June 22, 1971 J. V. BERG 3,586,586

TAPE APPLICATING AND SEVERING MEANS

Filed Dec. 15, 1969 2 Sheets-Sheet 1

FIG. 1

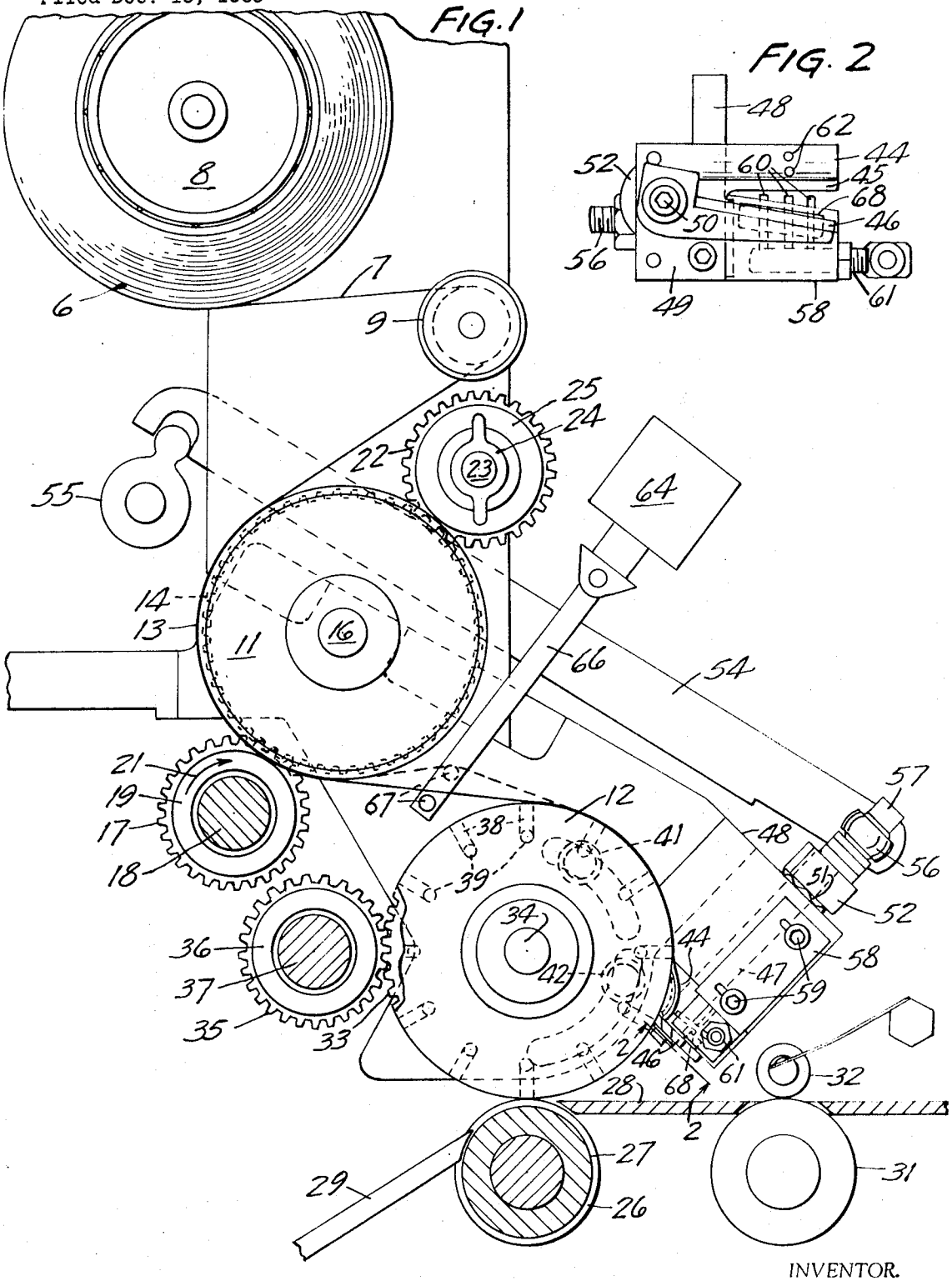

FIG. 2

INVENTOR.
JACK V. BERG
BY
Carpenter, Kinney & Coulter
ATTORNEYS

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Filed Dec. 15, 1969 2 Sheets-Sheet 2

