

June 9, 1964

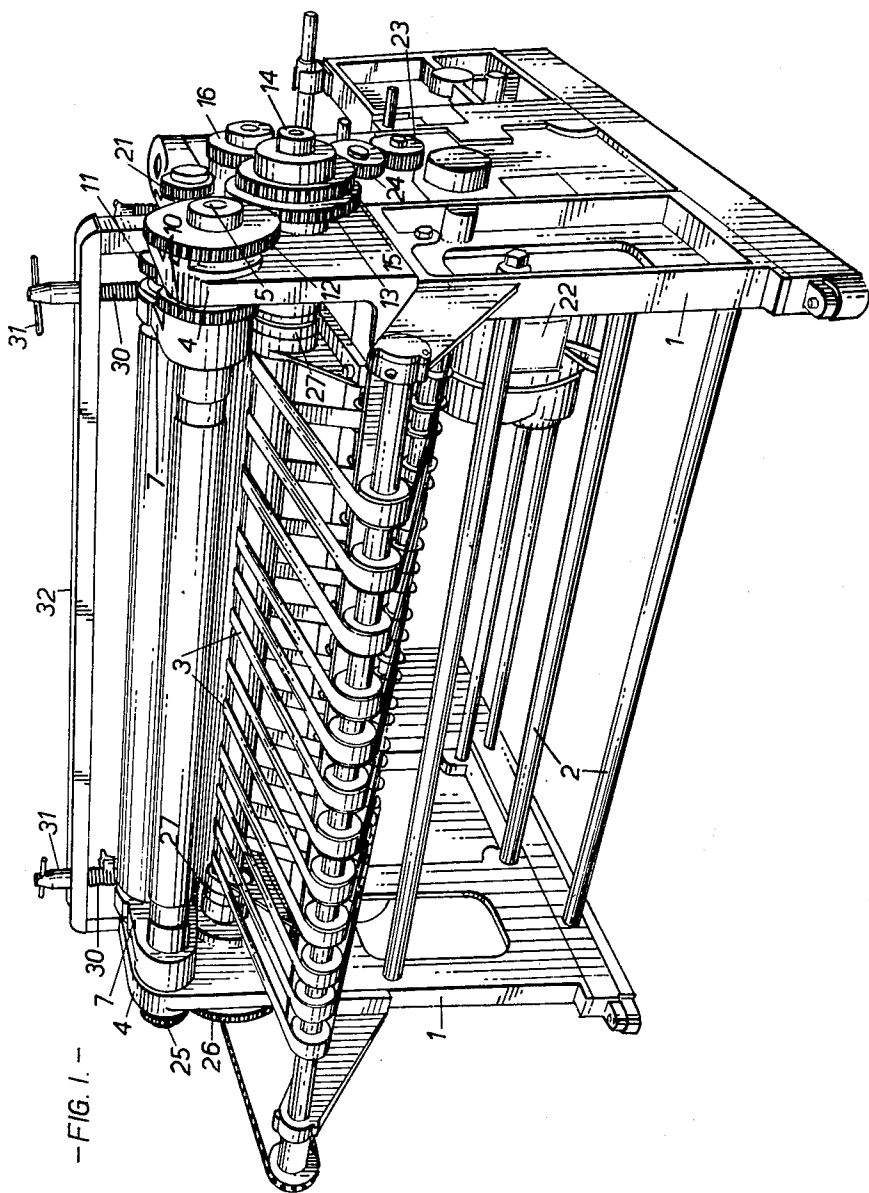
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3,136,194

