Oct. 1, 1957 T. ROWLANDS ET AL 2,808,261

MACHINES FOR PERFORMING CUTTING, CREASING, AND LIKE OPERATIONS, ON PAPER, CARDBOARD, AND LIKE MATERIALS

Filed May 2, 1955 5 Sheets-Sheet 1

Fig. 1.

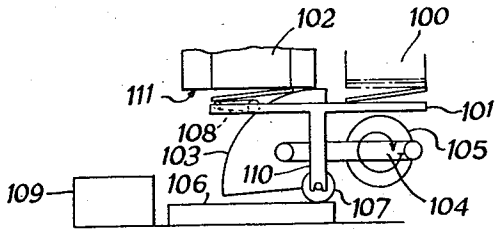
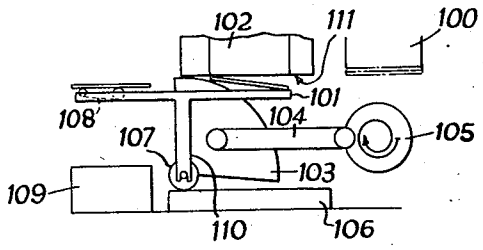


Fig. 2.



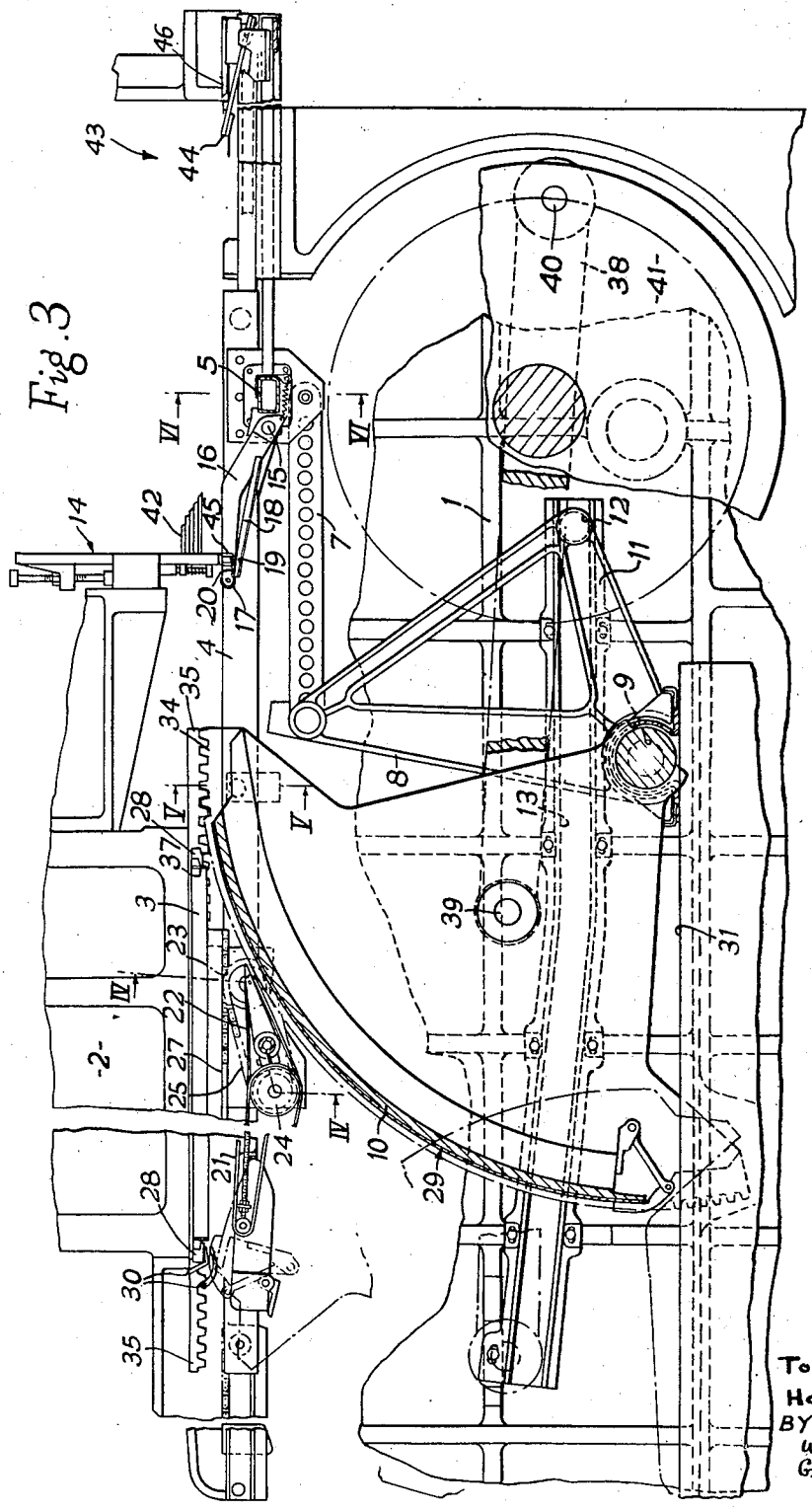
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Fig. 3



