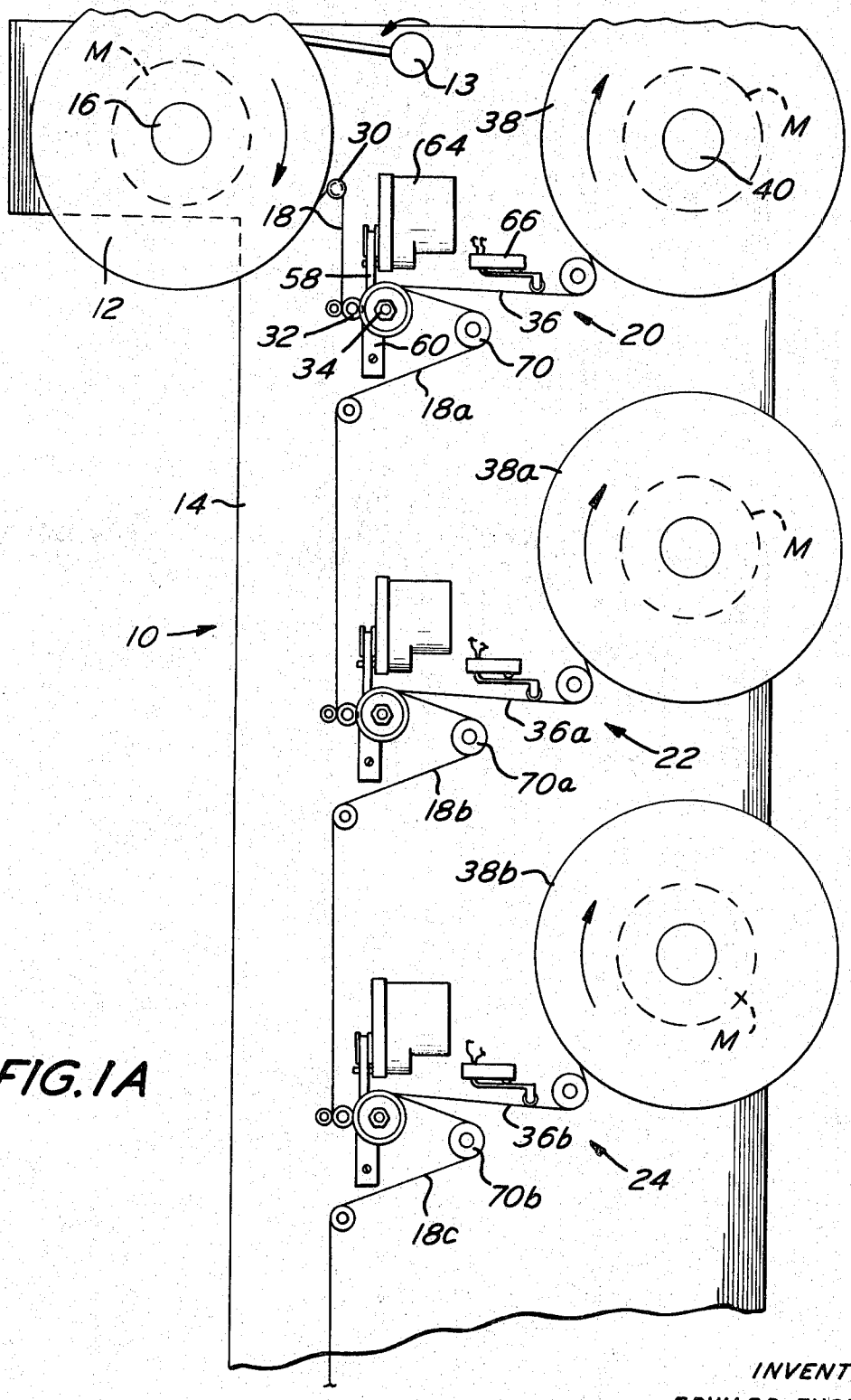
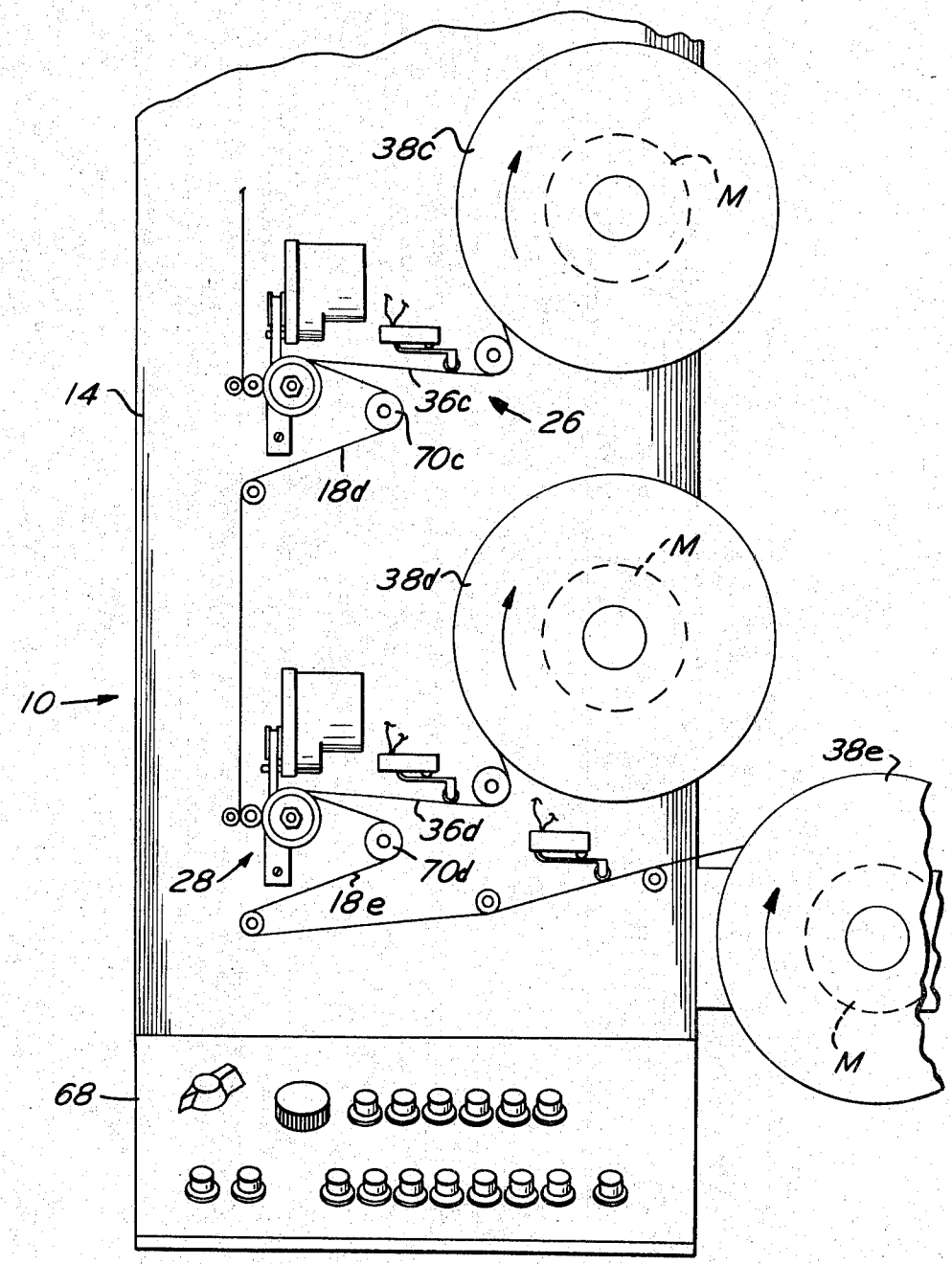