PAPER-CUTTING AND LIKE MACHINES

Filed March 7, 1962

5 Sheets-Sheet 1



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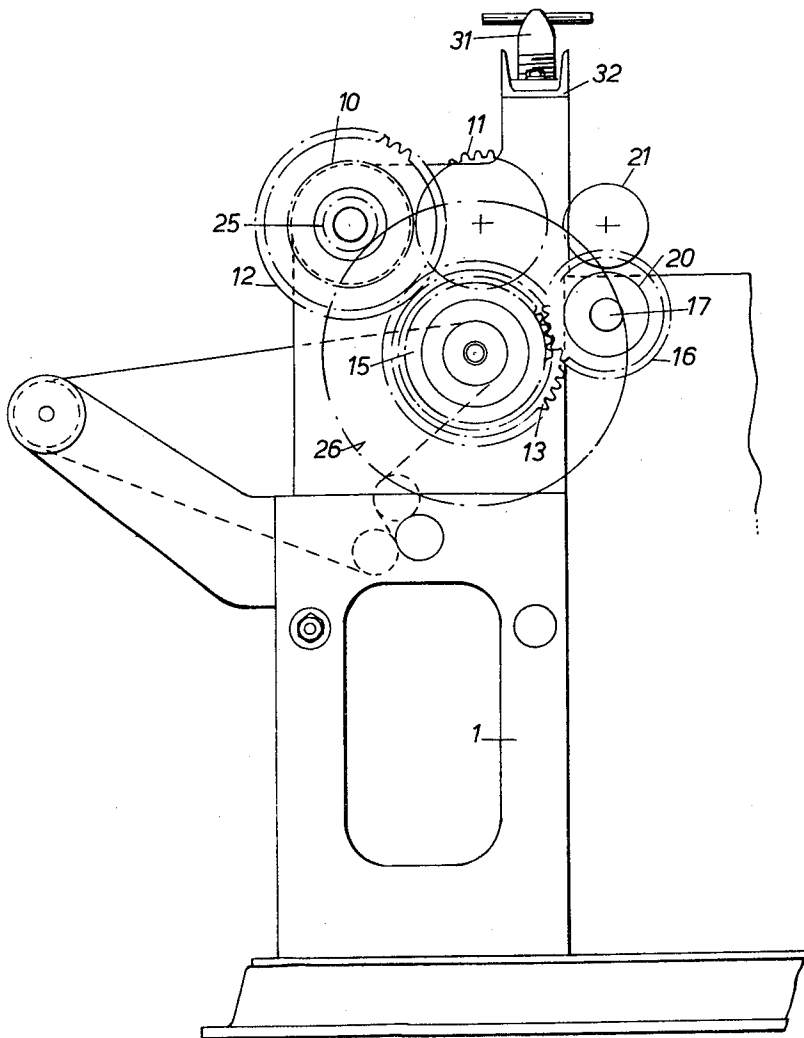
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5 Sheets-Sheet 2



