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METHOD OF CUTTING PRESSURE-SENSITIVE PAPER AND APPARATUS USED IN CONJUNCTION THEREBWITH
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The present invention relates generally to the cutting of paper, and more particularly to a method of cutting paper stock that is susceptible of damage when pressure above a predetermined limit is applied thereto, such as pressure-sensitized paper used for the reproduction of copies without carbon, stencils, signboard, and expensive textured papers.

During the past few years, great strides have been made in the paper industry in evolving a wide variety of papers in innumerable colors, finishes, and other special physical characteristics. One of the most important of such new papers is one produced under licenses granted by the National Cash Register Company, the developer thereof, which is known in the trade as NCR paper. Thousands of tiny capsules are bonded to one side of this NCR paper, with each capsule containing a liquid, which when brought into pressure contact with an appropriate surface, leaves a visible stain thereto. NCR paper is able to withstand a pressure of 35 lbs. per sq. in. without rupture of the capsules and reproduction of a visible mark on the treated paper surface disposed adjacent thereto.

A major problem encountered in the use of NCR paper is in the cutting of this paper stock which is supplied in large sheets that must be cut into smaller sheets such as used in tablets, business forms or the like, on which the material is written or typed on the first sheet thereof and reproduced without carbon paper on one or more under sheets. The use of a conventional paper cutting machine for this purpose has been found to be highly unsatisfactory, for the vertically movable bar employed in clamping the paper stock on a horizontal platform forming a part of the machine, exerts a force on the NCR paper greater than that required to rupture the capsules. Rupturing of the capsules obviously permanently damages the paper, to the extent that it cannot be used for its intended purpose. In addition to NCR paper, many other papers such as artboard, signboard, and various textured papers are ruined during cutting due to the application of excessive pressures thereto.

A major object of the present invention is to provide a method, and an apparatus that can be used in conjunction therewith, which permits cutting of paper stock that is sensitive to excessive pressures on a conventional paper cutting machine without damaging thereto.

Another object of the present invention is to provide a simple, inexpensive method of cutting pressure-sensitive paper stock without damaging thereto by any means of which the market demand for such pressure-sensitive papers is increased.

A still further object of the invention is to supply a method and apparatus used therewith that is extremely simple to carry out, permits the use of conventional paper cutting equipment and substantially eliminates the possibility of ruining expensive pressure-sensitive papers during the cutting thereof.

These and other objects and advantages of the invention will become apparent from the following description thereof, and from the accompanying drawing illustrating the same in which:

FIGURE 1 is a partial perspective view of a conventional power-operated paper cutting machine showing the paper stock to be cut resting on the horizontal platform thereof with the paper positioners seen in the background, together with the vertically movable knife and vertically movable pressure bar utilized in maintaining the paper in position on the platform;

FIGURE 2 is the same view as that of FIGURE 1 but showing the paper stock disposed in a position to be cut, with the invention situated adjacent thereto to redistribute the force exerted by the cutting bar on a resilient strip to the extent that the pressure exerted on the paper per square inch of area is less than that which will cause damage thereto;

FIGURE 3 is a perspective view of a portion of the apparatus used in carrying out the method of the present invention;

FIGURE 4 is a vertical cross-sectional view of the apparatus shown in FIGURE 3 taken on line 4—4 thereof;

FIGURE 5 is an enlarged vertical cross-sectional view of an alternate form of the apparatus; and

FIGURE 6 is a fragmentary front elevation view of the adjacent upper portions of the paper stock being cut showing the pressure bar of the paper cutter in initial contact with the upper surface of the resilient strip.

With further reference to the drawing, a conventional power-operated paper cutting machine A is shown in FIGURES 1 and 2 which includes a horizontal platform B of steel, or like material, that defines a hard, unyielding surface on which a stack C of paper stock is disposed. Prior to being cut the stack C is moved to a position on platform B where the rear edges of the stack abut against a series of spaced, vertically extending bars or plates D that serve as positioners for the paper on the platform.

In addition, the cutting machine A includes a vertically movable bar E of substantial width that is adapted to exert a pressure on stack C when positioners on the machine as shown in FIGURE 2 to maintain it in a fixed position relative to the machine during cutting of the paper. A vertically movable knife F is also included as a part of machine A, situated just forwardly of, and in sliding contact with the bar E (FIGURE 2). The pressure bar E on conventional paper cutting machines normally operates with such a downward force that when it contacts a stack C of pressure-sensitive paper, the pressure exerted thereon per square inch of surface area is in excess of that pressure the paper can withstand without permanent damage thereto.