FIG. 1A

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FIG. 1B



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FIG. 2

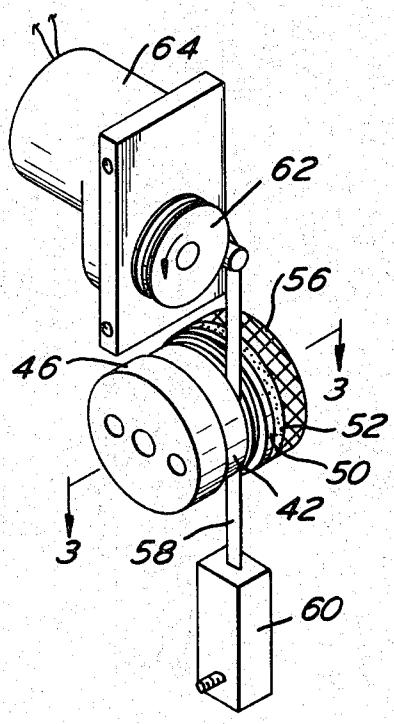
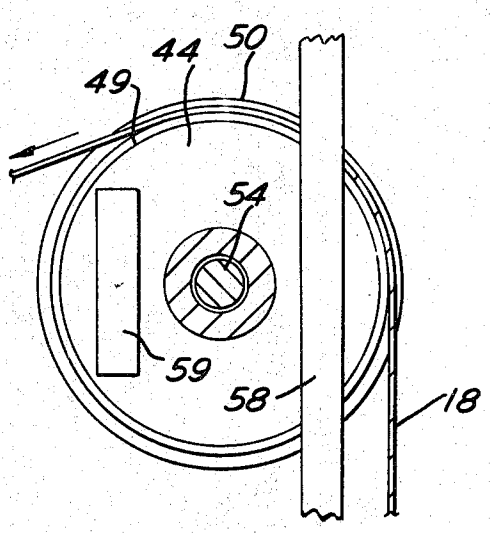


