Oct. 22, 1968 D. TERZUOLI 3,406,612

APPARATUS FOR INCISING PAPER OR OTHER FIBROUS SHEET MATERIAL

Filed Jan. 11, 1967 2 Sheets-Sheet 1

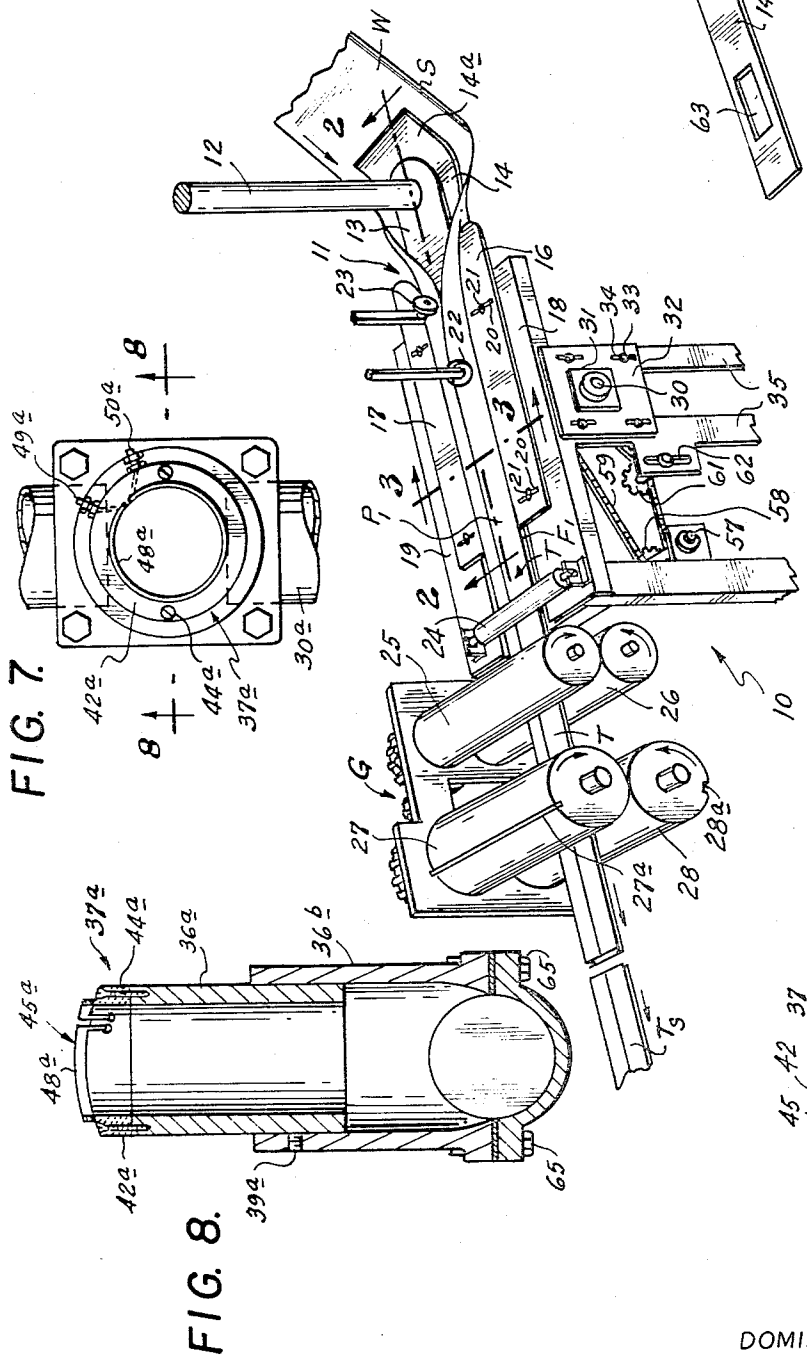


FIG. 1.

FIG. 4.

FIG. 7.

FIG. 8.

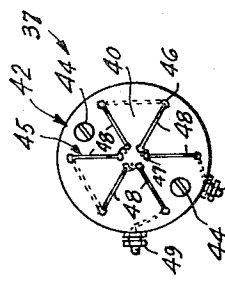


FIG. 5.

