

Sept. 30, 1941.

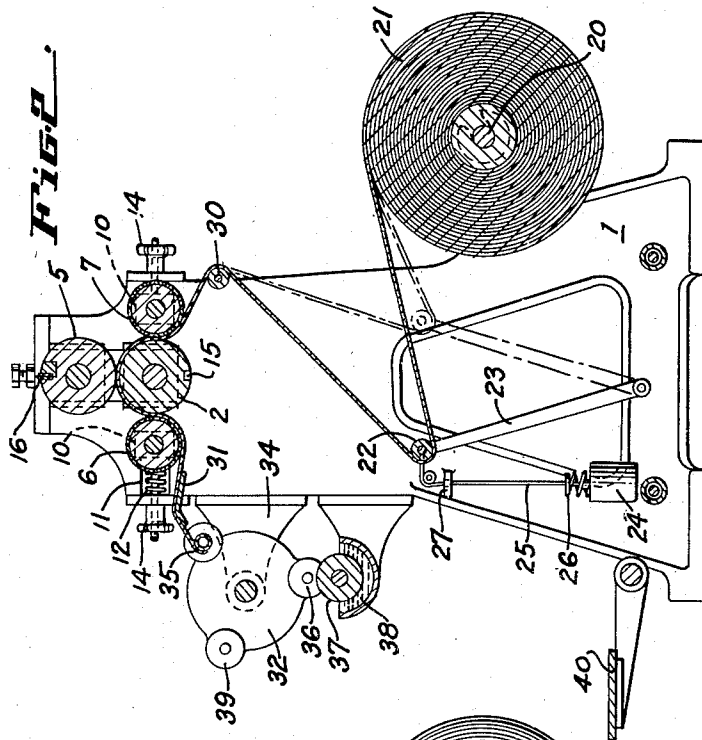
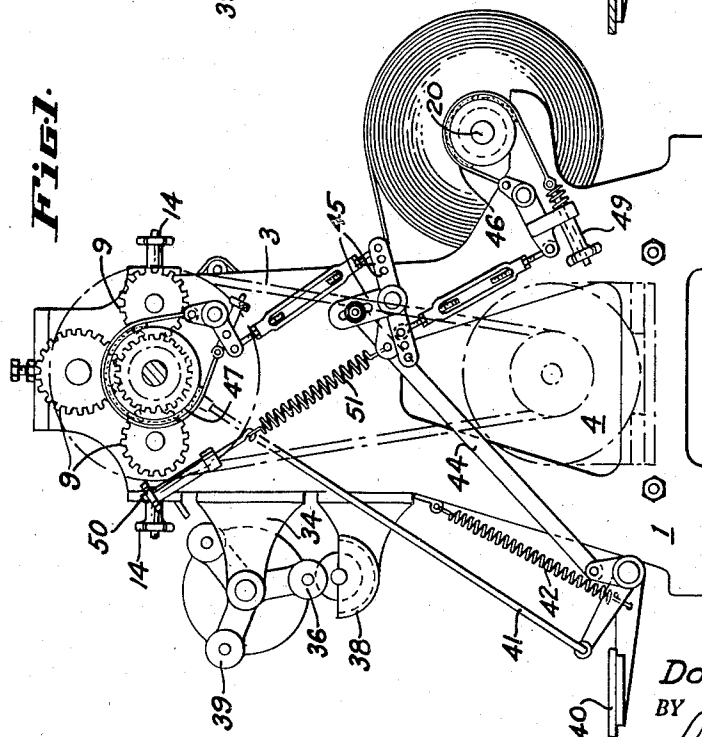
D. M. FEURT

2,257,336

KNIFE FOR PAPER CONVERTING MACHINES

Original Filed Feb. 12, 1940

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 3.

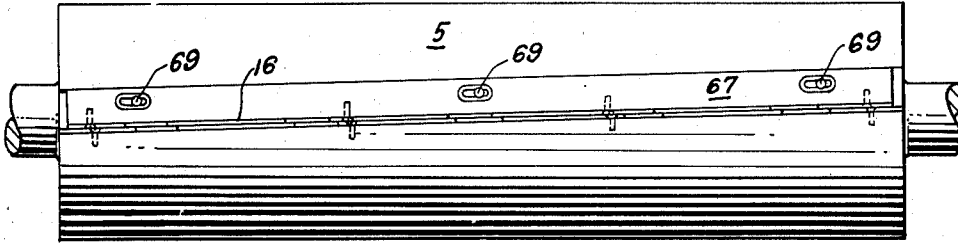


Fig. 4.