FIG. 4



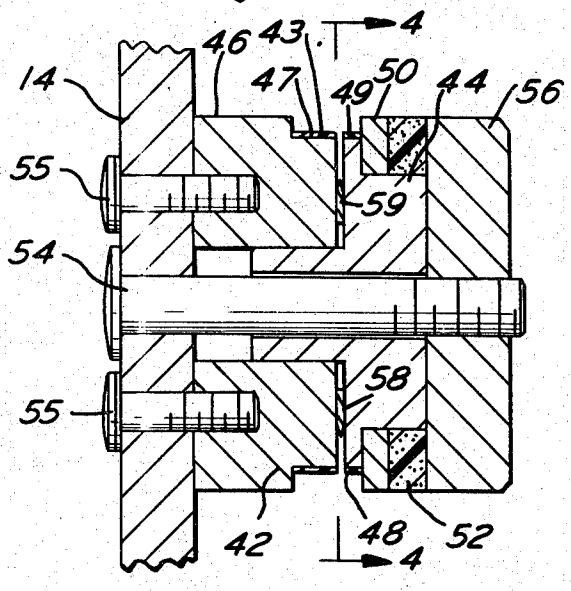


FIG. 3

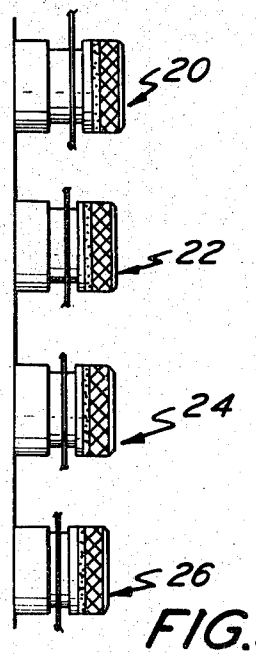


FIG. 5

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FIG.6

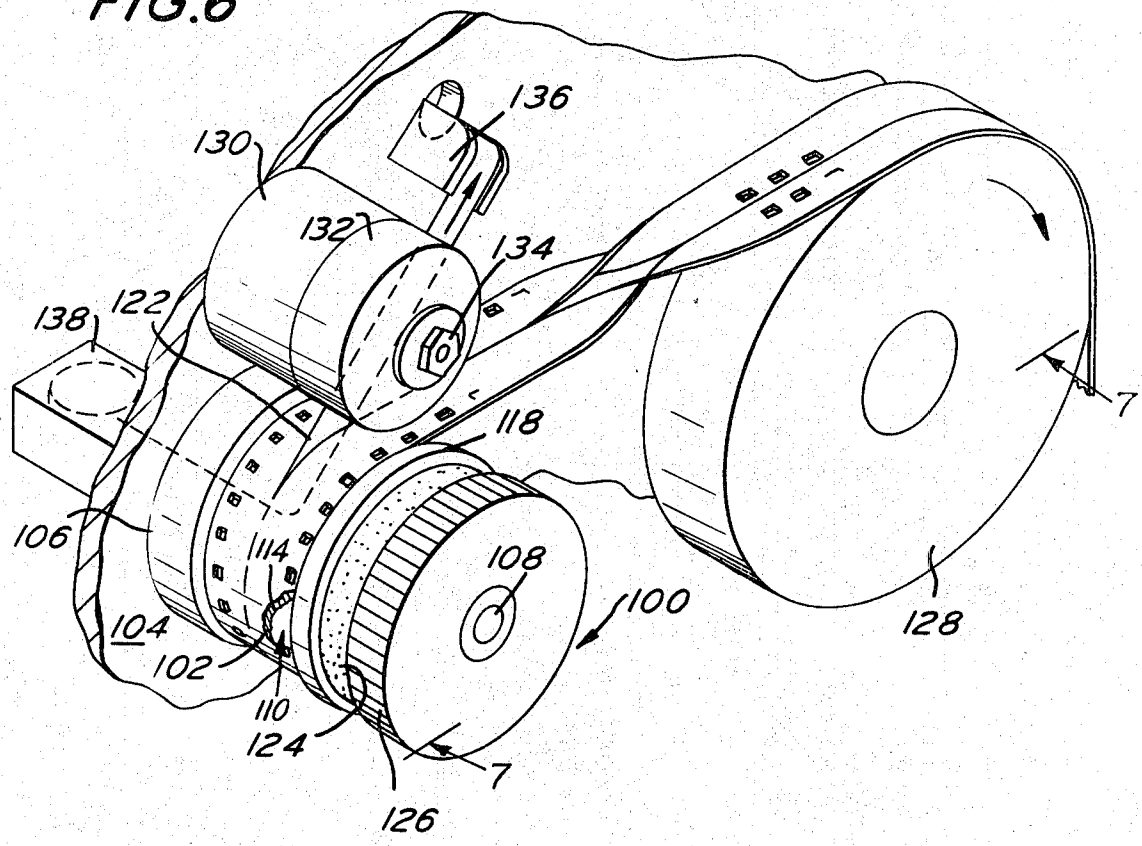
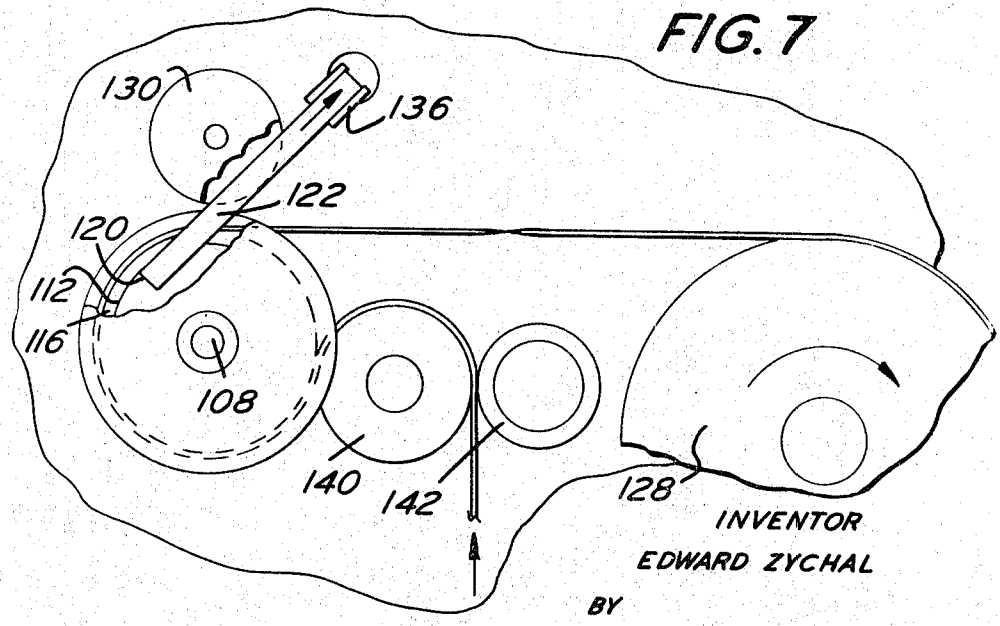


FIG.7



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United States Patent

[11] 3,545,322

[72] Inventor **Edward Zychal**
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[21] Appl. No. **774,720**
[22] Filed **Nov. 12, 1968**