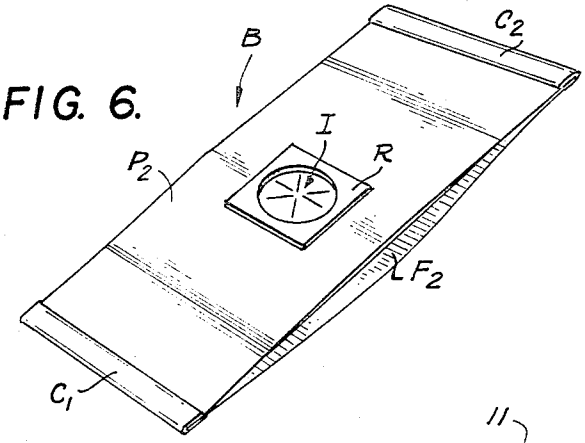
INVENTOR
DOMINICK TERZUOLI
BY
ATTORNEY

Oct. 22, 1968 D. TERZUOLI 3,406,612

APPARATUS FOR INCISING PAPER OR OTHER FIBROUS SHEET MATERIAL

Filed Jan. 11, 1967 2 Sheets-Sheet 2

FIG. 6.



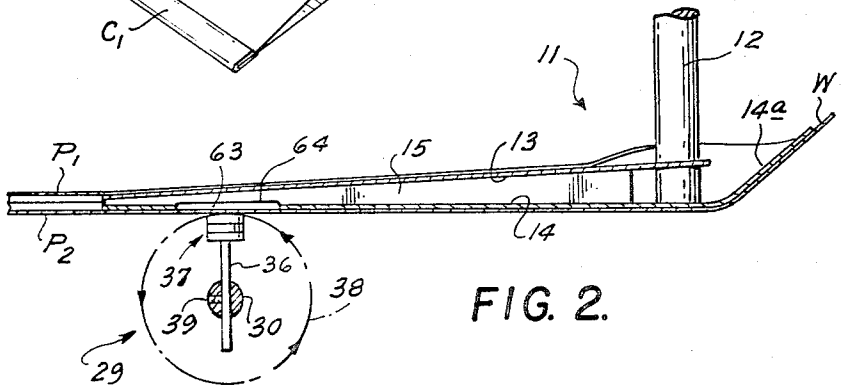


FIG. 2.

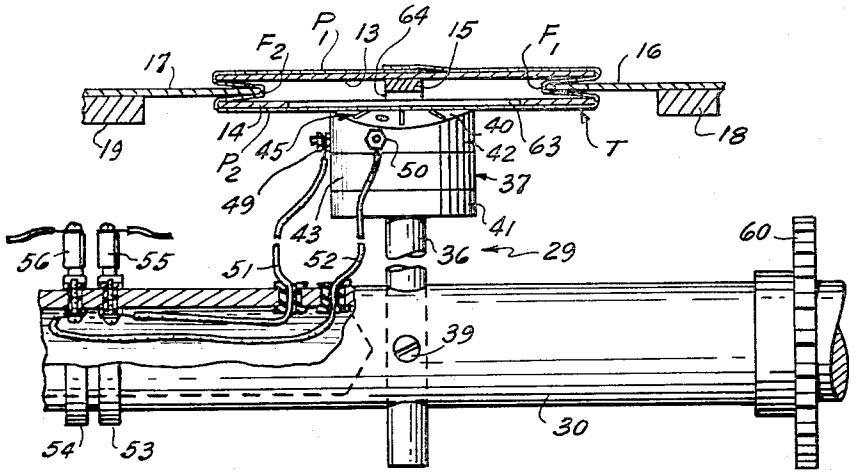


FIG. 3.

INVENTOR
DOMINICK TERZUOLI
BY
Alvin Swidenbank
ATTORNEY

United States Patent Office 3,406,612 Patented Oct. 22, 1968

3,406,612

APPARATUS FOR INCISING PAPER OR OTHER FIBROUS SHEET MATERIAL

Dominick Terzuoli, 2258 E. 70th St., Brooklyn, N.Y. 11234

Filed Jan. 11, 1967, Ser. No. 608,671
6 Claims. (Cl. 93—8)

ABSTRACT OF THE DISCLOSURE

A bag-making machine in which a paper web is moved continuously through a folding device which forms the web into a flattened tube having opposed plies and then through a cutting device which transversely cuts the tube into sections to be formed into individual bags by closing of at least one of the ends thereof, is provided with a resistance wire having the configuration of a desired pattern and being electrically heated to a temperature well above the charring temperature of the paper, and such heated wire is moved in a circular path in synchronism with the operation of the cutting device and the speed of movement of the web so as to repetitively effect non-slip contact with the web at locations spaced along the latter in the lateral portion of the web which constitutes one of the plies of the tube, thereby to burn or char through that one ply for incising the latter in the desired pattern. The web does not need to be backed-up or supported at the surface thereof facing away from the wire during contact by the latter, and thus the charring of the desired patterns can be effected desirably close to the cutting device, preferably at the folding device which can have an opening in its folding blade contacting the ply being charred at the region where the wire makes contact with such ply.