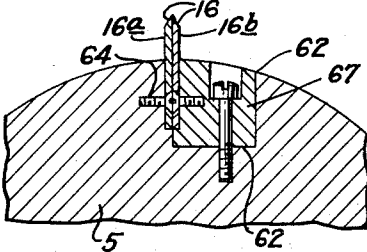


Fig. 5.

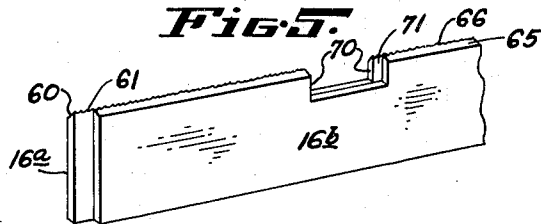


Fig. 6.

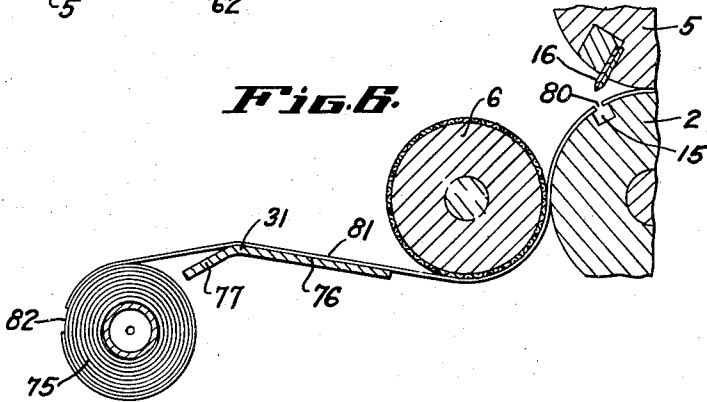
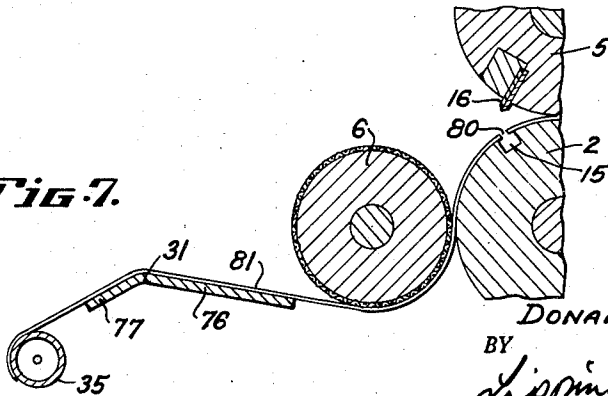


Fig. 7.



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2,257,336

KNIFE FOR PAPER CONVERTING MACHINES

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Original application February 12, 1940, Serial
No. 318,471. Divided and this application
March 26, 1941, Serial No. 385,256

5 Claims. (Cl. 164—70)

My invention relates to a knife for paper converting machines, and more particularly adapted to machines which die-cut and re-wind predetermined amounts of paper on individual rolls, from a parent roll. The knife of my invention is especially desirable for high speed operation on lightweight paper. This application is a division of my prior application Serial No. 318,471, filed February 12, 1940.

Among the objects of my invention are:

To provide, in a paper converting machine, a means and method of readily changing the dimension of the cut-off bonds; to provide a readily adjustable cut-off knife, and to provide a simple and easily operated means for mounting a cut-off knife in a cut-off roll.

My invention possesses numerous other objects and features of advantage, some of which, together with the foregoing, will be set forth in the following description of specific apparatus embodying and utilizing my novel method. It is therefore to be understood that my method is applicable to other apparatus, and that I do not limit myself, in any way, to the apparatus of the present application, as I may adopt various other apparatus embodiments, utilizing the method, within the scope of the appended claims.

In the drawings:

Fig. 1 is a side view in elevation of a paper converting machine embodying my invention.

Fig. 2 is a view partly in vertical section and partly in elevation of the device illustrated in Fig. 1.

Fig. 3 is a top plan view of the male die roll showing a compound cut-off knife claimed in this application.

Fig. 4 is a partial sectional view of the die roll shown in Fig. 3, showing the sectional details of the compound cut-off knife.

Fig. 5 is a perspective view of the compound cut-off knife.

Figs. 6 and 7 are fragmentary diagrammatic views showing the operation of the break-off of the individual rolls from the paper line and the action of the delivery plate.

