May 20, 1969 D. D. SLOAN 3,445,047

APPARATUS FOR FORMING SHEETS FROM A STRIP OF MATERIAL

Filed July 31, 1967 Sheet 1 of 4

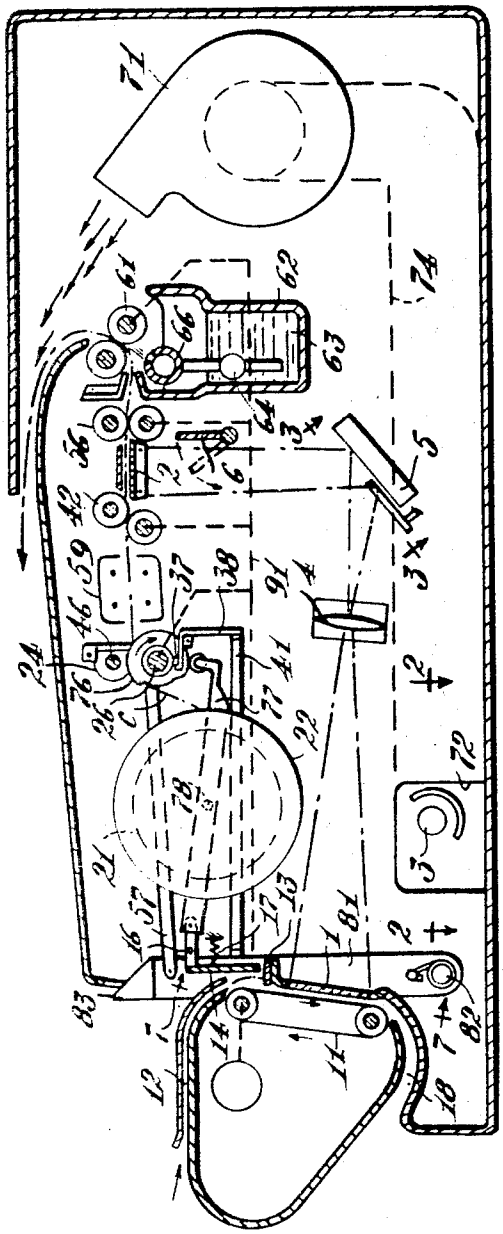


Fig. 1

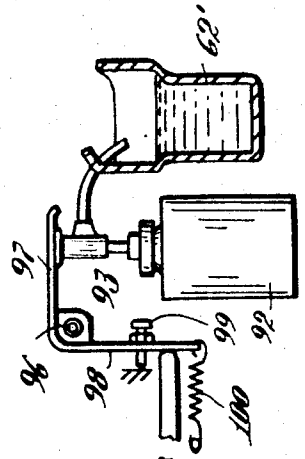


Fig. 8

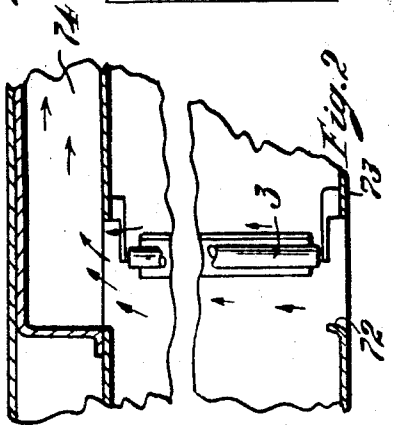


Fig. 2

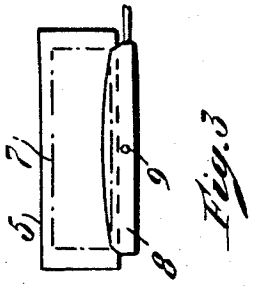


Fig. 3

May 20, 1969 D. D. SLOAN 3,445,047

APPARATUS FOR FORMING SHEETS FROM A STRIP OF MATERIAL

Filed July 31, 1967 Sheet 2 of 4

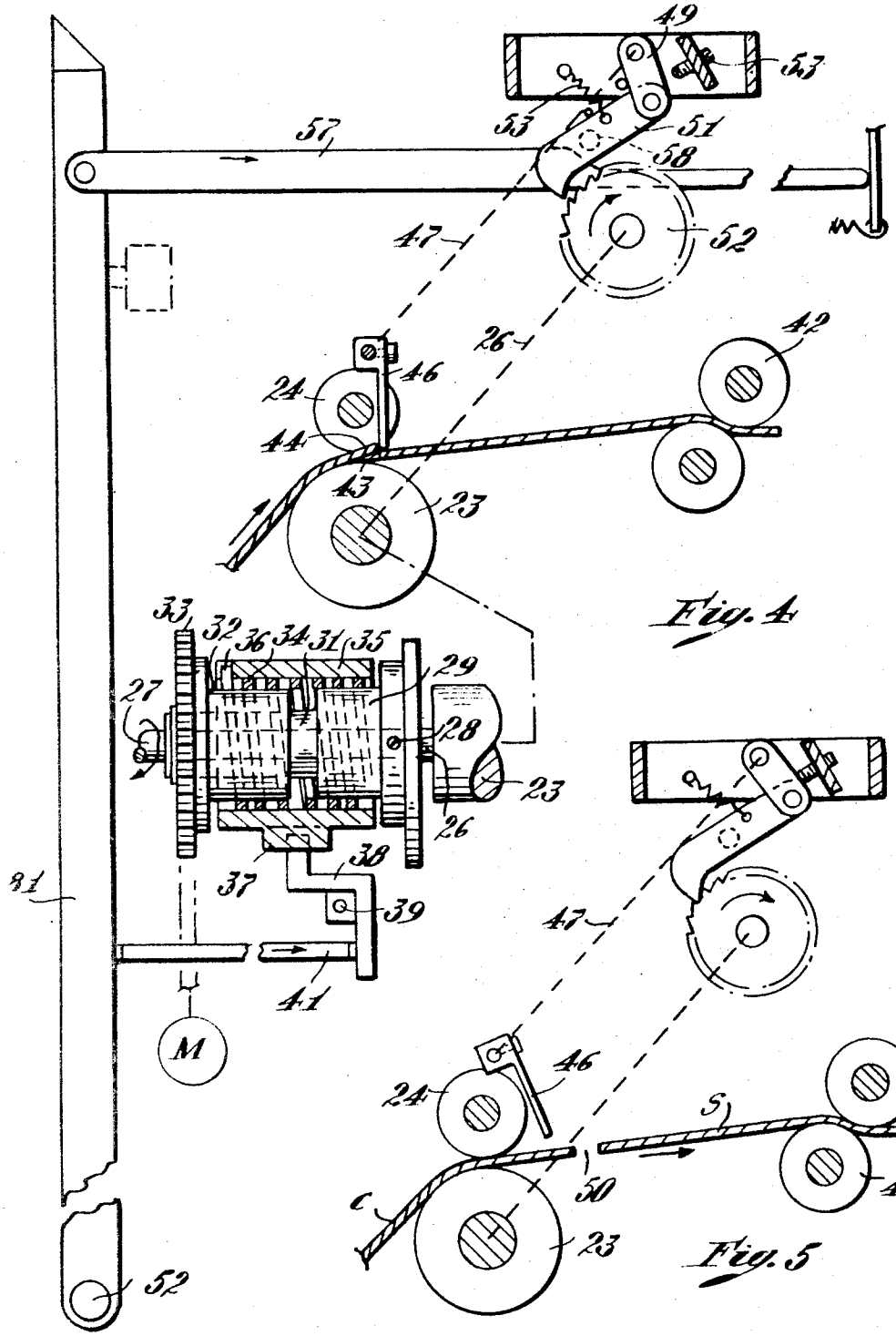


Fig. 4

Fig. 5

May 20, 1969 D. D. SLOAN 3,445,047