[45] Patented **Dec. 8, 1970**

[73] Assignee **Zyco Manufacturing, Inc.**
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a corporation of Pennsylvania

[54] **SLITTING APPARATUS**
11 Claims, 8 Drawing Figs.

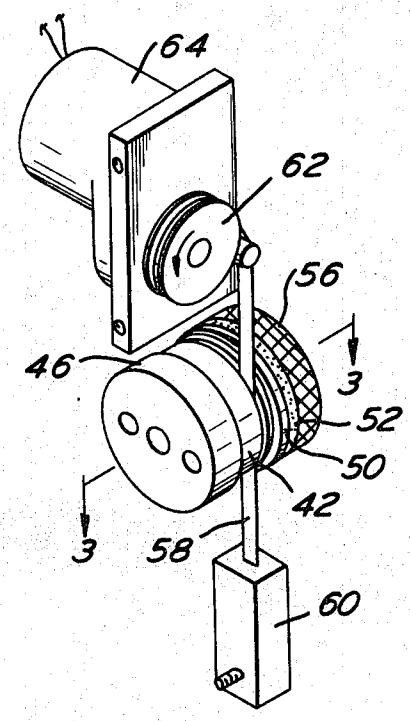
[52] **U.S. Cl.** **83/61,** 83/201, 83/201.15, 83/407, 83/425, 83/446, 83/449, 83/661; 242/56.7
[51] **Int. Cl.** **B26d 1/46**
[50] **Field of Search** ..... 83/61, 407, 201, 201.02, 201.14, 201.15, 425, 426, 427, 433, 435, 446, 449, 661; 242/56.2—567