-FIG. 2.-

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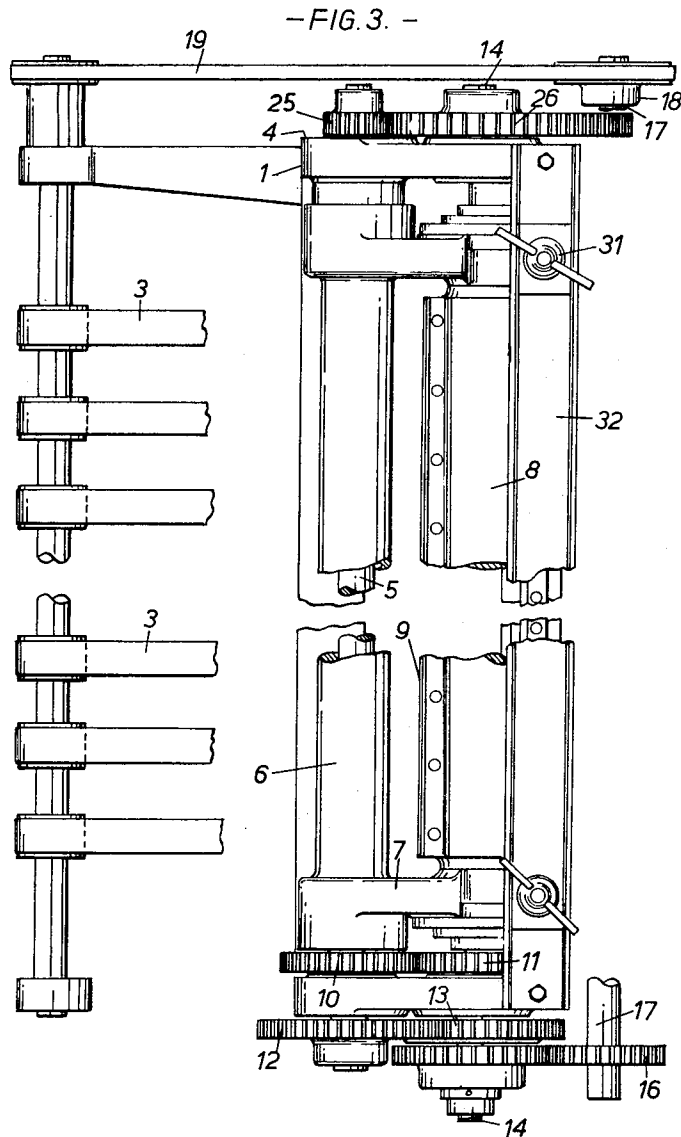
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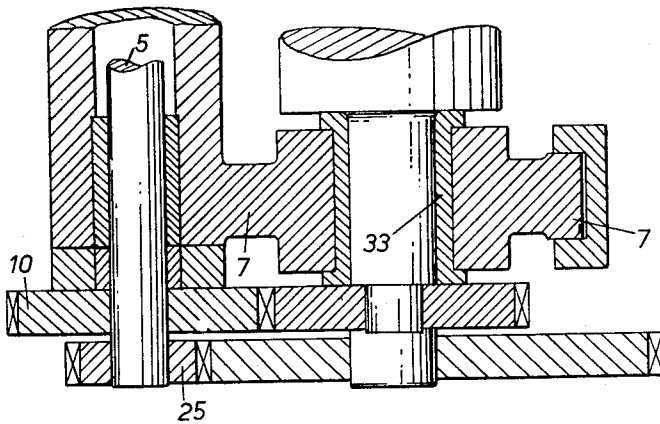
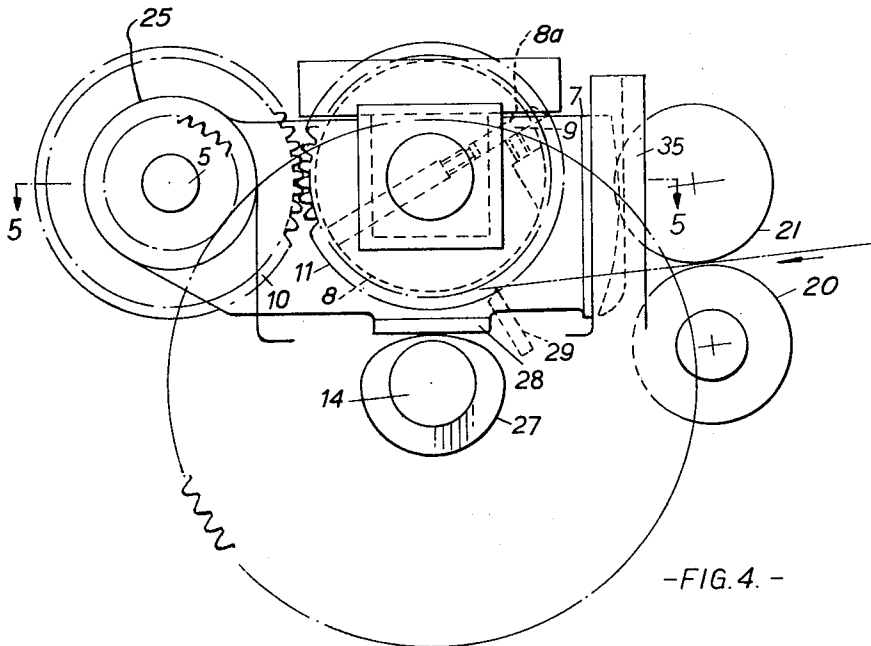
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- FIG. 5. -