APPARATUS FOR FORMING SHEETS FROM A STRIP OF MATERIAL

Filed July 31, 1967 Sheet 3 of 4

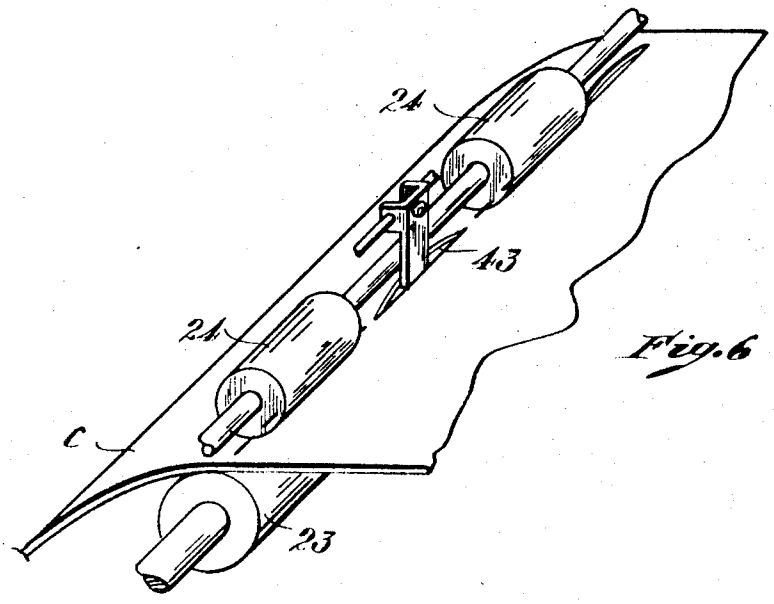


Fig. 6

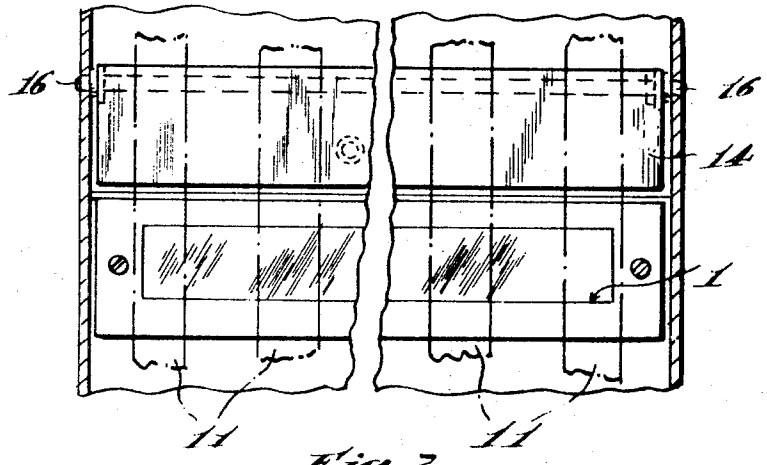


Fig. 7

May 20, 1969 D. D. SLOAN 3,445,047

APPARATUS FOR FORMING SHEETS FROM A STRIP OF MATERIAL

Filed July 31, 1967 Sheet 4 of 4

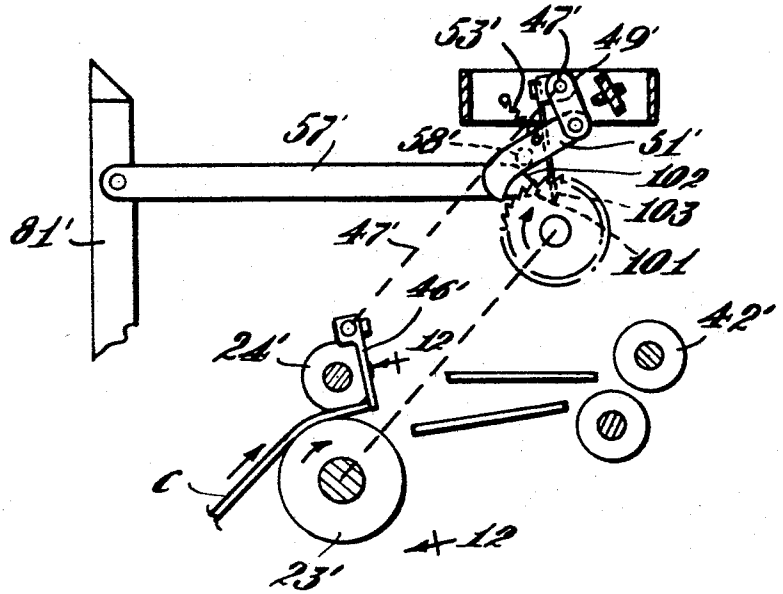


Fig. 9

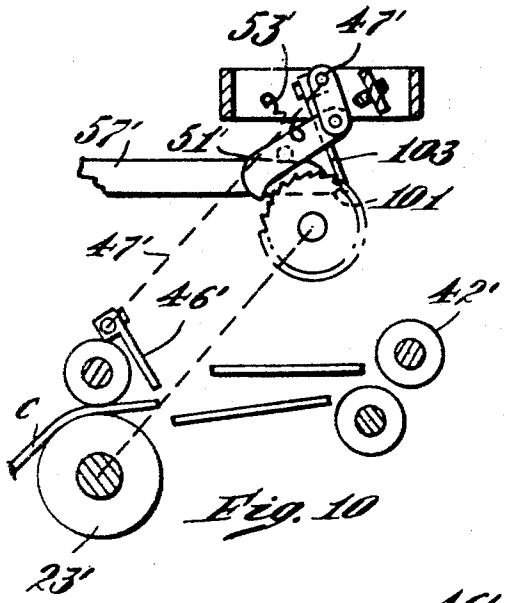


Fig. 10

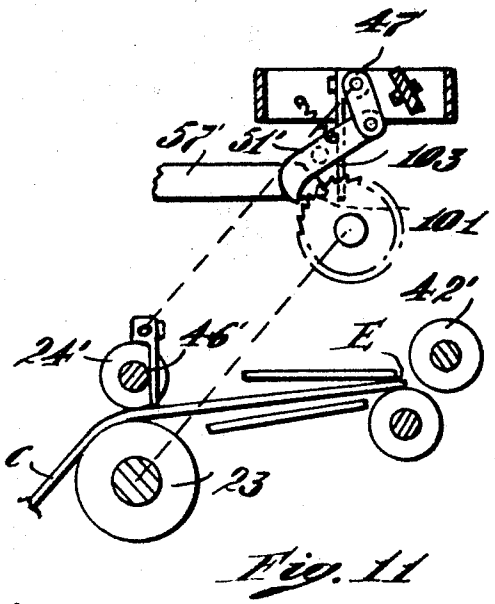


Fig. 11

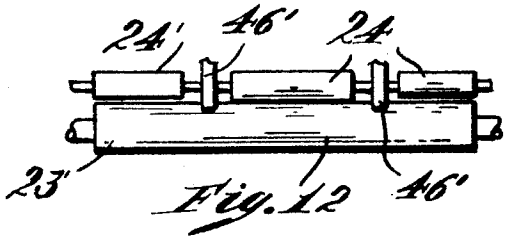


Fig. 12

United States Patent Office 3,445,047 Patented May 20, 1969

3,445,047

APPARATUS FOR FORMING SHEETS FROM A STRIP OF MATERIAL

Donald D. Sloan, Weston, Mass., assignor to Dennison Manufacturing Company, Framingham, Mass., a corporation of Nevada

Continuation-in-part of application Ser. No. 586,131, Oct. 12, 1966. This application July 31, 1967, Ser. No. 657,151

Int. Cl. B26f *3/02*; B65h *35/10*

U.S. Cl. 225—100 10 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus for forming sheets of predetermined length from a strip of material such as paper having cuts extending part way across the strip along transverse lines at recurrent intervals corresponding to said length and copying records on the sheets, the sheets being formed during recurrent cycles of operation by rupturing the strip along said lines, with manual means for starting each cycle.

This is a continuation-in-part of application Ser. No. 586,131, filed Oct. 12, 1966.

Objects of the invention are to provide apparatus which is simple and economical to produce, which is durable and reliable in use, which is compact and convenient to maintain, and which is free from jamming.