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Filed May 2, 1955 5 Sheets-Sheet 3

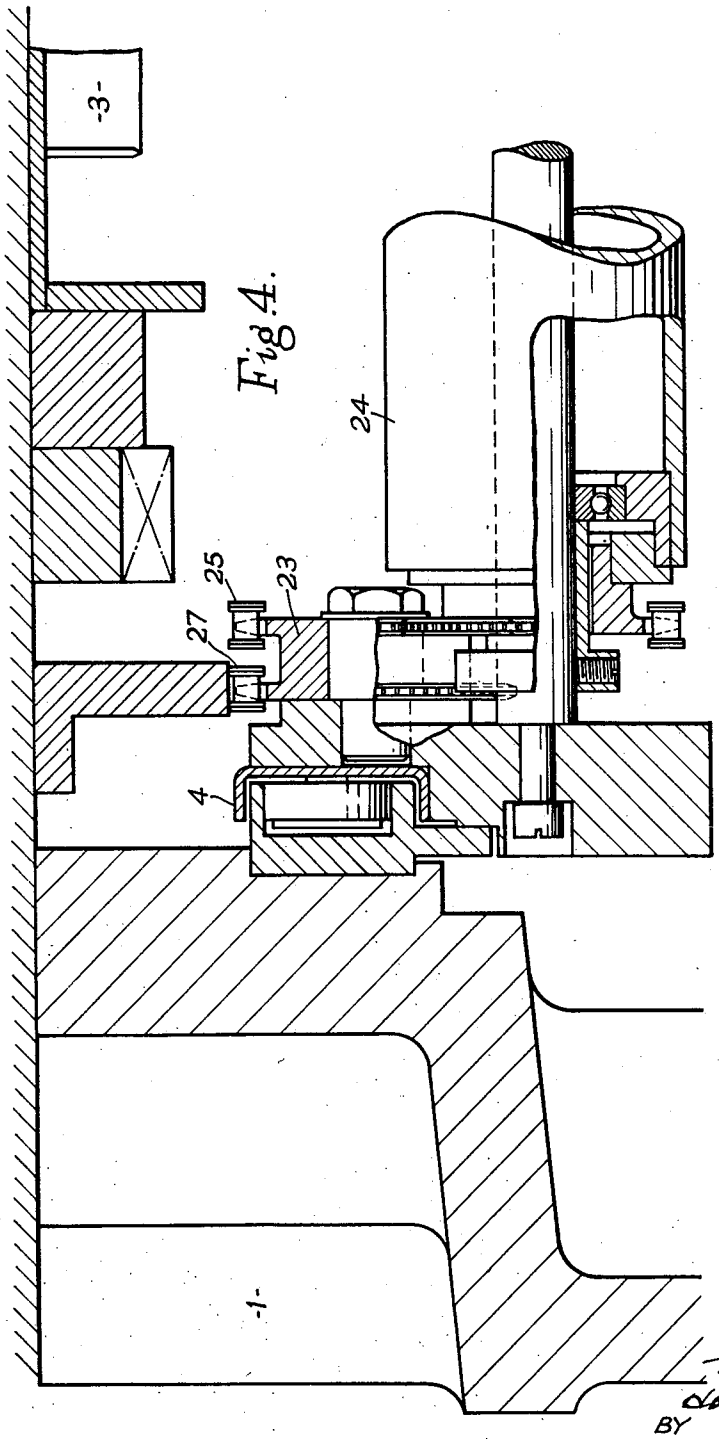


Fig. 4.

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Fig. 5.