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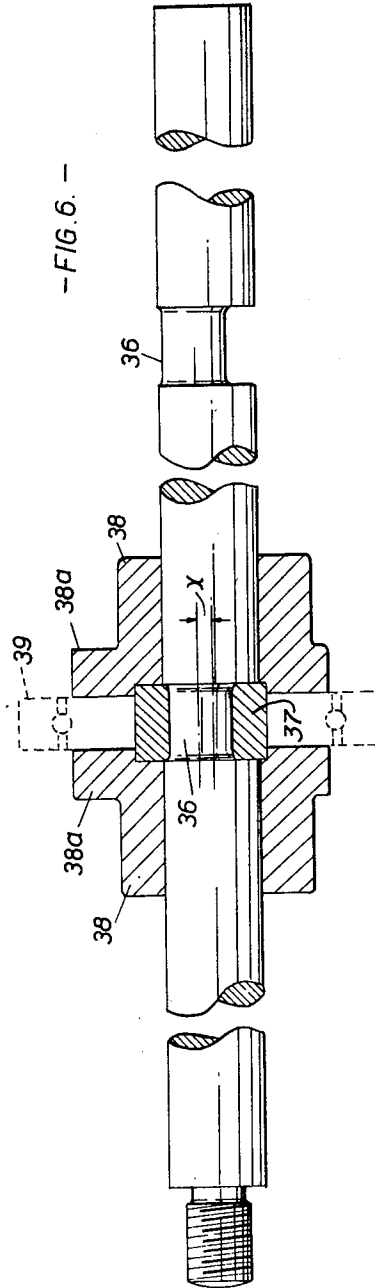
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PAPER-CUTTING AND LIKE MACHINES

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5 Sheets-Sheet 5



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PAPER-CUTTING AND LIKE MACHINES

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7 Claims. (Cl. 83—305)

This invention relates to a machine for cutting reeled paper and other web materials into predetermined sheet lengths. The invention will be described as applied to the cutting of paper but it is equally well adapted for the cutting of synthetic plastic material and other material of similar form and behaviour.

The invention relates to that type of machine in which a knife disposed across the direction of feed of the paper is held in a periphery of a rotating drum or like carrier and severs the paper by contact with a complementary "dead" knife fixed in the frame of the machine.

Machines of this kind are used for example in the cutting of a reeled length of wrapping paper into sheets of equal size. Nowadays there is found to be a tendency for the length of sheet required to increase considerably, and with longer sheets to be cut, the consequent increase in the size of the machine becomes most marked.

In the machines hitherto known, the rotating knife severs the paper once in each revolution of the knife carrier and, in consequence, the greater the length of sheet required the larger must be the diameter of the said drum or carrier for the knife. The greater sheet lengths now being called for, require a drum of proportionate size, which calls for a larger construction of machine. For example, with a machine adapted to cut sheets 150" in length the said rotating knife carrier would have to be at least 48" in diameter and the rest of the machine would have to be proportionately large. All this involves additional expense. The problem cannot be solved by reducing the speed of rotation of the knife carrier because this would reduce the lineal speed of the knife. It is necessary however that the knife move faster than the paper at the time of cutting and therefore any such mere reduction in the diameter of the knife carrier is ruled out.

It is the object of the present invention to overcome these difficulties and to provide improvements in this type of cutting machine such that the machine can be adapted to cut sheets of any length without requiring a corresponding increase in the diameter of the rotating knife carrier and therefore making it possible for the same machine, with only slight changes such as the altering of a gear train, to cut sheets of widely differing lengths.

According to this invention, instead of the rotating knife rotating only once for each sheet to be cut it rotates a number of times but is held out of cutting position for all except a predetermined one of such rotations. Because of this the rotating carrier for the knife may be of relatively small diameter and the necessary linear speed of the knife obtained by determining the rate of rotation of the knife carrier. In the practice of the invention the rotating knife carrier is adapted to rise and fall between upper and lower positions at predetermined intervals so as to cooperate with the complementary stationary knife in only one (usually the lower) of those positions. The knife carrier rotates constantly and may rotate any exact number of times between the successive cutting operations in dependence on the required sheet length and on its own diameter, thus dispensing with the need for a knife drum of a diameter directly proportionate to the maximum sheet length being cut.

In the preferred forms of the invention the rising and

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falling rotating knife carrier is carried at the ends of lever arms which are made to rise and fall periodically about their pivot by a rotating cam or cams or by one or more eccentrics or the like, the drive to the rotating knife carrier being conveyed through a member rotating on the pivot axis about which such rising and falling movement takes place, so as to be continuous for all positions of the lever arm. With such an arrangement, the frequency with which the knife rises and falls may be varied for example by varying the relative diameters of the toothed gears between a main drive shaft and the said cams or eccentrics, or by varying the speed of a motor used as an independent drive to said cams or eccentrics. In one construction, a driving shaft receiving a drive from an electric motor has two toothed pinions fixed on it one of which drives the rotating knife carrier at an invariable one-to-one ratio, and the other of which drives a cam shaft or the like at a ratio selected from a number of variables according to the maximum length of sheet to be cut.