[56] **References Cited**
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Primary Examiner—James M. Meister
Attorney—Seidel and Gonda

ABSTRACT: The apparatus slits tape by directing the tape to slitting stations disposed in series. The slitting stations may be disposed one above the other. At each station a narrow strip is slit from the tape by means of a strip blade which is adjustable so as to vary the cutting edge contact area. The apparatus is particularly adapted for slitting magnetic tape with great accuracy. In another embodiment a single slitting station is provided by slitting a predetermined width of movie film into two identical half portions.



SLITTING APPARATUS

It has been conventional heretofore to slit webs, tape, film, fabric and the like by means of a plurality of spaced parallel cutting blades which simultaneously slit the web into a plurality of strips. For example, see FIG. 5 of U.S. Pat. No. 2,781,839. In accordance with the present invention, the web or tape is slit in sequential stations with a narrow strip being slit from the web or tape at each station.

In accordance with one embodiment of the present invention, there is provided apparatus having a plurality of slitting stations. The slitting stations may be disposed one above the other and thereby conserve floor space. At each slitting station, a narrow strip is cut by means of a strip blade. The strip blade is maintained in a housing or cassette and periodically adjusted so as to vary the cutting edge contact area. The used portion of the blade is wound on a reel. At each station, the cut narrow strip is wound on a reel and the remainder of the web is directed to the next cutting station.

In another embodiment a 16-millimeter width of triacetate film may be cut into two identical 8-millimeter width at a single station. If desired, three stations, in series, may be provided to slit a 32-millimeter film into four 8-millimeter widths.

The apparatus of the present invention can maintain close tolerances whereby tape or film may be slit with an accuracy of .001 inches. The factors or characteristics of the apparatus which contribute to such accuracy include provision for minimizing skewing, the narrowness of the width of the cutting edge on the blade, automatic adjusting of the cutting edge contact area, etc. Means are provided to shut down the entire apparatus when there is a breakage of the tape so as to prevent wastage of material.

It is an object of the present invention to provide a novel slitting apparatus.

It is an object of the present invention to provide a novel slitting apparatus wherein a narrow strip is slit from a web at sequential slitting stations.

It is another object of the present invention to provide a slitting apparatus which sequentially slits a narrow strip from a side edge of a tape by means of an adjustable strip blade.

It is another object of the present invention to provide a novel slitting apparatus for slitting magnetic tape with great accuracy.

It is another object of the present invention to provide a slitting apparatus for slitting a width of triacetate film into equal segments.

Other objects will appear hereinafter.

For the purpose of illustrating the invention there are shown in the drawings forms which are presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIG. 1A is a front elevation view of the top portion of the apparatus of the present invention;

FIG. 1B is a front elevation view of the bottom portion of the apparatus shown in FIG. 1A;

FIG. 2 is a perspective view of a slitting station utilizing the apparatus shown in FIGS. 1A and 1B;

FIG. 3 is a sectional view taken along line 3–3 in FIG. 2;

FIG. 4 is a sectional view taken along the line 4–4 in FIG. 3;

FIG. 5 is an end view of the slitting stations, on a reduced scale, shown in FIGS. 1A and 1B;

FIG. 6 is a perspective view of a slitting station utilized in an alternative embodiment of the present invention; and

FIG. 7 is a section view taken along the line 7–7 in FIG. 6.

Referring to the drawings in detail, wherein like numerals indicate like elements, there is shown in FIGS. 1A and 1B a tape slitting apparatus of one embodiment of the present invention designated generally as **10**. The apparatus **10** includes an upright frame **14** supporting at its upper end a tape supply reel **12** which is to be slit into narrow strips. The reel **12** is rotatably supported by the spindle **16** of a torque motor M which maintains a torque in the direction shown by the arrow superimposed over reel **12**. The torque control for all of the torque motors M of the entire apparatus **10** originates at the reel **12** by means of torque arm **13** which follows the position of the residue of tape on the supply reel **12**. The torque motors are conventional and are shown in phantom line in the drawings.