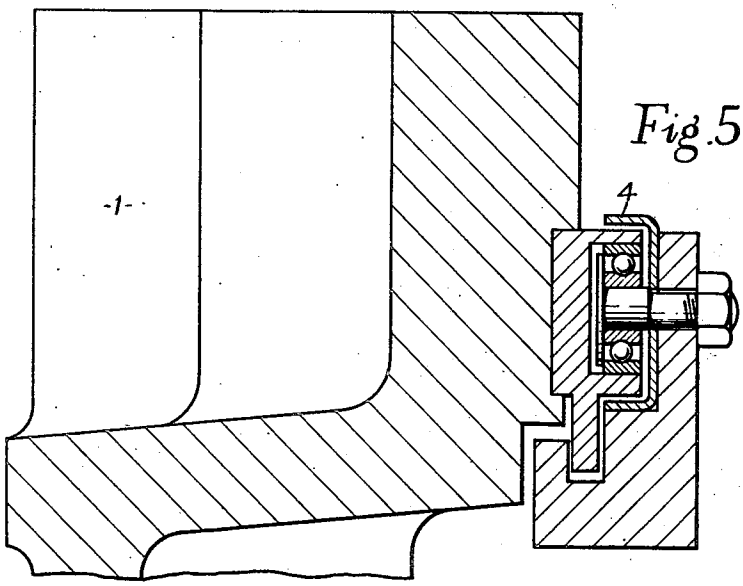
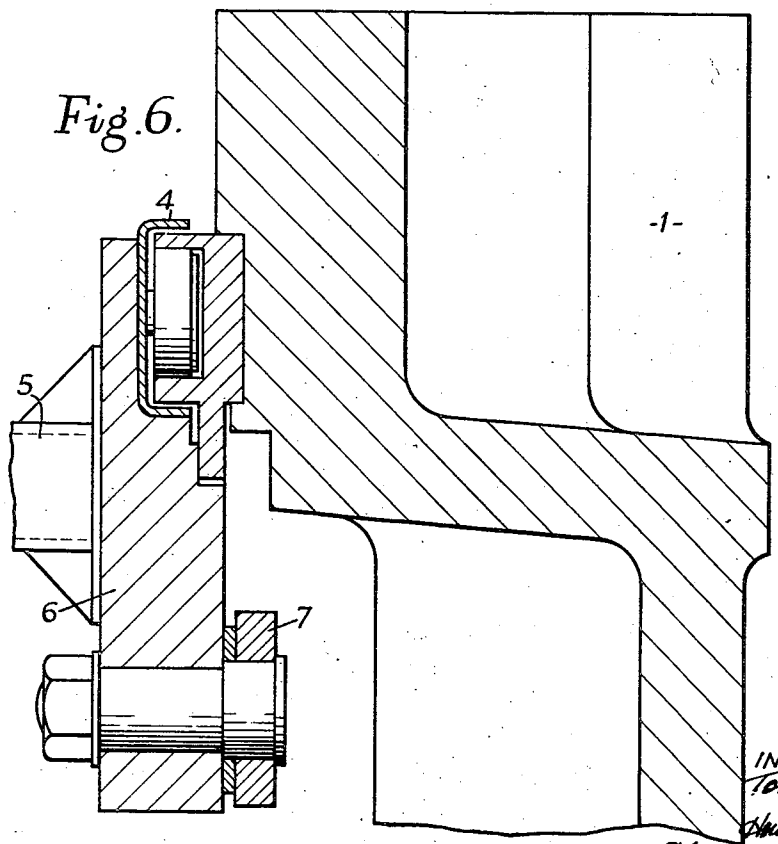


Fig. 6.



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Filed May 2, 1955 5 Sheets-Sheet 5