The invention will now be described with reference to the accompanying drawings, wherein:

FIG. 1 is a perspective view of the main parts of one form of machine incorporating the invention, for example a machine for cutting sheets up to 120" in length using a drum 8" in diameter;

FIG. 2 is a diagrammatic front view of the same machine;

FIG. 3 is a plan of the same, broken at the centre so as not to reduce the drawing scale unduly;

FIG. 4 is a diagrammatic representation of the drive transmission to the main parts of another and smaller form of the improved machine for cutting sheets up to 40" in length;

FIG. 5 is a sectional plan on the line 5—5 of FIG. 4; and

FIG. 6 is a part-sectional side elevation of an alternative form of knife-lifting means.

Referring first to FIGS. 1, 2 and 3, the machine has side frames 1 braced together by the rigid ties 2 and is provided with tape feeds and tape delivery in the normal way. FIG. 1 shows the tape delivery devices 3 in action. Mounted in bearings 4 in the said side frames 1 is a cross shaft 5 which carries between the said side frames a rocking bracket 6 having radially extending arms 7 and, rotatably mounted in such radial arms is a rotating knife carrier 8, substantially cylindrical but slotted at 8^a to receive the knife blade 9. This blade 9 is slightly tapered, in known manner, as can be seen in FIG. 3. Secured respectively to the shaft 5 and to one trunnion of the knife carrier 8 are equal sized intermeshing toothed wheels 10 and 11 and the shaft also carries a further toothed wheel 12 intermeshing with a wheel 13 rotatably mounted on the cam shaft 14, on which shaft 14 is fixed a further toothed wheel 15 meshing with a wheel 16 on a cross shaft 17 the other end of which, by pulley 18 and belt 19 drives the tape delivery 3. The cross shaft 17 drives the lowermost roll 20 of a pair of feeding or measuring rolls 20 and 21 which are geared together for equal but opposite rotation by toothed wheels 21 of which one can be seen in FIG. 1.

The wheel 13 receives its drive from an electric motor 22 located in the base of the machine (see FIG. 1), the drive to such wheel being through the gears 23, 24 (FIG. 1).

Mounted at the far end of the shaft 5 is a further toothed wheel 25 which meshes with a large-toothed wheel 26 fixed on the cam shaft 14. This shaft 14 carries face-hardened cams 27 lying below the respective radial arms 7. A typical shape of cam is illustrated in FIG. 4, as also is a hard-wearing pad 28 on the arm 7, to take the thrust of the cam.

The intermeshing wheels 15 and 16 are arranged to be interchangeable with others of different relative diameters so that the ratio between the rate of rotation of the knife carrier 8 and the rate of rotation of the measuring rolls 20, 21 can be varied. Thereby, with a constant rate of rotation of the knife drum 8, various rates of feed and therefore various lengths of cut sheet can be arranged for.

In order to ensure full contact of the pads 28 with the cams 27 return springs 30 are provided, these reacting between the free ends of the arms 7 and adjusting screws 31 carried on a fixed cross bar 32 attached to the machine frame.

In operation the web of paper or other material is fed in, in the usual way by means (not shown) at the right hand side of FIG. 2, and the cut sheets are taken off one by one by the tapes 3. According to the ratio of the wheels 25 and 26, the knife carrier 8 rotates a preselected exact number of times between each cut, the cams 27 being arranged to hold the rotating cutter 9 out of the path of the paper except on one of the predetermined revolutions when they allow the arms 7 to fall to bring the rotating knife 9 into cooperation with the fixed or "dead" knife held in the machine frame, and thus sever the paper. The cams 27 immediately raise the knife again allowing the paper web to continue its passage through the machine until the next cutting interval is reached. During the period between each cooperation of the knives, the amount of feed of the material (i.e. the sheet length) passing through the machine is determined by the ratio of the wheels 15 and 16, or, if necessary, by a compounded train between the two shafts concerned.

A typical dead knife is shown at 29 in FIG. 4.

With this arrangement therefore it is possible to rotate the knife carrier 8 at any desired rotational speed necessary to give the requisite linear speed to the cutting edge of the knife in excess of the speed of the paper when cutting the longest sheet required, whilst at the same time restricting the size of the knife carrier and its driving and supporting means within relatively small limits.