The pressure exerted by bar E on stack C is reduced to a pressure per square inch less than that at which the paper stock can be damaged when cut, by disposing an elongate resilient strip G along the stack C and extending the strip longitudinally along the upper surface of the invention I which is placed adjacent to the stack C as shown in FIGURE 2. Prior to the cutting thereof the paper stock C is moved to a position on platform B where the rear edges thereof abut against a series of spaced vertically extending bars or plates D which serve as positioners for the stock on the platform.

The invention I, as can best be seen in FIGURE 3, includes a number of identical sheets H, J, K and L, preferably rectangular in shape, that are fabricated from a compression-resistant material such as cardboard, or the like. In actual practice, Falpaco display board, manufactured by the Falulah Paper Company of Fitchburg, Massachusetts, has been found ideally suited for this purpose. Each sheet H, J, K and L has a number of longitudinally spaced, transversely extending slots 10, 12, 14, 16, 18 and 20 formed therein which are in vertical alignment when sheets H, J, K and L are stacked as shown. For clarity of description, the individual slots 10, 12, 14, 16, 18 and 20 will hereinafter be referred to by the numeral assigned thereto, and with the identifying letter of the sheet in which the slots are formed being used as a prefix thereto.

Pairs of films H', J', K' and L' are bonded to opposing longitudinally extending sides of sheets H, J, K and L

movable pressure bar utilized in maintaining the paper in position on the platform;
respectively, as shown in FIGURE 4. The films preferably have a roughened surface similar to velours, so that the films may slide relative to one another but are not separable. When a force is applied to sheet H, J, K or L to cause such movement. A paper known as Potomac Velours Cover has been used for films H', J', K' and L' and found to be quite satisfactory for this purpose. Two magnets M-1 and M-2 are disposed in slots H-10 and H-20 respectively (FIGURE 4). Magnets M-4 and M-6 are positioned in slots J-14 and J-16 respectively, with the magnets M-5 and M-6 being so oriented as to be attracted to magnets M-3 and M-4. Thus, when sheet J is laid upon sheet H as shown, the two sheets will tend to adhere to one another due to the attractive forces between the magnets M-3, M-5 and M-4, M-6 -M-10 are disposed within the slots in sheets J and K, and so oriented as to attract one another and hold the sheets together, when sheets J and K are positioned as shown in FIGURE 4. Likewise, magnets M-12, M-13 and M-11 and M-14 are positioned in slots formed in sheets K and L and bonded to the films covering the same, with these magnets tending to hold sheets K and L together as shown in the drawing. Each of the sheets H, J, K and L is identified with a particular indicia (not shown) that permits them to be stacked in the configuration shown in FIGURE 4. Groups of four of the sheets H, J, K and L positioned as illustrated in FIGURE 4 are stacked one above the other to define the invention I (FIGURE 2), which is slightly higher than the stack C of pressure-sensitive paper to be cut. In general, it is desirable that the invention I extend upwardly above the stack C approximately the thickness of one of the sheets H, J, K or L.

After the invention I is placed adjacent the stack C of pressure-sensitive paper to be cut, the resilient strip G is longitudinally disposed to cover at least a portion thereof and to extend to the left across the entire upper surface of the stack as shown in FIGURE 2. Strip G is preferably fabricated from a chemically blown sponge rubber having a density between 0.5 and 1.2 lb. per cu. in. in the rubber industry is used to designate a rubber of medium density and R-14 the beginning of the maximum density. Should it be desired, strip G can be permanently affixed to the lower surface of the pressure bar E if the machine A is to be used only for cutting pressure-sensitive papers. Having strip G permanently affixed to bar E in the above described manner would, of course, eliminate the manual operation of extending the strip across stack C and invention I as shown in FIGURE 2. Irrespective of whether the strip G is permanently affixed to the underside of bar E or is laid to extend across the top of stack C and at least partially across the invention I, the function of strip G remains the same. As the pressure bar E moves downwardly, the portion E-I of the strip sandwiched between the upper surface of the invention I and the lower surface of the pressure bar requires a greater and greater force to further compress the same.