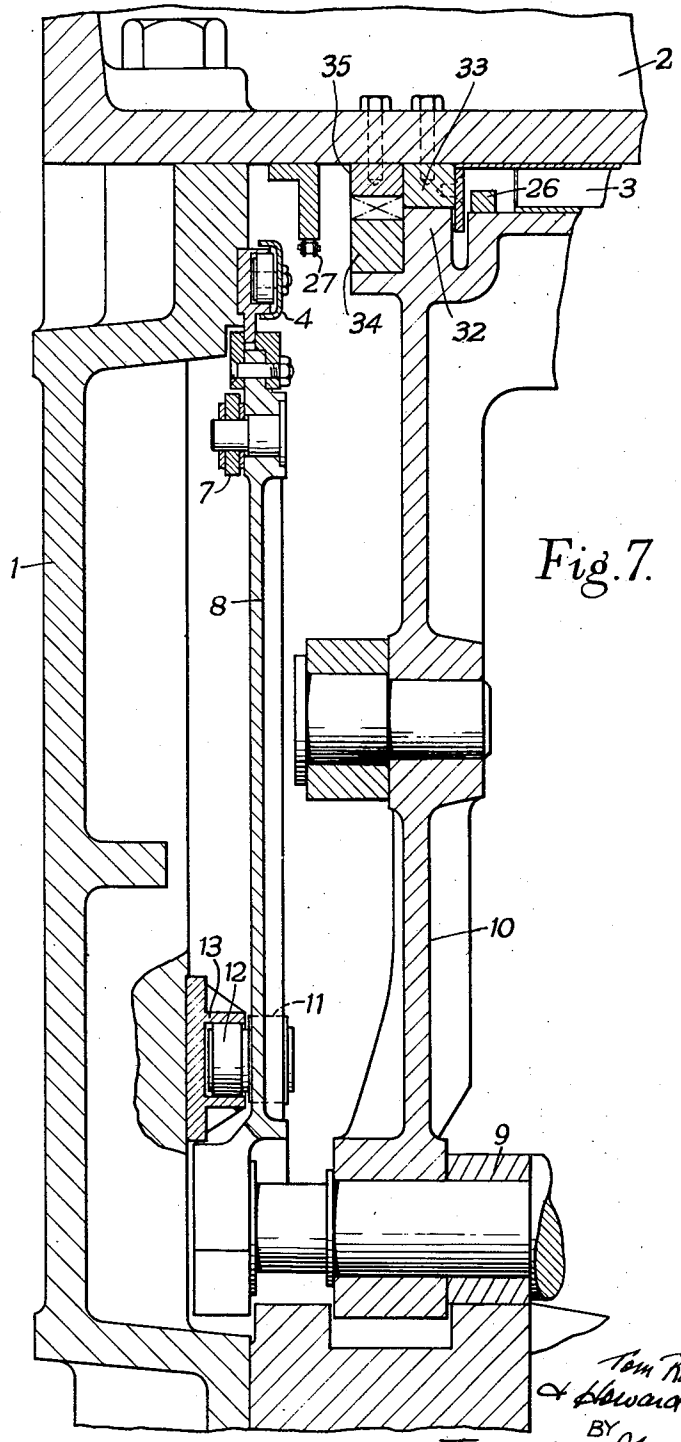


Fig. 7.

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United States Patent Office 2,808,261
Patented Oct. 1, 1957

2,808,261

MACHINES FOR PERFORMING CUTTING, CREASING, AND LIKE OPERATIONS, ON PAPER, CARDBOARD, AND LIKE MATERIALS

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Application May 2, 1955, Serial No. 505,496

Claims priority, application Great Britain May 4, 1954

4 Claims. (Cl. 271—54)

This invention concerns improvements in or relating to machines for performing cutting, creasing, and like operations, on paper, cardboard, and like materials, of the kind described and illustrated in Rowlands Patent No. 2,737,238, granted March 6, 1956. In said machine, a segment of a drum rolls beneath a forme and the arcuate face of the segment presses a sheet of material against the forme and effects the desired operations on the sheet. Sheets are fed to the machine by a reciprocating sheet carrier to which sheets are supplied by a suitable sheet feeder. This sheet carrier is of open work construction, such a device being usually termed a "grill" and this term is used in the description.

The present invention relates to a machine of this general kind hereafter called "a machine of the kind referred to" and provides an improved grill motion and other devices, for reasons explained in detail later.

The material used in such machines is often fairly thick cardboard, or sometimes corrugated board, and such materials are usually referred to as "boards" but the word "sheet" is used throughout to include any materials of the nature specified and of any thickness.

According to the invention there is provided a machine of the kind referred to wherein the sheets are positioned for feeding at a distance from the remote end of the forme longer than the distance through which the centre of curvature of the segment moves and the grill is coupled to said centre for movement therewith, means being provided whereby the motion so derived is supplemented to increase the feeding stroke of the grill to deliver a sheet into the desired position at the end of the grill stroke.