This invention relates generally to a method and apparatus for incising paper or other fibrous sheet material, and more particularly for producing patterned cuts or incisions in one wall or side of paper bags, such as, the disposable dust collecting bags for vacuum cleaners.

Machines for making bags of the described type effect the continuous movement of a paper web from a supply roll through a folding device which longitudinally folds the web to form a flattened tube, usually with pleats in its opposite longitudinal margins, and then through a cutting device which transversely cuts the tube at longitudinally spaced locations to sever the tube into sections which are thereafter formed into individual bags by closing one or both of the ends thereof. In the case of dust collecting bags for vacuum cleaners which are closed at both ends, it is necessary to cut or incise one wall of the bag and to secure a stiffening or reinforcing collar of cardboard or the like to such wall around the incision so that the usual intake tube of a vacuum cleaner can be inserted through the incision to admit the dust-laden air conveyed through such tube to the bag.

In existing machines for making bags of the described character, the incision in a wall of each bag is formed by a pair of rotary cutting dies which obviously must engage the paper at the opposite surfaces thereof. Thus, the cutting of the incisions must be performed on the paper web before it is longitudinally folded into a flattened tube, that is, at a location spaced a large distance along the path of movement of the web from the location at which the tube is cut into sections. Since the paper for dust collecting bags must be porous, it has a tendency to stretch when moved under tension through the bag-making machine and, by reason of the large distance along the path of movement of the web between the location of the dies for incising the web and the location of the device for cutting the tube into sections, the tendency

of the web to stretch unavoidably results in relatively large variations in the positioning of the incisions with respect to the ends of the respective cut sections. Such variations in the positioning of the incisions with respect to the ends of the respective cut sections cause difficulties in automatically securing the stiffening collars to the bags in register with the incisions.

The paired rotary cutting dies employed for cutting the incisions in bags of the described type are further undesirable in that they have a relatively short useful life after which the dies must be removed for sharpening or replacement resulting in relatively frequent shut-downs of the bag making machine and a reduction of its productive capacity. The existing rotary cutting dies are also relatively expensive, particularly when it is considered that different sets of dies must be furnished for every change in the pattern to be incised or cut in the bags and for every change in the spacing along the web between successive incisions, for example, when bags of different lengths are being produced.

Accordingly, it is an object of this invention to provide a method and apparatus for incising paper or other fibrous sheet material in any desired pattern by acting on only one surface of such sheet material so that, for example, in a bag making machine of the type described above, the paper can be incised at a location close to the cutting device for severing the tube into sections and thereby ensure precise positioning of the incisions with respect to the ends of the sections.

In accordance with an aspect of the invention, a desired pattern is repetitively incised in fibrous sheet material moving continuously in a predetermined path at a portion of which the sheet material is unsupported at least at one side, by moving a resistance wire having the configuration of the desired pattern in a circular path to which the mentioned portion of the path of movement of the sheet material is tangential and at a speed synchronized with the speed of movement of the sheet material so that the resistance wire makes brief non-slip contact with the other side of the fibrous sheet material during each circuit by the wire of its circular path, and electrically heating the resistance wire to a temperature substantially above the charring temperature of the fibrous sheet material so as to char or burn through the latter in the desired pattern during each brief non-slip contact therewith.

When the invention is applied to a bag making machine of the described character, the circular path of the heated resistance wire is disposed to bring the latter into contact with the moving paper near the exit end of the folding device, that is, at a location where the paper is already folded into a tube with the folding blades of such device serving to separate the ply of the tube which is to be incised from the other superposed ply of the tube. Further, in order to avoid shorting of the resistance wire when the latter burns through the contacted paper ply, the folding or pleating blade which engages such ply may have an opening in an area thereof which corresponds to the location of the tangency of the path of the paper to the circular path of the resistance wire.

Another object is to provide an apparatus of the described type in which the distances along the web between the successive incisions charred therein can be easily varied.