According to this invention the apparatus forms sheets of predetermined length from a strip of material having cuts extending part-way thereacross along transverse lines at recurrent intervals corresponding to said length, the appparatus comprising a feeder for producing movement of the strip along a predetermined course, a guide for the strip at a location in advance of said feed means a distance approximating said length to change the direction of said course, said change being sharp enough to cause the trailing edge of each of said cuts to form an arch away from the guide as the strip is fed over the guide, and means at said location for arresting said movement thereby to cause the feeder to detach the foremost sheet from the strip along the first of said transverse lines, said means including a controller in the path of said arch, said controller being movable by said arch out of the path of the arch. Preferably said means comprises a cyclic driver which drives the strip until after the strip reaches said feeder and then idles while the feeder continues to pull the strip, said means comprises a detent to stop the driver, said guide comprises a roller and said driver actuates the roller, said driver is free-wheeling and said detent stops the free-wheeling, and the apparatus has manual means for retracting the detent to permit the strip to be advanced again by said driver to start a new cycle of operation. In the preferred embodiment the apparatus has means to move the controller out of the path of the leading edge of the strip at the beginning of each cycle in the event the controller has not been so moved by said arch in the preceding cycle, thereby to avoid jamming at the beginning of a cycle, and means to move the controller back into the arch path after the leading edge has passed the controller and before the next arch reaches the controller, said last means being a part of said manual means.

For the purpose of illustration typical embodiments of the invention are shown in the accompanying drawings in which:

FIG. 1 is a vertical longitudinal section largely diagrammatic;

FIG. 2 is a section on line 2—2 of FIG. 1;

FIG. 3 is a view from line 3—3 of FIG. 1;

FIG. 4 is a sectional view of the mechanism for feeding a strip of copy material to the exposure window;

FIG. 5 is a similar view showing the parts in position to sever a sheet from the strip;

FIG. 6 is an isometric view of a part of the feeding and severing means;

FIG. 7 is a section on line 7—7 of FIG. 1;

FIG. 8 is a view like FIG. 1 showing a modification;

FIGS. 9 to 11 are views like FIG. 5 showing a modification in successive stages of operation; and

FIG. 12 is a view from line 12—12 of FIG. 9.

The particular embodiment of the invention shown in FIGS. 1 to 8 comprises a record gate **1** for a record to be copied, an exposure window **2** in which the paper or other copy material is exposed, the record being illuminated by lamp **3** and an image of the record being projected to the material by a lens **4** and mirror **5**. Between the window and mirror is a shutter **6** pivotally mounted to swing into the path of the light beam to adjust the degree of exposure. Preferably the light beam has an elongate rectangular shape such as shown at **7** in FIG. 3 and the copy material is exposed while it and the record are traveling contnuously in synchronism. With an elongate beam the intensity of light decreases from the center towards the ends of the beam, and to compensate for this decrease, a mask **8** is disposed in the beam, the mask being shaped as shown in FIG. 3 to obstruct light in gradually decreasing degrees from the center toward each end. The mask is pivoted at **9** to swing about an axis perpendicular to the mirror so that, by tipping the mask about the axis, correction may be made for any slight misalignment of either of the windows or the mirror which results in a distance from record to copy material at one end of the elongate beam which is greater than at the other end.

Records are fed through the record gate by endless belts **11** traveling continuously in the direction of the arrows in FIG. 1 in juxtaposition to the gate **1**. A record to be copied is slipped into slot **12** until its forward edge abuts the shelf **13** and then, to start the record through the gate, the forward margin of the record is pushed off the shelf and pressed against the belts **11** by a flapper **14** pivotally supported at **16** and normally held in retracted position by a spring **17**. After passing through the gate the record is deposited in slot **18**.

The copy material C is supplied in strip form from a roll **21** through a slot in a cylindrical container **22** which is preferably constructed as described and claimed in copending application Ser. No. 609,983. The strip feeds from the container between rollers **23** and **24**. The lower roller is driven through a shaft **26** by a conventional cyclic slip driver such as shown in FIG. 4. As is well known this driver comprises a central shaft **27** to which is fastened, by screw **28**, a hub **29** having a reduced extension **31**. Fitting over the extension is another hub **32** driven by gearing **33**. Surrounding the hubs is a coiled spring **34** and surrounding the spring is a sleeve **35** to which one end of the spring in anchored at **36**. When the hub **32** is driven in the direction of the arrow in FIG. 4 the spring grips the hubs **29** and **32**, causing them and the sleeve **35** to rotate together. On the outside of the sleeve is a lug **37** and in the path of this lug is a lever **38** pivoted at **39** to be swung out of the path of the lug by a manual push-bar **41**. When the lug engages the stop the rotation of the sleeve and spring stops, releasing the grip of the spring on hub **29** and permitting free-wheeling of hub **29**, shaft **26** and roller **23**. When the push-bar **41** is actuated momentarily the stop **38** disengages lug **37** and the spring-driven parts make another revolution before stopping again.