FIG. 3

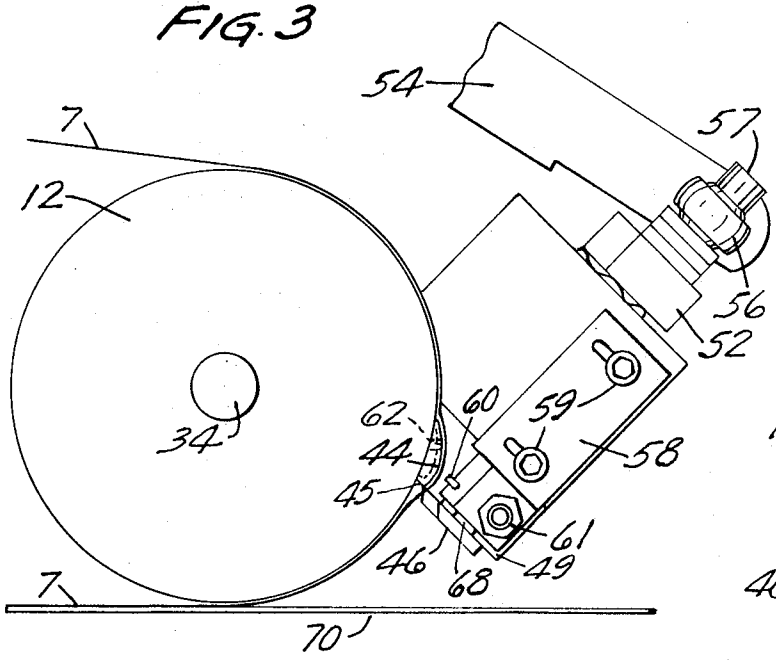


FIG. 5

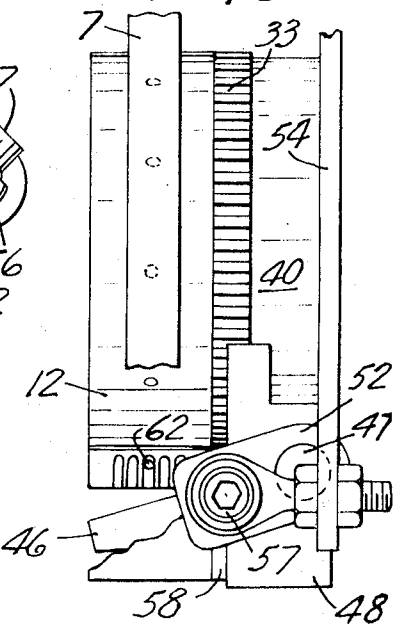


FIG. 4

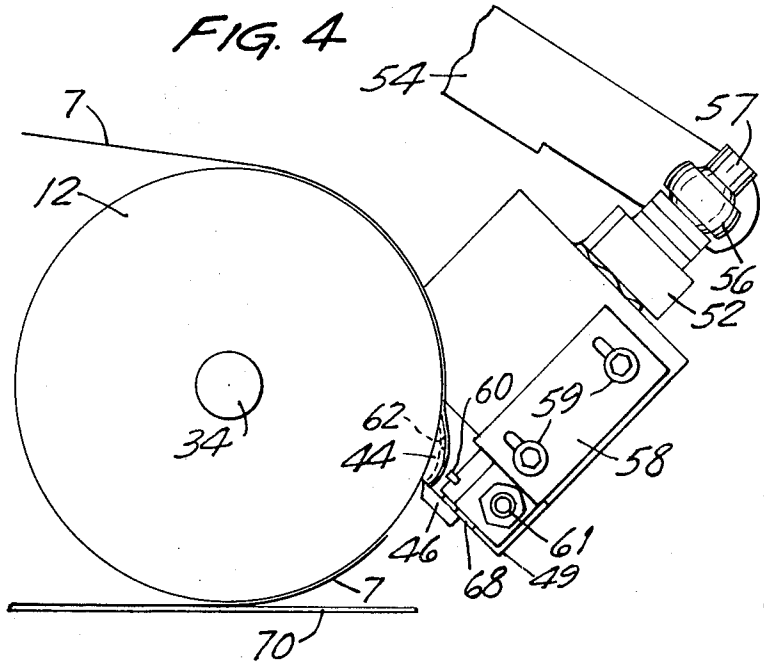
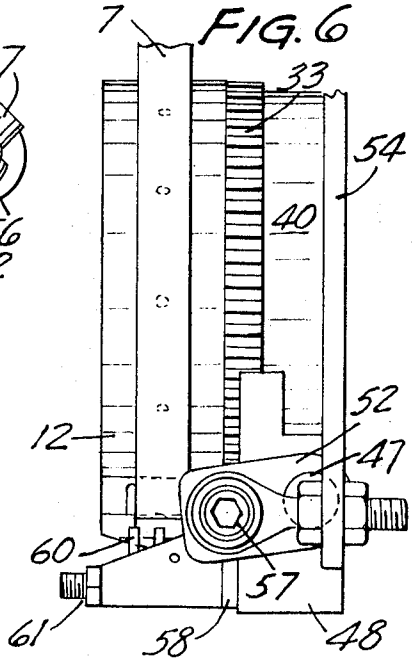