The above, and other objects, features and advantages of the invention, will be apparent in the following description of illustrative embodiment thereof which is to be read in connection with the accompanying drawings, wherein:

FIG. 1 is a partial perspective view of a bag making machine provided with apparatus in accordance with this invention for incising one wall of each of the bags, and

showing only those elements of the bag making machine essential for understanding the invention;

FIG. 2 is an enlarged longitudinal sectional view taken along the line 2—2 on FIG. 1;

FIG. 3 is a still further enlarged transverse sectional view taken along the line 3—3 on FIG. 1;

FIG. 4 is a fragmentary perspective view of a portion of one of the folding or pleating blades included in the bag making machine of FIG. 1 and illustrating the modification thereof to adapt such machine to the apparatus embodying this invention;

FIG. 5 is a detail elevational view of a head included in the apparatus embodying this invention;

FIG. 6 is a perspective view of a dust collecting bag for vacuum cleaners which has a wall thereof incised in accordance with this invention;

FIG. 7 is an elevational view similar to that of FIG. 5 but showing another embodiment of the invention; and

FIG. 8 is a sectional view taken along the line 8—8 on FIG. 7.

Referring to the drawings in detail, and initially to FIG. 1 thereof, it will be seen that a bag making machine 10 of a type in which apparatus in accordance with this invention may be advantageously incorporated uses, as the starting material for the making of bags, a continuous web W of paper or other fibrous sheet material which is unwound from a supply roll (not shown). The web W unwound from the supply roll moves continuously in the longitudinal direction through an adhesive applying device (not shown) operative to apply a stripe S of adhesive to the web along one of the longitudinal edges thereof.

After the longitudinal stripe C of adhesive has been applied to the web, the latter moves continuously through a folding device 11 which may be of a conventional type, as shown. Such folding device 11 generally includes a post 12 which may be suspended, at its upper end, from the frame of machine 10 and, at its lower end, supports upper and lower inner folding or pleating blades 13 and 14. As shown on FIG. 2, blades 13 and 14 are substantially spaced apart at the ends thereof mounted on post 12 and extend from the latter in the direction of longitudinal movement of web W, with the distance between blades 13 and 14 decreasing progressively in the direction away from post 12. The end portion of lower blade 14 secured to post 12 may extend beyond the latter and be upwardly bent, as at 14*a*, so as to guide the moving web to folding device 11. The blades 13 and 14 may taper laterally in the direction of movement of the web therealong to final transverse dimensions that are substantially equal to the desired width of the side panels or walls of the bags to be produced. If desired, the rigidity of blades 13 and 14 supported at one end from post 12 may be increased by a central, longitudinally extending spine 15 (FIGS. 2 and 3) disposed between and joining the two blades.

Folding device 11 is further shown to include outer folding or pleating blades 16 and 17 mounted on horizontal frame members 18 and 19 extending along the opposite sides of inner blades 13 and 14 so that the inner longitudinal edge portions of blades 16 and 17 project laterally into the opposite side openings of the gap or space between blades 13 and 14 (FIG. 3). Blades 16 and 17 are secured to the respective frame members 18 and 19, for example, by providing slots 20 in each of blades 16 and 17 receiving bolts 21 screwed into tapped holes in the frame members (FIG. 1), so as to permit lateral adjustment of blades 16 and 17, and hence variation of the depth of the pleats formed along the opposite margins of the flattened tube into which web W is folded by device 11. Rubber tired rollers 22 and 23 are suspended from above to bear on blade 13 and have their axes of rotation arranged obliquely with respect to the direction of movement of the web.

In the operation of folding device 11, the web W moved longitudinally therealong has its outer longitudinal portions folded upwardly and inwardly and drawn toward each other by rollers 22 and 23 over blade 13 with the edge portion carrying adhesive stripe S being overlapped on the opposite edge portion, thereby to form the upper panel or ply P_1 of a flattened tube T (FIG. 3) which further has a lower panel or ply P_2 connected to the upper panel P_1 by folds or pleats F_1 and F_2 formed inwardly along the opposite longitudinal margins of tube T by blades 16 and 17.