In the converting of paper from a large uncut parent roll to individual rolls of definite length, when the paper is partially cut to form transverse cuts with bonds left therebetween, high speed operation is greatly desired in order that commercial production may be feasible. Much of the paper used, for example, for thin paper towels or the even thinner toilet seat covers, is so thin that high speed operation requires complete coordination of forces and exact atten-

tion to details which will at all times tend to prevent stoppages due to breaking of the paper with subsequent piling up of paper on the machine rolls by being carried around over unwanted paths. The fact that the paper, after the cut-off cuts have been made therein, is held together only by a few very weak break-off bonds, also requires that the path of the paper from the die rolls to the re-winding rolls shall be properly coordinated to prevent unwanted breakage during the re-winding operation.

My invention is broadly concerned with the coordination of forces and the positioning of structures so that thin paper such as, for example, an uncalendered, twelve pound, semi-crepe paper from two to three thousandths of an inch thick, can be die-cut to leave break-off bonds therein and re-wound upon individual rolls at the rate, for example, of eleven hundred and twenty-five feet per minute, with an output production of two hundred individual rolls per hour. The stopping and starting of the machine for each individual roll must be so controlled that no unwanted breakages occur, and so that after release of one individual roll from the paper line the paper will remain in a position to be attached to the next individual roll.

It is believed that the advantages and details of my invention may be more fully understood by direct reference to the drawings, which show one manner in which my invention has been adapted to machines of commercial speed and productivity.

Referring to Figs. 1 and 2 for the general set-up of the machine, a pair of upright frame members 1 position a female die roll 2 in proper bearings, this die roll being driven from outside the frame by belt 3 from a motor 4 through a clutch (not shown). Immediately above the female die roll 2 is a male die roll 5, and on opposite sides of the female die roll are positioned an output felt roll 6 and an input felt roll 7. Male die roll 5 and felt rolls 6 and 7 are driven from the female die roll by gears 9. Felt rolls 6 and 7, however, rotate in bearing blocks 10 slidable in recesses 11 in frame members 1 and are forced against the female die roll 2 by springs 12, the tension of which may be adjusted by knobs 14. These springs prevent damage in paper jams, and also prevent crushing of the operator's fingers if they should get caught. Female die roll 2 is provided with a cut-off knife cavity 15 into which enters a composite cut-off knife 16, to be described later. Obviously, if other die-cutting operations other than that accomplished by the

cut-off knife 16 are to be performed on the individual lengths of paper, such dies may be mounted on the male die roll and corresponding depressions made in the female die roll 2. Such additional cuts are made, for example, in die-cutting toilet seat covers.

On the back of the frame members is mounted a parent roll shaft 20 carrying a parent paper roll 21 which is wound with a continuous length of paper, as is customary in the art. The paper is led from the parent roll around a dancing roll 22 swinging on a vertically extending arm 23 pivoted to the lower portion of the frame. Dancing roll 22 is held in forward position by a weight 24 connected to the dancing roll by cord 25, the cord 25 being of such length that when the slack in the paper passing around dancing roll 22 is completely taken up, spring 26 on weight 24 will bear against fixed spring boss 27 so that the paper will always have the weight tension thereon and at the minimum loop size will have in addition, greater tension due to spring 26. The paper then passes over a guide roll 30 and between felt roll 7 and female die roll 2. The paper is then carried around die roll 2 and between felt roll 6 and the female die roll 2, and from there onto delivery plate 31. This delivery plate and the function thereof will be explained later.

On the front of the machine is mounted a rotating re-wind chuck carrier 32 carrying three re-wind chucks so that the individual roll cores may be mounted thereon and rotated one at a time to receive the paper coming out of the machine. The chuck carrier is rotatable on roll carrier bracket 34 so that one chuck with roll core 35 therein, at a time, will be in a position to receive paper from the die rolls. The next chuck 36 will carry a core moistened by contact with moistening roll 37 dipping into a source of liquid 38, and the third chuck 39 will be in a position for the operator to insert a core therein after he has removed a full re-wound individual roll therefrom. I prefer to friction-drive the individual roll chuck carrying the core then receiving paper from the machine, this drive being relatively light and being over-driven to wind the paper thereon at both empty and full conditions without slack.

While many paper converting machines utilize an automatic stop operative after a certain amount of paper has been wound on the individual rolls, and I may desire to utilize such an automatic stop; since such stop is no part of the present invention I have merely shown a foot control. Foot pedal 40 operates, through rod 41, a clutch (not shown) coupling the female die roll to the motor belt 3. The clutch pedal is engaged by clutch spring 42, and clutch pedal 40 also operates brake rod 44 which in turn coincidentally operates, through bell crank 45, a parent roll brake 46 and a female die roll brake 47. I also prefer to provide each brake with adjustment screws 49. Tension on parent roll brake 46 may also be adjusted by hand wheel 50 through spring 51 so that the braking power on the rolls may be occasionally readjusted during the change in size of the parent roll. Obviously, such an adjustment could be made automatic in accordance with the size of the parent roll, but I have found that such coordination is not at all necessary to the high speed operation of the device, due to the efficient operation of the dancing roll 22.