FIG. 6



INVENTOR.
JACK V. BERG
BY
Carpenter, Kinney & Coulter
ATTORNEYS

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TAPE APPLICATING AND SEVERING MEANS

Jack V. Berg, 2501 Hudson Road, St. Paul, Minn. 55119

Continuation of application Ser. No. 587,814, Oct. 19, 1966. This application Dec. 15, 1969, Ser. No. 884,767
Int. Cl. B32b 31/18
U.S. Cl. 156—521 12 Claims

ABSTRACT OF THE DISCLOSURE

A tape dispensing device in which the tape is transported from a rest position to a dispensed position on the surface of a member to which it is attracted by a physical force and including stationary bridge means for lifting successive portions of the tape from the transport member intermediate the rest and dispensed positions as the tape is moved and means for severing the tape in the lifted area to permit dispensing of random lengths.

This application is a continuation-in-part of Ser. No. 587,814, filed Oct. 19, 1966, now abandoned.

This invention relates to the dispensing and severing of various lengths of adhesive tape from a supply thereof, and in one aspect, to a novel dispensing, severing and applying apparatus for dispensing and severing lengths of normally tacky pressure-sensitive adhesive tape drawn from commercial supply rolls thereof and for applying such severed lengths to the surface of an object or article.

Devices are available for applying strips of pressure-sensitive adhesive tape to objects or articles which may include sheet material. Such tape may be applied to sheet material, such as paper sheets, for purpose of reinforcing edges of the sheet or the tape may be adhesive transfer tape, permitting the application of an adhesive layer and removable backing strip to the sheet material. In any event, the tape is most accurately applied by the use of a rotatably mounted wheel which has vacuum means operative within the wheel to hold the tape against the wheel and transport it to the article. One primary difficulty however has been in dispensing and severing the desired lengths of tape and particularly severing any desired length either before application or after partial application of the tape to the article moving through the taping area. A machine which would dispense, support, and sever a wide variety of tapes into a wide range of tape lengths has not been successfully demonstrated heretofore. Also, the severing and application of a wide range of tape lengths by a single machine has not been successfully demonstrated with any prior known machines.

Prior machines using vacuum support technology have severed the tape after the same is removed from the supply roll and placed upon the vacuum applicating wheel by crushing the same against an anvil surface on the vacuum wheel. This has been accomplished by a rotary knife which is driven synchronously with the vacuum wheel having blades to crush the tape between an edge thereof and an anvil on the wheel surface. These machines require close manufacturing tolerances and do not offer the desired versatility as to lengths of tape because of the synchronous driving relationship required to present the rotating anvil and blade in opposed cutting position. Other devices which use a swinging knife to sever the tape may use a tape applying head to place the end of a length or strip of tape onto the article or onto an applying and buffing roller. These devices are less desirable than vacuum applicators because placement of the tape is not as accurate.

The present invention provides a novel tape dispensing, severing, and applying machine which utilizes a physical force for transporting and supporting the tape, and a machine which has considerably more versatility relative

to the lengths of tape it will dispense. The machine operation is independent of fixed parameters and is more economical than presently known devices using crush cutters because of the removal of the close manufacturing tolerances required in crush cutting machines. Further, it provides a device which may be used with a wide variety of tapes and one which is more reliable as concerns successive feeding cycles.

The present invention provides the novel combinative relationship of a vacuum transport for moving tape from a supply to a dispensed position and a cutter mechanism wherein means are provided for lifting or temporarily removing the tape from the surface of the vacuum transport intermediate the position on the transport where the tape first engages the same and the end position where the tape leaves the transport or is transferred to an article The severing means, which may be actuated manually, in response to movement of the article, or in response to an automatic program, is positioned to sever the tape in the area in which it is removed from the vacuum transport. Means are also provided for holding, by physical force, the end of the tape after a length has been severed therefrom and for guiding the end back to the surface of the transport upon subsequent actuation to advance the tape.