Before drive roller **23** starts free-wheeling, the strip has reached roller **42** which continues to advance the strip

until the free-wheeling is stopped as will now be described. Thus the rollers 23 and 42 must be close enough together for the roller 42 to start feeding the strip before roller 23 starts to free-wheel, and each feeding cycle of roller 23 must be short enough to start free-wheeling before roller 23 is stopped by pawl 51.

At regular intervals lengthwise of the strip C, the copy material has elongate cuts 43 extending transversely of the strip to divide the strip into portions of length equal to that of the copy sheets S to be severed from the strip, the material being stiff enough to cause the lips of said cuts to arch up when the strip is pulled over a guide which changes its direction of travel. Thus when the strip is pulled over roller 23 by the rollers 42 the lips of the cuts arch away from the rollers as shown at 44 in FIG. 4. The spaces between the cuts are preferably perforated as shown in FIG. 6.

In the path of these lips is a controller 46 fast to shaft 47 to swing from the idle position shown in FIG. 4 to the operative position shown in FIG. 5. Fast to shaft 47 is an arm 49 pivotally supporting a pawl 51 cooperating with a ratchet wheel 52 on shaft 26. Normally the pawl is held out of contact with the ratchet wheel by a spring 53 but when a lip 44 actuates the controller 46 the pawl 51 is swung into engagement with ratchet wheel 52 which swings arm 49 against stop 53 (FIG. 5) thereby stopping the free-wheeling of rollers 23 and 24. The continuing pull of rollers 42 severs the foremost sheet S from the strip along the line of cuts 43 and passes the sheet on to the next pair of feed rollers 56. FIG. 5 shows the parts in the positions they occupy after the foremost sheet has been severed, with a gap 50 between the strip C and the severed sheet S. To start another cycle the pawl 51 is lifted from the ratchet wheel by a cam rod 57 sliding under a pin 58 on the pawl. Lifting the pawl rotates shaft 47 clockwise thereby returning controller 46 from the operative position shown in FIG. 5 to the idle position shown in FIG. 4.

Between feed roller 23 and rollers 42 the copy sheets pass through a corona device 59 to receive an electrostatic charge in well-known manner, and between the feed rollers 42 and 56 each sheet is exposed as above described.

Beyond rollers 56 is another pair of feed rollers 61 which are disposed over a tank 62 of liquid 63 for developing the electrostatic images. A stream of developer is directed against the exposed side of each sheet S by a pump 64 which projects a ribbon of developer through a slot in a nozzle 66 directed into the nip between the rollers so as to produce vigorous agitation of the developer as it impacts the sheet. The feed rollers 61, which also serve as squeegee rolls, deliver the developed sheets through the outlet 67.

To cool the lamp 3 and dry the developed sheets a pump 71 circulates air through an inlet 72 in the casing 73, thence along the lamp to a duct 74 and thence through the outlet 67.

The aforesaid flapper 14, which starts a record through the gate 1, is actuated by a cam 76 on the shaft 26 through the medium of a lever 77 pivoted at 78. The aforesaid push-bar 41 and cam rod 57 (FIG. 4) are both connected to a lever 81 pivotally supported at 82 with a handle 83 at its upper end projecting through an opening in the casing 73. Thus by pressing the handle momentarily a record is started through gate 1 and the strip C of copy paper is started by feed roller 23.

As indicated by the broken line 91 in FIG. 1 all the feeders are driven in synchronism by motor M. The distances between feed rollers are less than the length of a copy sheet so that, after being severed as indicated at 50 in FIG. 5, each sheet is picked up by the next succeeding pair of feed rollers before leaving the preceding pair.

From the foregoing it will be understood that upon pressing the handle 83 momentarily a record is fed through gate 1 and a sheet S of copy paper is fed through the exposure window 2 concomitantly. While the sheet S continues through the outlet 67, the strip C stops in the position shown in FIG. 5 until the handle 83 is pressed again.