The details of a preferred form of cut-off knife are shown in Fig. 3. I have found that more efficient cut-off is obtained by placing the cut-off knife at a slight angle across the male die roll, thus giving a shearing action of the knife to the paper. Inasmuch as the cuts made by the cut-off knife are not intended to completely sever the paper, but are designed to leave bonds across the paper so that the paper may be readily separated into units, the usual procedure is to form the cut-off knife of a single piece, with interruptions to give uncut bonds, preferably adjustably attached to the male die roll. I have found, however, that in spite of the efficiency of modern paper making machinery, that paper as supplied in the parent rolls from paper manufacturers will vary slightly in thickness and strength in different rolls and in different lots. I therefore have found it highly advantageous to be able to quickly and accurately change the size of the bonds left between the individual paper units. I have accomplished this by making the cut-off knife 16 in two halves, a front half 16a and a rear half 16b. Front half 16a is provided with a single bevel 60 and top teeth 61, and is fastened directly to the side of knife cavity 62 in the parent roll by screws 64. Rear half 16b of the knife is also provided with a single bevel 65 and top teeth 66, but is mounted on a knife block 67 slidable in recess 62 and held therein by set screws 69. Both half knife 16a and 16b are provided with teeth interruptions or bond notches 70 preferably of the same width, and when these notches are registered the widest bond is obtained. If, however, the knife half 16b is moved laterally with respect to front half 16a, then the bond becomes effectively narrower due to the advance of one edge of knife 16b toward the other edge of knife 16a as shown in Fig. 5 by offset 71, the single projecting edge cutting the paper. Thus, I am able to very quickly change the bond dimension in accordance with the type of paper being handled by the machine, a procedure which is impossible with the older type of single knife customarily used for cut-off.

I have also found that the paper, after the cut-off bonds have been formed, may be controlled electrically to prevent one of the greatest disadvantages of a converting machine, namely, the loss of control of the paper end after the individual rolls have been separated therefrom. For example, it is quite a frequent occurrence to have the output felt roller 6 become electrified to such an extent that the paper will stick to it, and upon starting of the machine the paper will wrap around roller 6 and cause a jam which takes time to clear. This is a frequent occurrence even when a special output roller is utilized to direct the paper onto the individual rolls, as the paper end is not securely held after break-off of the full re-wound rolls.

I retain full control of the free paper end by providing delivery plate 31, which preferably is shaped to have a dual angle, namely, an input angle 76 tangent to the periphery of a filled core on which the paper immediately leaving felt roller 6 always bears as shown in Figs. 6 and 7, and an output angle 77 which is an angle tangent to the periphery of the core which directs the paper onto the unfilled core 35 as shown in Fig. 7.

The friction of the paper passing rapidly over delivery plate 31, electrostatically charges the paper so that when the filled core is removed, the free end of the paper sticks tightly to the

plate 31 thus preventing slack between plate 31 and roller 6.

In order to more fully understand the operation of the converter I will now follow through a complete operational sequence which will describe the action of the brakes, the die rolls, and the delivery plate 31.

The parent roll having been placed in position with the paper threaded between felt rolls 6 and 7 and laid on output plate 31, the individual re-wind chucks 35, 36 and 39 are filled, and it may be assumed that the empty core 35 presented to the end of the paper has been wet by previous contact with the moistening roller 37. The end of the thin paper is then wrapped around the empty core 35 and sticks thereto. The operator of the machine then depresses clutch pedal 40 which simultaneously engages the clutch connecting the motor with the female die roll and eases off the brakes on both the female die roll and the parent roll. The paper is then wound through the machine at an increasing speed and the inertia of the parent roll 21 is absorbed by the change in position of the dancing roll under control of weight 24 and spring 26 until the machine is running at its full speed, such as, for example, eleven hundred and twenty-five feet of paper per minute.

