and reduces the life of the roller drive and support members.

OBJECTS OF THE INVENTION

It is one object of this invention to eliminate the above disadvantages, by providing a pleating machine for sheets of material which is simple, sturdy, and has an economical construction, and which consists of a smaller number of parts than known pleating machines.

Another object of this invention is to provide a machine constructed so as to be capable of reliably and accurately pleating sheets according to a prearranged pattern.

A further object of the invention is to provide a machine having considerably less bulk than known types of pleating machines.

SUMMARY OF THE INVENTION

According to the present invention a machine for automatically pleating sheets of material such as paper or the like comprises a pair of counter rotating, cooperating main rollers each driven in a given constant rotational direction, a freely rotatable third roller mounted on movable supports by means of which the third roller can be moved between two positions alternately engaging each of the said main rollers to form a path, between itself and the main roller thus engaged, to one of two guides located symmetrically about the main rollers, commutation of the third roller from one position to the other causing the sheet to fold as the path is changed from one guide to the other, the guides having stops and means sensitive to the position of the sheet and responsive to the approach of the sheet to a stop to effect commutation of the said third roller from one position to the other.

Various features and advantages of this invention will become apparent during the following description given by way of non-limiting example, with reference to the accompanying drawings.
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unit in order to adjust the pitch between successive pleats of the sheet to be pleated.

**OPERATION**

As shown in FIG. 1, when a sheet A is introduced into the chute 4, 5 it moves along the chute until it intercepts the beam of light from the source 5 which energizes the first photo-electric cell 6; this is arranged to set the machine into its initial operating condition, lowering the roller 8, (if this has remained at the top of its travel at the end of the previous operational cycle) and energizing the solenoid 22 which moves the stop 20 to the closed position at the base of the lower guide unit 15, 16.

The sheet then passes between the two main rollers 2, 3, and is gripped between the third roller 8 and the main roller 2 and thrust along the lower guide unit. Shortly before the end of the sheet A reaches the stop 20 the light beam from the source 18 which energizes the photo-electric cell 17 is interrupted by the sheet A, thus causing energization of the electromagnet 13 and the consequent clock-wise rotation of the levers 9, so that the roller 8 moves away from the lower roller 2 and comes into contact with the upper roller 3, as shown in FIG. 2.

The sheet A is therefore no longer thrust downwards between the rollers 2 and 8 but is still fed forward by the grip between the main rollers 2 and 3. It thus forms an upwardly extending loop after the end has met the stop 20, and this loop is then gripped between the rollers 3 and 8. The first pleat is thus formed, and the pleated fold of the sheet is thrust upwards along the upper guide unit 15', 16', until the end thereof encounters the upper stop 20'. Before this engagement occurs, however, the folded end of the sheet intercepts the light beam from the source 18' which energizes the photo-electric cell 17' thus causing the de-energization of the solenoid 13 and the consequent anti-clockwise rotation of the levers 9 under the action of the return spring 14.

The roller 8 then moves away from the upper roller 3 and returns into contact with the lower roller 2.

Again, since the sheet continues to be fed forward by the main rollers 2 and 3, and since the folded end has by now abutted the stop 20' a new loop is formed which is gripped between the rollers 2 and 8 thereby forming another pleat. The folded ends of the sheet, which are already pleated, are pulled from the upper guides and urged, together with a new piece of the sheet, towards the lower guide unit, by the rollers 2 and 8.

The above described stages alternate repeatedly until the whole sheet to be pleated has been used up and folded into a plurality of regular pleats.

At the end of the operation the sheet may be taken out of the machine: this can be effected from the upper guide unit by means of a removable panel, or from the end of the lower guide unit from which the stop 20 has been moved by the solenoid 22 so as to allow the removal of the folded sheet as the result of a delayed signal given by the photo-electric cell 6 which is energized when the end of the sheet passes between the rollers 2, 3; this signal also allows the last edge of the sheet to be pleated.

The machine can also be provided with a programming device which may be either manually or automatically operated and arranged to move the two reversing units 23, comprising the photo-electric cells 17, 17', and the members cooperating with them according to a predetermined pattern in order to change the pleating pitch of the sheet as the pleating progresses. The same result could be achieved by providing along the two guide units a plurality of photo-electric cell units which are then selectively activated in the desired order in order to achieve a predetermined pleating pattern.

Once a sheet has been pleated along its whole length, the pack thus made can be replaced into the machine in order to be pleated in the transverse direction.

In the machine described above only three rollers are used, two of which rotate constantly in a given direction, the third moving alternately between two working positions in each of which it changes its direction of rotation. The reversal of the direction of rotation of the third roller is controlled, in effect, by the sheet of material itself and this makes the regular pleating of the sheet more reliable.

It will be appreciated that this machine can be made considerably smaller than known pleating machines in which a considerable number of rollers are used, in view of the fact that in the present invention only three rollers are required.

Naturally the principle of the invention remaining the same, the practical embodiments, and the details of construction can be widely varied in respect of what has been described and illustrated, without nevertheless going beyond the scope of this invention.

1 claim:

1. A machine for automatically pleating sheets of material comprising:
   - two main rollers, means driving said main rollers in opposite constant rotational directions to advance said material to be pleated,
   - a freely rotatable third roller,
   - movable support means supporting said third roller, means moving said support means to engage said third roller alternately against each of said main rollers,
   - guide means associated with each main roller, said third roller forming a path, between itself and the roller against which it is at any time engaged, to said guide means associated with said main roller against which said third roller is engaged, for material passing through said main rollers, said guide means having stops adjacent one end thereof and position sensing means sensitive to the position of said sheet in said guide means, said position sensing means being connected to said moving means and responsive to the approach of said sheet to said stop in said guide to actuate said moving means to move said movable support means to commute said third roller from engagement with one said main roller to engagement with the other said main roller causing said path to change from one said guide means to the other said guide means whereby a fold is created in said sheet.

2. The pleating machine of claim 1 wherein said means sensitive to the position of said sheet in said guide means are photo sensitive and comprise:
   - a photocell and a cooperating light source adjacent each said stop, said light source and said photocell
being arranged side by side along said guide means,
reflector means facing said photocell and said light source, said photocell and said light source cooperating with each other, by means of said reflector means to detect the passage of the end of said sheet past said photocell to actuate said moving means.

3. The pleating machine of claim 2 wherein said movable support means comprise two parallel centrally pivoted levers bearing said third roller adjacent one end,
at least one solenoid controlling the position of said levers,
said photosensitive detectors responsive to the position of said sheet along said guide means controlling the energization of said solenoid, and spring means biasing the armature of said solenoid to a first position when said solenoid is de-energized.

4. The pleating machine of claim 1 wherein said stops are adjustable along said guide means and at least one said stop is mounted for transverse movement out of position to allow said sheet to pass down said guide means,
a solenoid controlling said transverse movement of said stop,
photosensitive means controlling the operation of said solenoid, said photosensitive means being positioned adjacent the path of said sheet in advance of said main rollers and operative to move said stop into position in said guide means at the start of each pleating cycle and to move said stop out of position at the end of said pleating cycle to open said guide means to allow removal of said pleated sheet.
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION


Inventor(s) Vittori Garrone

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In The Heading:

The Priority Date was omitted. Should read:

--Italy October 22, 1970 ................. 70516-A/70--

Signed and sealed this 3rd day of July 1973.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR. Rene Tegtmeyer
Attesting Officer Acting Commissioner of Patents