Referring now to FIGS. 4 and 5, the rotating knife carrier 8 is trunnioned in bushes 33, in the lever arms 7 which themselves are mounted on bushes 34 on the rock shaft 5, which shaft 5 carries the toothed wheels 10 and 25 in mesh respectively with the wheel 11 on the knife carrier 8 and the wheel 26 on the cam shaft 14. The shaft 14 carries the cams 27, one under each lever 7 the shape of the cam being apparent from FIG. 4. The lever arms 7 are provided with the hardened steel pads 28 to take the wear of the cam, and the free ends of the levers 7 may move in guides 35 forming part of the frame of the machine. When in the lowermost position the lever arms 7 rest on the bottom of the recesses in the guides 35 or on a suitable stop, in which position the rotating knife blade 9 cooperates with the fixed "dead" knife 29 also held in the frame.

Instead of using cams to raise and lower the lever arms 7 eccentrics may be used and these may have a direct contact with the levers, in the same way as do the cams 27 or they may carry anti-friction bearings. FIG. 6 shows one part of a cam shaft which is turned eccentrically at 36 to receive a split bush 37 and over this are fitted the collars 38 having eccentric flanges 38^a; in practice, a ball or roller bearing of standard type (indicated in outline at 39) would be mounted over the bush 37 and located between the collar flanges 38^a, the axis of rotation of the bearing being eccentric to the axis of the shaft by the amount indicated at X.

In all cases the arrangement is such that the peripheral speed of the knife carrier is calculated to have the required excess over the speed of advance of the paper or other material being cut, and the cams are designed so as to allow the rotating blade to come into the path of the paper only once during each cycle of rotations which represents the maximum size of sheet to be cut off.

What I claim is:

1. A cutting machine comprising support means, an elongated knife rotatably mounted on said support means so as to rotate in a circular path, a stationary knife mounted on said support means normally spaced from said circular path, feed means on said support means adapted to force sheet material between said knives at a speed substantially less than the linear speed of the rotating elongated knife, automatic means on said support means connected to said elongated knife so as to move its axis of rotation toward said stationary knife after said feed means has moved a predetermined length of said sheet material between said knives so as to cut said sheet material into predetermined lengths.

2. A cutting machine as defined in claim 1, wherein said elongated knife is inclined to the transverse axis of said sheet material.

3. A cutting machine as defined in claim 1, wherein said elongated knife forms an acute angle with the path of movement of said sheet material between said knives whereby the material is cut with a scissor-like action.

4. A cutting machine as defined in claim 3, wherein said circular path is of a small diameter relative to said predetermined length of sheet material and said elongated knife rotates a plurality of times about its axis before being moved by said automatic means toward said stationary knife.

5. A cutting machine as defined in claim 4 wherein said elongated knife is rotatably mounted on one of the ends of a pair of arms, the other ends of said arm pivotally mounted on a support shaft which is mounted on said support means, said automatic means including a rotatable cam shaft parallel to said support shaft, cam means on said cam shaft adapted to engage said arms and move said elongated blade away from said stationary blade, spring means on said frame connected to said arms so as to move said elongated blade toward said stationary blade.

6. A cutting machine as defined in claim 5, including a drive gear rotatably mounted on said cam shaft, power means drivingly connected to said drive gear, a driven gear fixed on said support shaft meshing with said drive gear, a knife drive gear secured on said support shaft, a knife gear meshing with said knife drive gear drivingly connected to said elongated blade so as to rotate about its axis of rotation, a cam drive gear secured on said support shaft meshing with a cam gear secured on said cam shaft.

7. A cutting machine defined in claim 6, wherein said feed means comprises a pair of rollers mounted on parallel shafts, a pair of meshing gears mounted on said parallel shafts, a roller drive gear secured on said cam shaft and meshing with one of said pair of meshing gears.

References Cited in the file of this patent

UNITED STATES PATENTS

1,798,929	Candee	Mar. 31, 1931
1,984,913	Biggett	Dec. 18, 1934
1,996,617	Hahn	Apr. 2, 1935
2,144,308	Hallden	Jan. 17, 1939
2,642,938	Hallden	June 23, 1953
2,843,202	Hallden	July 15, 1958