Tape **18** is unwound from the reel **12** and sequentially fed through a series of cutting stations **20**, **22**, **24**, **26** and **28** disposed one above the other on the frame **14**. The tape **18** in a particular embodiment may be a magnetic tape such as an acetate base tape having a magnetizable coating of a material such as iron oxide on its uppermost surface when fed to each of the slitting stations. The tape **18** is fed around an idler roll **30** and directed to the slitting station **20** which includes a free wheeling idler roller **32** which may be made from a smooth substantially friction-free material such as nylon.

At station **20**, a narrow strip **36** is slit from the tape **18** to thereby produce a remainder tape designated as **18***a*. Tape **18***a* is narrower than tape **18** by the width of strip **36**. The strip **36** is wound on a reel **38**. Reel **38** is mounted on the spindle **40** of a torque motor.

To facilitate slitting strip **36** from tape **18** at station **20**, there is provided a stationary spool **42** having a stationary end piece **44** as shown more clearly in FIG. 3. The spool **42** has a flange **46** and a reduced diameter portion **47** provided with a friction-free coating **43** made from a material such as Teflon. End piece **44** is telescopically received by the spool **42** and is provided with a flange **48**. The diameter of flange **48** corresponds to the diameter of spool **42**. The peripheral surface of flange **48** is provided with a coating **49** similar to the coating **43**.

A bolt **54** is threaded and locked to the frame **14**. Bolt **54** extends through the coaxial spool **42** and end piece **44**. Suitable locking bolts **55** are secured to spool **42** and prevent spool **42** from rotating. A plastic washer **50** made from a material such as nylon abuts the end face of end piece **44**. A washer **52** overlies the washer **50**. Washer **52** is preferably made from a foam polymeric material such as foam polyurethane. The components are maintained in assembled relationship as shown in FIG. 4 by means of the thumbnut **56** threaded to the bolt **54**. It will be noted that there is a gap between the end face of spool **42** and the flange **48**. A portion of a strip blade **58** is gripped firmly within the gap.

Accuracy of the slit widths of tape is maintained by design dimensions of the slitting assembly. Referring in particular to FIG. 3 width of reduced diameter portion **47**, flange **48** and the thickness of the blade **58** is always less than the width of the tape so that the tape is always maintained up against flange **46** as a result of the floating tension exerted on washer **50** by resilient foam washer **52**. This structural interrelationship exists at all slitting stations.

As shown more clearly in FIG. 2, the strip blade **58** extends from a supply housing or cassette **60**, through the gap, and is wound on a reel **62** by a gear motor **64** having a built-in timing mechanism for periodic operation. The strip blade **58** has a substantial length such as 6 feet. The blade **58** preferably has a thickness of approximately .0015 inches, and is maintained in tension by the motor **64** and the clamping of the thumbnut **56** which forces end piece **44** toward spool **42**. The advancement of the blade **58** to change the cutting edge contact area is extremely small and is approximately .020 to .030 inches. A strip of blade **59** may be utilized as a shim to balance the assembly. The shim may be held in place by a grease smear.

As more clearly shown in FIG. 1A, the tape **18***a* is slit into a narrow strip **36***a* with the remainder being designated **18***b*. The strip **36***a* is wound on reel **38***a*.

The tape **18***b* is directed from station **22** to station **24**. At station **24**, the tape **18***b* is slit into a narrow strip **36***b* with the remainder being designated as **18***c*. The strip **36***b* is wound on reel **38***b*.

The tape l tape **18***c* is directed from station **24** to station **26**. At station **26**, the tape **18***c* is slit into a strip **36***c* with the remainder being designated **18***d*. The strip **36***c* is wound on reel **38***c*.

The tape **18***d* is directed from station **26** to station **28**. At station **28**, the tape **18***d* is slit into strip **36***d* with the remainder

being designated 18*e*. The strip 36*d* is wound on reel 38*d*. The remainder of tape 18*e* is wound on reel 38*e*. Depending upon the width of the tape 18, the tape 18*e* may be of the same or different widths as compared with the narrow strips wound on the reels 38.

The structure of each of the stations 20—28 is identical except as will be clear from FIG. 5. As shown in FIG. 5, the length of the reduced diameter portion 47 of the spool 42 is progressively shorter. As shown in FIG. 1B, the apparatus 10 is provided with an instrument control panel 68 containing the knobs, buttons, switches, and the like which may be used to control the various torque motors coupled to the reels and the supply roll 12. Suitable controls may also be provided for manual operation of the blade takeup motors 64 for each of the blades. Between each slitting station and the reel for the slit narrow strip, there is provided a microswitch 66 having a floating arm which contacts the narrow strip. In the event of breakage in the strip, the associated microswitch for that station will stop the entire apparatus 10.