As the cut-off knife 16 makes each revolution, cuts joined by bonds are made between each individual paper unit, the length of the unit of course being controlled by the diameter of the die rolls. After a predetermined number of units have been wound upon empty roll 39 the machine is either tripped automatically as heretofore described, or directly by the operator who can determine the number of units by watching a counter, and the operator then stops the machine by releasing the clutch pedal. The stopping is of course accomplished quickly by the coordinate release of the clutch and application of brakes on both parent roll and die roll, and the final stopping position is controlled by the operator so that a cut is preferably on the periphery of the filled individual roll. This position is shown in Fig. 6, and it will be noticed that when the machine is stopped in this position that the next cut 80 has been made prior to the entrance of the paper between output felt roll 6 and female die roll 2, thus tightly gripping the individual paper unit 81. It will also be noted that the diameter of the individual re-wound roll 75 is such that the cut ahead of the one now on the surface of the roll, is buried in the roll. Thus, to break off the individual roll, all the operator has to do is to sharply rotate full roll 75, thus breaking the roll loose to form a gap 82 at the cut facing him. The re-wind chuck carrier 32 is then rotated to bring a fresh core 35 into place and the full roll into position as indicated by re-wind chuck 39, where it may be taken out and a new roll substituted as the core 35 is being filled.

A most important feature, however, of the operation of the delivery plate 31 is that friction of the paper in running over this plate highly electrifies the paper so that when full re-wound roll 75 is rotated out of the way and the fresh core 35 rotated into place, the latter being moistened, the paper is strongly attracted to angular portion 77 which moves the end of the paper into contact with moistened core 35, where the paper immediately sticks, ready for the next re-winding operation of the machine.

A still further advantage, however, is gained

by the electrification of the paper on plate 31, and that is that the paper sticks tightly at all times to angular portion 77 and thus any slack is prevented from occurring between plate 31 and felt roller 6 during the time that the paper is free while rolls are being changed. This gripping of the paper by plate 31 prevents pile-up of paper on felt roll 6 and enables a high speed operation of the device with an output, for example, of two hundred individual rolls per hour if desired, and more if the rolls are smaller.

Thus, the delivery plate 31 does two things; it holds the paper tightly during the time the end is free, and the angular portion 77 directs the paper, even against drafts, onto the unfilled core 35.

While I have described the break-off operation at point 82 on the full roll 75 as being accomplished by hand, it is obvious that the slight additional movement necessary may be supplied by an additional source of power frictionally applied to the re-wind chuck after the machine has reached its stop, and therefore I do not wish to be limited to hand rotation alone. Hand operation is, however, highly satisfactory because the operator is at that time grasping the full roll to move it out of the way and to substitute the new one for it, and the break-off twist to the roll may be given at the beginning of this grasping movement without loss of time.

I have also found that I may control the amount of electrification of the paper by varying the material of which delivery plate 31 is made. I have, for example, found that if the electrification in certain periods of the year, due to atmospheric conditions, becomes so high as to apply an appreciable drag on the paper during the re-winding operation, that I may utilize, for example, a zinc plate and obtain a lesser amount of electrification. I have found, however, that polished steel plates are in general highly satisfactory.

Thus, I have provided a paper converter which is capable of extreme high speed without the usual tendencies to jam paper around output rollers, and in which a special knife has been provided which will allow the cut-off bonds to be varied in accordance with the requirements of the paper being handled.

I claim:

1. In a paper converting machine having die rolls, a knife for making transverse cuts including uncut bonds in a paper strip moving between said die rolls, comprising a transverse knife member having a single bevel and a cutting edge interrupted by bond producing notches, and a second knife member having a single bevel and a cutting edge interrupted by bond producing notches, said knife members being mounted with their flat sides touching and with bond notches at least in partial registry, on one of said die rolls.

2. In a paper converting machine having die rolls, a knife for making transverse cuts including uncut bonds in a paper strip moving between said die rolls, comprising a transverse knife member having a single bevel and a cutting edge interrupted by bond producing notches, a second knife member having a single bevel and a cutting edge interrupted by bond producing notches, said knife members being mounted with their flat sides touching and with bond notches at least in partial registry, on one of said die rolls, said knife members being relatively movable to change the size of the bonds.

3. Apparatus in accordance with claim 1, wherein one of said knife members is non-adjustably fixed to one of said die rolls and the other knife member is adjustably fixed to said same die roll.

4. Apparatus in accordance with claim 1 wherein one of said die rolls is provided with a recess extending along said die roll and wherein one of said knives forms at least a portion of an outwardly extending wall of said recess and wherein a block is provided fitting said recess, said other knife forming an outwardly extending wall of said block, said block and second knife being slidable along said recess with said

knives in face contact, with their edges adjacent, and means for locking said block to said roll in a predetermined position.

5. A knife for making cuts in paper interrupted by uncut bonds comprising a knife member having a single bevel and a cutting edge interrupted by bond producing notches, a second knife having a single bevel and a cutting edge interrupted by a cutting edge interrupted by bonding notches, and means for holding said knives together with their edges coextensive and adjacent and with their bonding notches at least in partial registry.

DONALD M. FEURT.