In the modification shown in FIG. 8 the developer in tank 62 is replenished by a pump dispenser 92 of the well-known type having a plunger 93 which, when depressed, ejects a small amount of liquid through the nozzle 94. The plunger is depressed by an angular lever pivoted at 96 with one arm 97 bearing on the plunger and the other arm 98 carrying a stop 99. The lever is held in the position shown in FIG. 8 by a spring 100 and is swung counterclockwise by a pusher 57 connected to the aforesaid lever 81, the dispenser ejecting developer when the lever 97–98 is swung clockwise by spring 100 as the lever 81 is returned to normal position by spring 82 (FIG. 1).

If the rollers 49 should separate a sheet from the strip without swinging detent 46 from the idle position shown in FIG. 4 to the operative position shown in FIG. 5, at the beginning of a new cycle the leading edge of the pawl would actuate the detent to throw the pawl 51 into engagement with the ratchet 52, thereby jamming the apparatus. The modification shown in FIGS. 9 to 12 avoids the jamming difficulty. The modification is similar to the embodiment of FIGS. 1 to 8 and corresponding parts are correspondingly designated. However, the cam rod 57′ is shorter than the cam rod 57 with its nose 101 immediately in front of the inclined surface 102 on the cam rod which lifts the pawl 51′ as aforesaid, and a finger 103 fast to the shaft 47′ extends into the path of the nose. Thus when the cam rod 57′ is advanced to start a cycle the nose engages the finger 103 thereby swinging shaft 47′ counterclockwise and moving the controller 46′ from the idle position shown in FIG. 9 to the operative position shown in FIG. 10. By engagement with pin 58′ the advance of cam rod 57′ also lifts the pawl 51′ away from the ratchet thereby starting a new cycle. When the lever 81′ is released and the cam rod is retracted by spring 82 (FIG. 1) spring 53′ swings the controller 46′ back to idle position in the path of the next arch. By this time the leading edge E of the strip C has passed the controller so that no jamming occurs.

The modification shown in FIGS. 9 to 12 also differs from the first embodiment in that there are three rollers 24′ and two controllers 46′ as shown in FIG. 12 instead of the two rollers 24 and one controller 46 as shown in FIG. 6, and the two outside rollers have diameters slightly less than that of the intermediate roller. Thus even if the strip is somewhat wrinkled it feeds through smoothly and the wrinkles do not actuate the controllers 46′.

It should be understood that the present disclosure is for the purpose of illustration only and that this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. For forming sheets of predetermined length from a strip of material having cuts extending part-way thereacross along transverse lines at recurrent intervals corresponding to said length, apparatus comprising a feeder for producing movement of the strip along a predetermined course, a guide for the strip at a location in advance of said feed means a distance approximating said length to change the direction of said course, said change being sharp enough to cause the trailing edge of each of said cuts to form an arch away from the guide as the strip is fed over the guide, and means at said location for arresting said movement thereby to cause the feeder to detach the foremost sheet from the strip along the first of said transverse lines, said means including a controller in the path of said arch, said controller being movable by said arch out of the path of the arch.

2. Apparatus according to claim 1 wherein said means comprises a cyclic driver which drives the strip until after the strip reaches said feeder and then idles while the feeder continues to pull the strip.

3. Apparatus according to claim 2 wherein said means comprises a detent to stop the driver.

4. Apparatus according to claim 2 wherein said guide comprises a roller and said driver actuates the roller.

5. Apparatus according to claim 3 further characterized by manual means for retracting the detent to permit the strip to be advanced again by said driver to start a new cycle of operation.

6. Apparatus according to claim 3 wherein said driver is free-wheeling and said detent stops the free-wheeling.

7. Apparatus according to claim 6 further characterized by means to move said controller out of the path of the leading edge of the strip at the beginning of each cycle in the event the controller has not been so moved by said arch in the preceding cycle, thereby to avoid jamming at the beginning of a cycle.

8. Apparatus according to claim 7 wherein said last means is a part of said manual means.

9. Apparatus according to claim 7 further characterized by means to move the controller back into the arch path after the leading edge has passed the controller and before the next arch reaches the controller.

10. Apparatus according to claim 8 wherein said last means comprises said manual means.

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