The tube T formed from web W by folding device 11 passes from the latter under a freely rotatable pressing roller 24 (FIG. 1) which bears on the upper panel P_1 of the tube to ensure adherence of the overlapped edge portions of the web by the adhesive stripe S. After passing under roller 24, tube T passes between feed rollers 25 and 26 which are suitably driven, as by gearing G, to pull the web through folding device 11 and further to press the tube flat for ensuring secure bonding together of the overlapping edges of the folded web. From feed rollers 25 and 26, tube T passes between rotary cutting cylinders 27 and 28 which are also driven through gearing G and have cutting elements 27*a* and 28*a* cooperating to transversely cut through tube T at spaced apart locations therealong for severing the tube into sections T*s*.

The tube sections T*s* are adapted to be formed into individual bags by closing one or both of the open ends thereof. For example, as shown on FIG. 6, each section cut from the tube T may have adhesive applied to its opposite end portions which are then folded over to form end closures C_1 and C_2 of a dust-collecting bag B from vacuum cleaners. Such bag B further has its wall or panel P_2 incised, as at I, for example, in the form of a series of radiating cuts located approximately at the center of panel P_2, and a reinforcing collar R of cardboard or other stiff material is secured to panel P_2 around the incision I so that the usual intake tube of a vacuum cleaner can be inserted through the incision I to admit the dust-laden air conveyed through the tube to the bag.

In the bag making machine 10, the incision I in the panel P_2 of each of the bags made from the tube sections T*s* is formed by an apparatus 29 which acts on paper web W at a location in advance of cutting cylinders 27 and 28, for example, at a location adjacent the exit end of folding device 11. Such apparatus 29 embodying this invention is shown to include a shaft 30 extending laterally below frame members 18 and 19 and having its ends journalled in bearings 31 (FIG. 1) carried by plates 32. The plates 32 are preferably mounted for vertical adjustment, for example, by bolts 33 extending through vertically elongated slots 34 in plates 32 and being received in tapped holes provided in side frame members 35.

As shown on FIGS. 2 and 3, apparatus 29 further includes an arm 36 extending radially from shaft 30 so as to be movable in a plane which intersects the longitudinal median of folding device 11 upon rotation of the shaft. Arm 36 carries a head 37 on its outer end for movement in a circular path 38 (FIG. 2) upon rotation of shaft 30. Arm 36 is preferably radially adjustable relative to shaft 30, for example, by having its inner end portion slidable in a bore extending diametrically through shaft 30 and being adjustably secured in such bore by a set screw 39.

Arm 36 is radially adjusted so that the circumference of the circular path 38 travelled by the outer face 40 of head 37 is equal to the distance along the web to be provided between the successive incisions I formed therein, and plates 32 carrying shaft 30 are vertically adjusted so that the underside or outer surface of the lower panel or ply P_2 of tube T formed from web W by folding device 11 is tangent to circular path 38 at the top of such path.

Head 37 is shown to include a base 41 secured on the outer end of arm 36 and stacked bodies 42 and 43 (FIG. 3) of ceramic or other insulating, heat-resistant material removably secured on plate 41, as by recessed screws 44 (FIG. 5) which extend through aligned bores in bodies 42 and 43 and are received in suitable tapped holes in base 41. The outer surface 40 of head 37 is defined by the

exposed face of ceramic body 42 and is preferably curved, as shown, to correspond approximately to the curvature of circular path 38.

A resistance wire 45 capable of being heated by the passage of an electric current therethrough to incandescence or at least to a temperature substantially above the charring temperature of the paper or other fibrous material of web W, for example, to a temperature of approximately 1200° F., is carried by ceramic body 42. Portions of the length of wire 45 are exposed and overlie surface 40 in a configuration corresponding to that of the desired pattern of each incision I to be formed. Thus, where incision I is to be constituted by radiating cuts, as shown on FIG. 6, resistance wire 45 may be threaded through circularly arranged outer and inner series of holes 46 and 47 (FIG. 5) in body 42 and opening at surface 40 so that lengths 48 of wire 45 extend generally radially from the holes 47 near the center of surface 40 over the latter to corresponding holes 46 near the periphery of surface 40. The ends of resistance wire 45 are connected to terminals 49 and 50 projecting from ceramic body 42, and such terminals are connected through wires 51 and 52 with slip rings 53 and 54 mounted on shaft 30 and insulated from the latter (FIG. 3). Brush assemblies 55 and 56 engage slip rings 53 and 54 and thereby permit the supplying of electric current from as uitable source (not shown) to resistance wire 45 for heating the latter.