The novel features and advantages of the present invention will be more apparent and more fully described hereinbelow in reference to the accompanying drawings wherein:

FIG. 1 is a side elevation of a machine constructed in accordance with the present invention;

FIG. 2 is a detail bottom view taken in the direction of line 2—2 of FIG. 1;

FIGS. 3 and 4 are fragmentary side elevational views of the machine of FIG. 1 showing parts of the severing means in various positions; and

FIGS. 5 and 6 are fragmentary plan views of the severing means in positions corresponding respectively to FIGS. 3 and 4.

Referring to FIG. 1, a supply roll **6** of tape **7**, which may be any flexible web material and which is illustrated herein as a normally tacky pressure-sensitive adhesive tape, is mounted on a freely rotatable hub **8**. The tape is withdrawn from the roll **6**, adhesive side out, and travels over a guide roller **9** and onto a driven feed roll **11**. The drive speed and duration for the feed roll may be varied to feed selected lengths of tape from the supply roll **6** to a movable tape transporting and supporting member illustrated herein as a vacuum wheel **12**. The wheel **12** is provided with suction means so the end portion of a strip of tape placed upon the outer surface will adhere to the wheel to be moved thereby from a rest position to a dispensed position for removal as by application to an article. The feed wheel **11** has a sandpaper covering **13** on the outer peripheral surface thereof which engages the adhesive side of the tape **7**. The wheel **11** is secured to and driven by a coaxial gear wheel **14** and is mounted on a shaft **16**. Gear wheel **14** meshes with a pinion **17** supported on a drive shaft **18** by a commercially available one-way drive bearing **19** slidably mounted on the shaft **18**. The bearing **19** permits movement and location of the machine along the length of shaft **18**. Shaft **18** is driven from a suitable motor through a one-way releasable spring drive clutch in the direction of the arrow **21**. The gear wheel **14** also meshes with a braking pinion **22** which is rotatable on a fixed threaded rod **23**. The rod **23** carries an adjustable threaded thumb screw **24** which forces, through a pair of washers and an intermediate compression spring, a braking disk **25** against the face of pinion **22**, placing a continuous braking force thereon, affording more immediate stopping for the feed wheel **11** when the drive clutch for shaft **18** is released.

The free end of the tape adhering to the vacuum wheel **12** is carried thereby to an application area upon rotation of feed wheel **11**. At the application or transfer area the tape is transferred from the vacuum wheel **12** to the article. In the illustrated embodiment a guide roller **26**, which may have any desired length, is positioned beneath the vacuum wheel on an axis parallel to that of the vacuum wheel defining the application or transfer area with the vacuum wheel between which the article to be taped, as illustrated sheets of paper or posters, may pass. In this area an adhesive tape may be applied for purposes of reinforcing edges of the sheets or a tape known as adhesive transfer tape, having a coating of pressure-sensitive adhesive lightly adhering to a removable paper backing, may be applied to form posters or stickers. Support plates **28** and **29** guide the article to be taped to and from the transfer area respectively, between the wheel **12** and roller **26**. The roller **26** preferbaly has a plurality of circumferential axially spaced grooves **27** into which comb teeth formed on the support plate **29** may project to prevent the tape or the paper from wrapping on the roller **26**. Articles are fed to the transfer area by a drive roller **31** and spring biased pressure wheel **32**.

The vacuum wheel **12** has a gear wheel **33** mounted thereto and coaxial therewith on a fixed shaft **34**. Gear wheel **33** meshes with a pinion **35** mounted by a one-way drive bearing **36** to a continuously driven shaft **37**. The vacuum wheel **12** is provided with a plurality of radially extending bores **38** communicating with axially extending bores **39**. The bores **39** extend to the end of the wheel to communicate, upon rotation thereof, with openings or chambers in the opposed end wall of a fixed manifold **40**. The manifold **40** is connected in a well known manner with a vacuum source such that the wheel **12** will draw the tape **7** against its peripheral surface when the tape is trained around it. In the illustrated device two different pressures are applied to the vacuum wheel. One vacuum source (not shown) operates through a conduit and manifold opening **41** to create a continuous subatmospheric pressure, in the area of the first quadrant of the wheel, of, for example, about 23 inches (600 mm.) of mercury. A second source of vacuum (not shown) operates through a conduit and manifold opening **42** to create a continuous subatmospheric pressure, but of lower vacuum, for example, about 3 inches (80 mm.) of mercury on the area of the wheel representing the fourth quadrant of the wheel. These areas are respectively within the arcuate extent between the point where the tape **7** first engages the vacuum wheel to the location where the tape is lifted from the wheel and between the point where it is lifted to a point at which it is transferred to the article to be taped.