In operation, when starting with a full reel of tape 18, torque on the motor for spindle 16 must be maintained at the maximum amount and diminish as the supply of tape is unwound off the reel 12. On the other hand, as the spindle 40 accumulates the slit narrow strip 36, the torque on spindle 40 must be maintained low and increased as the reel fills up. The continuous feeding of the tape may be accomplished by motor-driven capstans 70, 70*a*, 70*b*, 70*c* and 70*d*. If desired, a transparent plastic guard may be provided to protect fingers from being sliced by the razor edge on strip blade 58.

Due to the fact that the strips are cut from the tape one at a time with accurate registration at each strip, mistakes in adjustment are not compounded so as to ruin an entire reel. I have found that apparatus 10 to be particularly useful for cutting magnetic tape into strips .030 inches wide with an accuracy of .001 inches.

An alternative embodiment of the present invention is shown in FIGS. 6 and 7. A station 100 is provided for slitting triacetate movie film 102 which is substantially thicker than the tape 18 which is slit by the apparatus 10.

The film 102 may be a 16-millimeter width of movie film which may be slit into two equal 8-millimeter splits. While only a single slitting station is disclosed in FIGS. 6 and 7, it is within the scope of the invention to provide three stations in series to slit 32-millimeter film into four 8-millimeter film widths.

The apparatus 100 includes a frame 104. A stationary spool 106 is secured to frame 104. A bolt 108 is threaded and locked to the frame 104. Bolt 108 extends through the spool 106. The spool 106 and means for attaching the same to the frame 104 are substantially identical to the spool 42 discussed in reference to apparatus 10. Also, an end piece 110, while dimensionally different, is structurally similar to end piece 44 as discussed with reference to apparatus 10.

The spool 106 is provided with a reduced diameter portion 112. The end piece 110 is provided with a flange 114 which is equal in diameter to the reduced diameter portion 112.

It is important when slitting the film to avoid abrading the film with any friction since any abrasion will substantially adversely affect the quality of the film. Accordingly, bands 116 are provided on both the flange 114 and the reduced diameter portion 112. The bands consist of thin shells of accurately machined Delrin AF which is essentially an acetal resin impregnated with Teflon. The thin shell bands 116 ride freely over the accurately machined reduced diameter portion 112 and flange 114 and permits the film to pass with a minimum of interference. It is to be noted that only one band 116 is shown. The band 116 is illustrated in FIG. 7 on reduced diameter portion 112 and is not illustrated on the flange 114. However, as set forth hereinabove, a band 116 is provided on flange 114.

A plastic washer 118 rides against one edge of the film 102 as the film passes through the reduced diameter portion 112 and flange 114. The spools 106 is provided with a radial slot 120 therein. The slot 120 need not necessarily lie on a radii of the spool 106. A strip blade 122 emanates from behind the frame 104, extends through the radial slot 120 and is firmly gripped between the spool 106 and the end piece 110.

A washer 124 made from a foam polymeric material, such as foam polyurethane, is forced against the plastic washer 118 by thumbnut 126 which threadingly engages the end of bolt 108. The thumbnut 126 is also utilized to control the pressure of the blade grippage since the thumbnut bears down upon a solid metal portion of the end piece 110. The thumbnut 126 also accommodates variations of film width caused by slight imperfections, such as splices in the film, by providing sufficient pressure against the resilient washer 124 to maintain the floating washer 118 firmly against the edge of the film.

The principle difference between the film slitter 100 and the tape slitter 10 is the angle of attack of the blade 122 on the material and the manner in which the material is cut and handled. The blade 122 emanates from the slitting roll generally tangentially so that the slit is generated substantially along the edge of the blade as the film is beginning to lift off the reduced diameter portion 112 and the flange 114 as the film contacts the blade 122. In order to facilitate cutting the film, in view of the hardness of the film in conjunction with the narrowness of the blade, the film is twisted 180° in the span between the spool 106 and the end piece 110 and the drive wheel assembly 128. The drive wheel assembly 128 has a friction driving surface. This arrangement provides a peeling away of the film from the blade as it is cutting resulting in a very minimal blade wear.