Shaft 30 is suitably driven in synchronism with feed rollers 25 and 26 and cutting cylinders 27 and 28 so that the speed of movement of surface 40, and hence of the exposed lengths 48 of wire 45 overlying that surface, in circular path 38 is equal to the speed of movement of web W through folding device 11. Thus, during each revolution of shaft 30 the exposed lengths 48 of wire 45 make non-slip contact with the underside or outer surface of panel or ply P_2 at the top of circular path 38. Further, the angular position of head 37 on shaft 30 is related to the angular positions of the cooperating cutting elements on cylinders 27 and 28 so that each such non-slip contact of the exposed lengths of resistance wire 45 with panel P_2 occurs at a position along the latter which is at the desired location between the ends of the respective section Ts to be cut from the tube.

The drive for shaft 30 may include a variable speed transmission (not shown) interposed between gearing G and an intermediate drive shaft 57 (FIG. 1). A sprocket 58 is secured on shaft 57 and drives a chain 59 which runs around a sprocket 60 secured on shaft 30 (FIG. 3). An idler sprocket 61 (FIG. 1) on a stub shaft which is vertically adjustable in a slot 62 engages chain 59 to maintain the desired tension in the chain upon adjustment of the vertical position of shaft 30.

It will be apparent that, during each non-slip contact with paper panel P_2 of the exposed portions of resistance wire 45 heated to a temperature substantially above the charring temperature of the paper, the latter is charred through in a pattern corresponding to that of the exposed lengths 48 of the wire. Since the paper web and the heated wire are continuously moving, and thus contact each other only briefly, the charring of the paper only results in the forming of a corresponding incision in the paper and the charring or burning does not extend beyond the lines of contact of the wire with the paper.

In order to prevent shorting of wire 45 when its exposed portions have charred through paper panel P_2, the metal blade 14 which overlies panel P_2 is formed with an opening 63 (FIGS. 3 and 4) in the region thereof overlying the upper portion of the circular path 38. Further, the lower edge of spine 15 may be cut away, as at 64 (FIGS. 2 and 3) over the extent of opening 63 for further ensuring that the upper surface of panel P_2 will be unsupported during contact of such panel with the heated wire for preventing shorting of the latter.

Although a pattern of radiating lines is incised in the paper web by the above described head 37, it is apparent that the configuration of the exposed portion or portions of the heated wire 45 can be changed to correspondingly alter the configuration of the pattern charred through the paper or other fibrous sheet material. Thus, for example, as shown in FIGS. 7 and 8, a head 37*a* may be constituted by an annular ceramic body 42*a* mounted, as by screws 44*a*, on the outer end of a tubular arm section 36*a* which is telescopically adjustable on a tubular arm section 36*b* and secured relative to the latter by a set screw 39*a*. Arm section 36*b* is clamped, as at 65, on shaft 30*a* so as to extend radially therefrom, and shaft 30*a* is hollow so as to communicate with the hollow interior of arm section 36*b*. The resistance wire 45*a* of head 37*a* is arranged to present an exposed length 48*a* thereof in the form of a substantially closed ring projecting from the outer face of annular ceramic body 42*a* along the inner periphery of the latter. The ends of resistance wire 45*a* are connected to terminals 49*a* and 50*a* (FIG. 7) to which current may be supplied as previously described. Thus, when the assembly of the arm 36 and head 37 is replaced by the arrangement shown on FIGS. 7 and 8, each contact of the heated resistance wire 45*a* with the paper or other fibrous sheet material causes the incision of a circular charred cut in the latter. Where such a circular cut is incised in the fibrous sheet material, the piece of the latter within the circular incision can be removed by applying suction to hollow shaft 30*a*, and hence through the hollow interiors of arm sections 36*a* and 36*b* and annular body 42*a*, for withdrawing each cut piece from the web.

It will be apparent that, since the exposed portion of the heated wire 45 or 45*a* does not need to exert any significant pressure against the paper web in order to incise the desired pattern therein by charring of the paper or fibrous material, there is no need to back-up or support the web at the location where it is being incised repetitively. Thus, the apparatus 29 embodying this invention can be disposed at any desired location along the path of travel of the web. The foregoing makes it possible to locate the apparatus 29 at a position along the path of travel of the web close to that at which the latter is severed into sections by cutting cylinders 27 and 28, for example, at the location adjacent the exit end of folding device 11, as shown. Since only a relatively short length of the web material extends from the location where apparatus 29 cuts or incises the desired patterns therein to the location at which the web is cut into sections, there is no danger that the inherent stretch of the fibrous material constituting the web will result in substantial variations in the positioning of the successive incisions with respect to the ends of the successive sections cut from the web. Further, the fact that the heated wire 45 or 45*a* need not apply a substantial pressure against the web material makes it possible to support the head 37 or 37*a* in a manner permitting its radial adjustment with respect to the shaft 30 or 30*a* as described, and thereby permits convenient variation of the distance along the web between the successive incisions charred therein.