Further according to the invention there is provided a machine of the kind referred to wherein the grill is coupled to the segment for movement therewith, said coupling comprising a link pivoted to the grill and to a lever pivoted to the segment and means for rocking the lever on its pivot whereby the velocity imparted to the grill is varied and the stroke increased. The lever may be rocked by a cam follower attached thereto and movable in a fixed cam track of suitable shape.

Cam controlled feed fingers may be provided adapted to engage and move with the leading corners of a sheet to ensure that bent corners of a sheet do not hinder sheet feeding.

The invention will be further described with reference to the accompanying drawings in which:

Figures 1 and 2 are small diagrams (not to scale) showing the basic features of the machine described and illustrated in said patent.

Figure 3 is a sectional elevation of the machine according to the present invention, the view being broken away in places.

Figure 4 is a local section of Figure 3 on the line IV—IV.

Figure 5 is a local section of Figure 3 on the line V—V.

Figure 6 is a local section of Figure 3 on the line VI—VI.

Figure 7 is a side sectional elevation of Figure 3.

Referring first to Figures 1 and 2, which are diagrams showing the basic features of the machine described in said patent, sheets are fed from a magazine **100** to a reciprocating sheet carrier or grill **101** which carries them beneath a forme **111** fixed at the base of a crosshead **102** and against which a segment **103** rolls them when moving back from the position shown in Figure 2 to the position shown in Figure 1. The segment is rolled to and fro by a connecting rod **104** driven by a crank disc **105** and is supported by a base **106** on which rolls a roller **107** attached to the geometric centre of the segment. The grill embodies a travelling tape delivery **108** which discharges finished sheets to a pile **109**. In operation, while a sheet is being fed to the grill as in Figure 1, a finished sheet falls from the forme on to the tape delivery and while a sheet is being rolled against the forme the tapes discharge a finished sheet to the pile. As the sheet is carried by the grill towards the cutting position, the forward end of the sheet contacts the segment surface and if, as is usual, the segment is provided with string "make ready," the sheet may foul the string and either dislodge it, or the sheet will be injured.

The grill is coupled by a fixed member **110** to the segment at the centre of curvature thereof and thus the velocity and stroke of the grill are always the same as that of said centre.

In the machine shown in Figures 1 and 2 no special provision is made for distorted sheets although it is quite common for cardboard sheets to be bowed or have bent corners.

For these and other reasons the machine forming the subject of the present specification is provided with a different grill motion described below with reference to Figures 3 to 7 and guiding devices are provided to engage the sides of a sheet and hold the corners of its leading end sufficiently straight for satisfactory feeding, in spite of any tendency to distortion, and to guide the sheet as described in detail hereafter.

In the machine shown in the patent referred to above the distance between a sheet being carried along by the grill and the cutting rule in the forme is comparatively small and thus a sheet having a considerable amount of curl or distortion is liable to foul the forme, for example the cutting rule in said forme, but particularly its rubber ejectors, even if the sides of the sheet are guided as above remarked. In the machine described with reference to Figures 3 to 7 this distance is materially increased but, without further provision, this would mean that the leading edge of the sheet would strike the segment surface earlier than in the previous machine and means are provided to avoid this and also to guide the leading edge and prevent contact later on.

Referring now to Figures 3 to 7, **1** is the frame of the machine, shown broken away, and supporting the crosshead **2** to which is fixed a chase **28** to hold the forme **3**. A segment **10** is movable beneath the forme in such a manner that the curved face of the segment can press a sheet of cardboard or the like against the face of the forme which therefore cuts and creases the sheet according to the pattern of the forme. At the center of the arc of the segment there is provided at each side of the machine a roller **9** and a fixed plane surface **31** is provided over which this roller rolls when the curved face of the segment rolls along the forme. The rollers **9** and the planes on which they roll provide the necessary reaction and pressure to force the sheet against the forme during the cutting operation. A tympan **29** is provided as usual and as in the case of the patent referred to. The segment has arcuate guides **32**, Figure 7, which roll on plane strips **33** at each side of the machine and is also provided with gear teeth **34** which roll in racks **35** fixed

to the machine beneath the crosshead **2**, the pitch line of the racks and gear teeth coinciding respectively with the surface of the strips **33** and the arcuate guides **32**. From the foregoing, it will be understood that if the segment is actuated in a suitable manner, the gear teeth of the segment will roll along the rack teeth and the rollers **9** will roll along the plane guides **31** so that a sheet of material held against the face of the forme is pressed against the cutting edges **37** thereof, which are provided by strips of cutting rule in the usual way. The cutting pressure takes place on a line which moves along from one end of the forme to the other as the segment is operated. For operating the segment, there is provided at each side thereof a connecting rod **38** which is pivoted to the segment at **39** on the central radius thereof and at the center of said radius, the connecting rod being attached at its other end to a crank pin **40** fixed in a crank disc **41**, shown broken to expose parts behind it. The connecting rod drives the segment from the full line position shown to the chain line position, and back again.