Due to the additional height of the invention I above the stack C being cut, the pressure bar E when moving downwardly must compress the resilient strip G to the line G-1 above the invention before the lower surface of the pressure bar E even contacts that portion of the strip above the stack of paper to be cut. The compressed portion of the strip G above the invention I resists compression directed upwardly which opposes the downward force exerted by the pressure bar E. Accordingly, when the pressure bar E contacts that portion of the strip above the stack C to be cut, the pressure exerted on the stack is not normally exerted by the pressure bar, but instead is the force it normally exerts as the force required to compress strip G above the invention I from the position where the bar initially contacted the strip to the position G-1 above the invention indicated in phantom line in FIGURE 5. When the pressure bar E has moved downwardly relative to the stack C and invention I as shown in FIGURE 6, to the position G-2 of strip G above the invention has been two-thirds compressed, while the portion of the invention above the stack C has been compressed only one-third. Assuming that there are equal areas of the strip G above the stack C and the invention I, it will be seen that roughly two-thirds of the force exerted on the pressure-sensitve paper of the stack in a position to be cut by the knife F. Thus, irrespective of the downwardly directed force at which the pressure bar E normally operates, by positioning a resilient strip G above the invention I to a height above the stack, the pressure exerted by the cutting bar E on the stack can be held to less per unit of area thereof than that which will damage the same.

An alternate form of sheet 30 that can be used in the formation of the invention I is shown in FIGURE 5. The invention I is of the same thickness as sheets H, J, K and L, but is formed of two plies of cardboard 32 and 34 which are positioned back-to-back and bonded together. The two plies 32 and 34 have longitudinally spaced, vertically aligned slots 36, 38, 40, 42, 44 and 46 formed therein. Two films 48 and 48" of paper or other suitable sheet material are bonded to the outer surfaces of sheets 32 and 34 respectively. Two permanent magnets M-16 and M-18 are positioned in slots 36 and 46 and contained therein by films 48 and 48". The alternate sheets (FIGURE 5) are used in the same manner as the sheets H, J, K and L shown in FIGURE 4.

The operation of the invention has been described in detail hereinabove, and need not be repeated. It will be obvious to those skilled in the art that various changes may be made in the invention without departing from the spirit and scope thereof, and therefore the invention is not limited by that which is shown in the drawing and described in the above specification, but only as defined in the appended claims. I claim:

1. A method of cutting paper stock that is damaged when subjected to greater than a predetermined pressure per unit of surface area, comprising: placing a second portion of said paper stock on a first portion of said unyielding surface; having a substantially non-compressible elongate body on said surface adjacent said stack, said body being slightly higher than said stack; placing an elongate strip of resilient material of substantially the same width as said body in a longitudinally spaced position on the top of said stack and on at least a portion of the top of said body; moving a second hard, unyielding surface of substantially the same horizontal cross-sectional area as said strip into contact therewith; exerting a downwardly directed force on said second surface of such magnitude as to subject each horizontal unit of surface area of said strip above said body to a pressure greater than said predetermined pressure, said strip during downward movement of said second surface when in contact therewith opposing said downward movement with an upwardly directed force of such magnitude that the pressure exerted by said second surface per unit of said surface area on said stack being less than said predetermined pressure; moving an elongate knife downwardly parallel to vertically aligned faces of said strip and body to sever said stack into two portions, a first portion of which stack is at least partially disposed under said strip, with a second portion of said stack being disposed for-
wardly of said strip; withdrawing said downwardly directed force; moving said second surface to an elevated position relative to said first and second portions; and removing said strip from said first portion and said body to permit removal of said first portion from said first surface.

2. A method as defined in claim 1 which includes the further step of forming said body by placing a plurality of rigid sheets one above the other.

3. A method as defined in claim 2 which includes the further step of providing said rigid sheets with magnetic means that cause said sheets to cling together in groups, but permit said sheets to be manually separated as well as assembled into said clinging groups of sheets to define said non-compressible body of a desired height.

4. A method as defined in claim 3 which includes the further steps of forming at least one slot in each of said rigid sheets, placing a permanently magnetic body in each of said slots, and sealing each of said magnetic bodies in said slot wherein it is placed to become an integral part of one of said rigid sheets.

5. A method as defined in claim 4 which includes the further step of grasping said clinging groups by the uppermost sheet therein and stacking said clinging groups one above the other to define said non-compressible body.

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