Although illustrative embodiments of the invention have been described in detail herein with reference to the accompanying drawings, it is to be understood that the invention is not limited to those precise embodiments, and that various changes and modifications may be effected therein by one skilled in the art without departing from the scope or spirit of the invention as defined in the appended claims.

What is claimed is:

1. In a machine for producing bags from a web of fibrous sheet material continuously moved under tension in a predetermined path and including a folding device acting on the web moving in said path to longitudinally fold the web into a flattened tube having at least two opposed plies and a cutting device acting repetitively on said flattened tube to cut transversely through the latter at locations spaced longitudinally along the tube and

thereby sever the tube into sections which can be formed into individual bags by closing of at least one of the ends thereof; an apparatus for incising in a desired pattern one of said plies of the tube, said apparatus comprising a resistance wire having the configuration of said desired pattern, means supporting said wire for movement in a circular path to which a portion of said predetermined path of the web in advance of said cutting device is tangent, said circular path being laterally located in relation to said predetermined path so that, in each traversal of said circular path, said wire contacts the fibrous sheet material at a lateral portion thereof constituting the outer surface of one of said plies of the tube, means guiding the web in said portion of its path so as to leave free the other surface of said lateral portion of the web, means moving said wire in said circular path at the same speed as the speed of movement of the fibrous material in said predetermined path and in synchronism with said cutting device so that said wire makes brief non-slip contact with said lateral portion of the web during each traversal of said circular path at a location along the web which is intermediate and in predetermined positional relation to said locations where the tube is to be transversely cut into one of said sections, and means for supplying electric current to said wire to electrically heat the same to a temperature substantially above the charring temperature of said fibrous sheet material so as to char through only said lateral portion of the web during each said brief non-slip contact therewith.

2. A machine for producing bags according to claim **2**; wherein said folding device includes a folding blade interposed between said opposed plies of the flattened tube and extending along said portion of the predetermined path of the web which is tangent to said circular path of the heated wire, said blade separating said one ply from the other opposed ply and having an opening at said portion of the path of the web to leave free said other surface of said one ply at the region of each said contact of the wire with said one ply.

3. A machine for producing bags according to claim **1**; wherein said means supporting the wire for movement in a circular path includes a rotatable shaft, means mounting said shaft for movement toward and away from said portion of the path of movement of the web, an arm extending from said shaft and being radially adjustable with respect thereto, and a head on said arm having an outer surface from which said wire projects, radial adjustment of said arm and corresponding movement of said shaft being effective to vary the distance along the web between the successive locations at which said wire makes non-slip contact therewith.

4. A machine for producing bags according to claim **1**; wherein said means supporting the wire includes a head having an insulating, heat resistant body with spaced openings in an outer surface of said body arranged in circular series, and said wire is threaded through said openings to expose lengths of the wire extending over said outer surface of the body and generally radiating from the center thereof.

5. A machine for producing bags according to claim **1**; wherein said means supporting the wire includes a head of insulating, heat resistant material having an outer surface on which said wire is supported in a substantially closed loop configuration so as to incise a correspondingly configured piece of the fibrous material from said web during each said non-slip contact therewith, an arm supporting said heat at an end thereof, and a rotatable shaft having said arm extending radially therefrom, said shaft, arm and head being hollow to define a passage opening at said outer surface of the head and through which pieces cut from the web can be removed by suction applied to said passage.

6. A machine for producing bags according to claim **5**; said arm being adjustable radially with respect to said shaft, and means supporting said shaft for movement toward and away from said portion of the path of the web so that, by radially adjusting said arm and correspondingly moving said shaft, the distance along the web between the locations at which said wire makes successive contacts therewith can be varied.

References Cited

UNITED STATES PATENTS

588,940	8/1897	Angell	93—58
619,471	2/1899	Fellowes	58
2,641,333	6/1953	Woessner	35 X
3,322,041	5/1967	Fesco	35
3,333,523	8/1967	Terzuoli	93—35 X

WAYNE A. MORSE, JR., *Primary Examiner.*