A pair of friction guide rolls 130 and 132 are machined so that the interface between the rolls is directly in line with blade 122 as it emanates from between the spool 106 and end piece 110. The blade 122 passes between the rollers 130 and 132 and the washer and nut assembly 134 insures the maintenance of reasonable tension on the blade 122. The blade 122 emanates from between the friction rollers 130 and 132 and passes over a right angle guide block 136. The blade passes through the frame 104 to a windup shaft mounted behind the frame. The windup mechanism for the blade may consist of a small geared motor driving a worm gear train so that the blade is constantly moving at a rate of .019 inches per minute, while the machine is in operation.

In adjusting the thumbnut 126, the thumbnut must be tightened until there is sufficient tension on the blade so that it maintains a very stiff condition. However, the force of the small geared motor behind the panel must in all cases overcome the clamping pressure exerted by the thumbnut 126. The blade 122 is fed from a suitable cassette 138 containing a roll of approximately 6 feet of strip blade. The cassette 138 may be suitably mounted on and supported by the frame 104.

In the preferred embodiment there is approximately 6 inches between the center line of bolts 108 and the center line of the drive wheel assembly 128 to permit a smooth transition in the flipping of the film 102 as it passes onto the drive roll in an inverted condition. A stationary guide 142 and a rotating plastic roller 140 guide the film firmly onto the spool 106 and end piece 110.

The film is thereafter taken from the drive wheel assembly and wound up on suitable windup reels. The principle differences between the film slitting apparatus 100 and the tape slitting apparatus 10 are the position of the strip blade, the provision of rotating bands 116 on the apparatus 100, and the twisting of the film 180° to relieve cutting stresses.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification as indicating the scope of the invention.

I claim:

1. Apparatus for slitting a narrow strip of material comprising at least one cutting station having a curved surface over which material to be slit is drawn, a strip blade associated with said surface for cutting the material extending around said surface, said blade lying in a plane perpendicular to the axis of

said surface at the area where the cutting edge of said blade contacts said material, means for moving the blade to vary the cutting edge contact area and a reel to facilitate winding up the cut strip.

2. Apparatus in accordance with claim 1 including a plurality of such cutting stations arranged in series while disposed at different elevations and mounted on a common frame, and means for feeding the material remainder from each station to the next station.

3. Apparatus in accordance with claim 1 including a supply reel from which the material to be slit may be unwound, a torque motor spindle supporting said supply reel, and a microswitch for stopping the apparatus in response to breakage of the cut strip.

4. Apparatus in accordance with claim 1 including a housing from which the strip blade may be withdrawn, and a reel for winding up previously used portions of the blade, the last-mentioned reel being coupled to a motor and forming a part of said means for moving the blade.

5. Apparatus in accordance with claim 1 wherein said curved surface is a stationary spool member having a gap or slot within which a portion of the blade is received, and said spool member having a coating of a frictionless material thereon.

6. Apparatus for slitting a narrow strip from a tape comprising a supply reel, a first cutting station for receiving the tape from the reel and slitting a narrow strip from the tape, a reel for winding up the slit strip, a strip blade for slitting the strip from said tape, means for moving the blade so as to vary the cutting edge contact ares, a second station for receiving the remainder of the tape and at which means are provided for slitting another narrow strip from said remainder of the tape, said second station being disposed below the first station, and a reel at said second station for winding up the strip cut at said second station.

7. Apparatus in accordance with claim 6 wherein said means for moving the blade includes an intermittently operated motorized reel for winding up the strip blade about an axis generally perpendicular to the axis of said supply reel.

8. Apparatus in accordance with claim 6 wherein each of said stations includes a stationary spool having a flange at one end, a first washer member coaxial with said spool and bearing against one edge of the tape, a resilient washer juxtaposed to said first washer member and means coaxial with said spool juxtaposed to said resilient washer for applying pressure to said member to retain said tape in intimate contact with said flange.

9. Apparatus for slitting a narrow strip from a material comprising at least one cutting station having a curved surface over which material to be slit is drawn, a strip blade associated with said surface for cutting the material extending around said surface, a supply reel from which material to be slit may be unwound, a housing from which the strip blade may be withdrawn, means for moving the blade to vary the cutting edge contact area, a reel for winding up previously used portions of the blade, the last-mentioned reel being coupled to a motor and forming a part of said means for moving the blade, and a reel to facilitate winding up the cut strip.

10. Apparatus as set forth in claim 9 wherein said curved surface includes a spool having a gap therein, a slot in said spool through which said strip blade may be drawn, said strip blade being received in said gap, a drive wheel assembly spaced from said spool, said material extending between said spool and said drive wheel assembly and said material being twisted 180° between said spool and said drive wheel assembly.

11. Apparatus as set forth in claim 10 including frictionless rotating bands on said spool, and friction guide rolls for maintaining said blade in a taut condition.