Sheets **42** of material to be fed one at a time into the machine are stacked in a magazine **43** and a reciprocating tooth or feed pawl **44** is provided whereby each time the tooth reciprocates the lowest sheet of the pile is fed out from the magazine beneath an adjustable gate **45** of the usual kind. The transport of the sheet from the magazine to the forme is effected by a grill **4** comprising a horizontal portion which lies beneath the face of the forme and parallel thereto to afford a temporary support for the sheet. The grill carries the sheet beneath the forme and its leading end is held by a gripper **30** which may be of any suitable kind, for example that described in detail in said patent. The grill is coupled to and travels to and fro with the segment though its motion is modified slightly as explained later and a sheet brought beneath the forme by the grill is thus rolled against the forme by the segment as the latter makes its return stroke. On the next outward stroke of the grill the sheet which has just been subjected to the cutting and creasing operation falls on a traveling tape device **21** attached to the grill and is carried forward with the grill movement and discharged from the tapes at the left-hand end of the machine in Figure 3, as will be described in detail later.

As previously remarked, the distance between a sheet carried by the grill and the edges of the cutting rule **37** in the forme in the machine illustrated is considerably greater than in the machine described in the patent, in order that sheets suffering from curl or distortion can be safely fed without fouling the forme. Since, as explained, a sheet is brought to the cutting position as the segment is about to roll back toward the magazine, it will be clear that if the sheet is fed at a lower level than previously it would, without other provision, strike the face of the segment. To avoid this, the grill is driven from the segment by a device causing the grill to have a slightly variable motion, and this device will now be described. The grill which is shown at **4**, has a cross-member **5** shaped as a rectangular tube. A bracket **6** is attached to the grill at this position and to the bracket is pivoted a link **7**, the other end of which is pivoted to a lever **8**. This lever is pivoted at the center of rollers **9**, which is the centre of curvature of the segment **10**. The lever **8** has formed therewith an arm **11** whose free end carries a cam roller **12**. The roller runs in a fixed cam track **13** as the grill moves to and fro and it will be seen that the cam starts as a horizontal track and at its mid-length starts to rise. A lever **8** and link **7** are provided at each side of the machine. The tube **5** incorporates bearings in which is supported an oscillating shaft **15**, to which a lever **16** having a cam roller **17** at its free end is attached. A further lever **18** is attached to the shaft **15** and constitutes a sheet supporting finger. It will be understood that the parts **16** and **18** are duplicated and positioned at each side of the machine.

The free end of the lever **18** has guide members **19** and **20** extending from it and spaced apart to leave sufficient room for a sheet to easily enter between them. These members may be fairly short and only engage the sheet near the margin.

A sheet is fed by a feed tooth **44** as above mentioned, and this feed tooth is a part of the feeding device described in United States application, Serial No. 505,498, filed May 2, 1955, and presently described herein. The sheet is so fed that its leading corners enter between the guide members **19**, **20** at each side of the machine and these corners are therefore held in position, whether distorted or not. As the grill moves forward for sheet feeding, the guides **19** and **20** go with it controlling the corners all the time. As the sheet approaches the surface of the drum segment the rollers **17** run on cams **26**, Figure 7, on the segment and the levers **16** lift the fingers **18** and their guides and keep the sheet from touching the segment, thus avoiding contact with any "make-ready" that may have been attached to the segment.

As will be seen from Figure 3, the sheets start their movement from the face **14** of the magazine and the stroke of the grill, if it were derived solely from the centre **9** as in the patent referred to above, would be insufficient to feed the sheet to the operating position beneath the forme.

As will be apparent from the drawing, the grill moves with and at the same speed as the centre **9** for the first half of its stroke since the cam **13** which is horizontal for some distance does not alter the grill motion. In other words, the sheet remains "late" relatively to the segment for the first half of the grill movement.

This arrangement permits the feeding level to be low to provide adequate clearance between forme and sheet so as to avoid any risk of curly or distorted sheets fouling the forme, particularly the rubber ejectors always used in said formes which protrude somewhat, and at the same time, the leading edge of the sheet is kept out of contact with the segment surface to avoid interference with "make-ready." After the half stroke of the grill, the roller **12** begins to move up the slope of the cam **13** and the grill is accelerated relatively to the motion of the center **9** of the rollers, as the lever **8** moves anti-clockwise about the center of rollers **9**. Thus the grill stroke derived from the movement of the center **9** is augmented by the supplementary motion derived from the cam **13** and lever **11** and the sheet arrives at the desired position at the proper time, that is, just as the segment is about to roll back and effect cutting and creasing operations. During the return movement of the grill the guides **19** and **20** simply slide along the margins of the sheet. It is stated above that the grill is accelerated relatively to motion of the segment centre **9** but it will be appreciated that because of the motion of a crank drive both parts start to slow down after the half stroke, so the relative motions may perhaps be better expressed by saying that the grill is retarded after half stroke at a slower rate than the segment centre.

Since the feeding level has been lowered, the delivery tape system described in the specification referred to requires to be lowered also. It is illustrated in its low position but as the tapes **21** and **22** are driven from a rack **27**, Figures 3 and 4, constituted by a taut sprocket chain engaging a sprocket wheel **23**, the latter is geared to the tape driving roller **24** by a short chain drive **25**.

The sheet feeding device shown in Figure 3 is as stated and described in United States patent application, Serial No. 505,498, filed May 2, 1955, and forms no part of the invention but is merely shown here as a suitable sheet feeder. The feed tooth **44** is operated by a bar attached to the cross tube **5** of the grill and the sheets are first engaged by an auxiliary feed tooth **46** operated as described in detail in Serial No. 505,498.

What we claim as our invention and desire to secure by Letters Patent is:

1. A machine for cutting and creasing sheet material, comprising, in combination, a chase, a forme carried by said chase and facing downwardly, a segment of a cylinder mounted beneath the forme and having an arcuate pressing surface, said segment being arranged to be rocked so that its pressing surface rolls against said forme with approximate line contact therebetween, the contact being displaced lengthwise of the forme as the segment is rocked thereon, a roller journaled on said segment at the geometric center of the arcuate pressing surface, a plane reaction surface on which the roller rolls as the pressing surface rocks on the forme, mechanism for reciprocating said roller on said reaction surface to operate the segment, a sheet carrier to feed sheets into the machine, driving means for said carrier to cause movement thereof to and fro with the segment in the direction of displacement of line contact between the pressing surface of the segment and the forme, said carrier extending forwardly and rearwardly of said center to such extent as to occupy, in turn at opposite ends of the stroke of the segment, first a position in which the rearward extension of the carrier lies rearward of the forme to receive a fresh sheet from the feeder and the forward extension of the carrier lies beneath the forme to receive a finished sheet, and second a position in which the forward extension of the carrier lies forward of the forme to deliver the finished sheet and the rearward extension of the carrier lies beneath the forme to present a fresh sheet between the forme and the prssing surface of the segment, a magazine, and sheet feeding devices for feeding sheets from the magazine to the carrier, the front edges of sheets in the magazine being spaced from

the further end of the forme by a distance greater than that through which the said center travels, said carrier driving means comprising a coupling between said center and the carrier whereby the carrier derives its motion from the movement of said center, said coupling including means whereby the motion so derived is supplemented to increase the stroke of the carrier above that of the center and enable it to deliver a sheet so that its leading end lies beneath said further end of the forme at the end of the sheet feeding stroke of the carrier.

2. A machine as claimed in claim 1 wherein the carrier is coupled to the segment by a link pivoted to the carrier and to a lever pivoted to the segment at the center of curvature thereof and comprising means for rocking the lever on its pivot whereby the velocity imparted to the carrier by the segment is varied and the stroke of the carrier increased above that of said center.

3. A machine as claimed in claim 2 wherein the lever is rocked by a cam follower attached thereto and movable in a fixed cam track of suitable shape.

4. A machine as claimed in claim 1 comprising cam controlled feed fingers adapted to engage and move with the leading corners of a sheet to ensure that bent corners of a sheet do not hinder sheet feeding.

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