Positioned adjacent the wheel **12** and intermediate the ends of the area of the vacuum wheel **12** around which the tape travels, is a shoe or bridge piece **44** affording means for lifting or temporarily removing the tape from the surface of the transport wheel **12**. In the illustrated embodiment the bridge piece **44** is crescent-shaped in elevation, affording a sharp leading edge to direct the tape **7** off the surface of wheel **12** across the outer convex peripheral surface of the piece **44** and back onto the wheel to a dispensed position toward the applying station. The piece **44** has an inner concave surface mating the outer peripheral surface of the vacuum wheel **12** and the trailing edge of the piece **44** is truncated to form a flat surface **45**, (see FIG. 2) preferably substantially normal to the arcuate surface of piece **44**, which affords means on one side of the tape path to aid in cutting the tape. Actually, at the juncture between the outer arcuate surface and the flat surface **45** a cutting edge is formed cooperating with a blade disposed on the outer side of the tape. Because of the slight gap existing between the bridge piece and wheel **12**; and the fact that when the machine is not applying tape, as shown in FIG. 1, the manifold **42** is connected through bores **38** and **39** directly to the ambient air around wheel **12**; the source of vacuum connected to manifold opening **42** is capable of handling a large volume of air and thus able to maintain a subatmospheric pressure on the surface of wheel **12** and on the bridge piece **44**, as will hereinafter be described.

A pivoted blade **46** which is shaped to converge toward its outer end and which has a beveled face to define a cutting edge, is mounted on the lower end of a rod **47** adjacent the piece **44** and to one side of the wheel **12**. The blade **46** cooperates with the cutting edge on the piece **44** to provide cutting means disposed on opposite sides of the tape path for severing the tape into desired lengths, in the area where the tape is lifted from the surface of the vacuum wheel **12**. The rod **47** is mounted in and extends through a supporting frame **48** which is in turn secured by suitable means to the manifold **40** and through a planar supporting portion **49**, which is integral with and supports the bridge piece **44** (see FIG. 2). The knife blade **46** is fitted onto a square lower end portion of rod **47** and is fixed thereto by a washer and screw **50**. The blade **46** is biased into close fitting relation with the surface **45** of bridge piece **44** by a spring washer **51**, e.g. a Belleville spring, positioned about the rod **47** between the frame **48** and a radial crank arm **52** which is secured to the top of the rod **47** for rotating the rod and the knife blade **46**. The arm **52** is oscillated by a reciprocating link **54**, and an oscillating shaft **55**. Arm **52** is connected to the link **54** through a threaded eye bolt **56** and a stub shaft **57** fixed to the free end of arm **52**. The eye bolt **56** and stub shaft **57** have a bearing connection affording some universal movement.

Alternatively this cutting means could comprise the bridge **44** acting as a stationary anvil for use with a rotary cutting knife, driven independently of the vacuum wheel **12**, which would afford versatility similar to that of the illustrated embodiment because the rotary movement of the knife would not have to be in timed relation with that of the vacuum wheel.

After a length of tape is severed from the strip of tape it is necessary that the end of the strip of tape be held against the bridge piece **44** so that upon subsequent activation of the feed wheel **11** the tape will be guided over the bridge piece, back to the surface of the wheel **12**, and not follow the blade **46** or proceed in any direction except back to the surface of the wheel **12**. The tape can be held against the bridge piece **44** by means of one or more small air jets directed toward the outer arcuate surface of the bridge. In the illustrated embodiment, an L-shaped block **58**, formed with a pressure chamber, is adjustably mounted by suitable fasteners **59** to the frame **48**, with the horizontal leg spaced from and generally parallel to the bridge piece **44**. Three small discharge tubes **60** are placed in the horizontal leg in communication with the pressure chamber and are directed toward the bridge **44**. The pressure chamber is connected by a suitable coupling **61** to a source of compressed air.

Also, as in the illustrated embodiment, the bridge **44** may have one or more tiny openings **62** extending from the outer peripheral surface thereof toward the vacuum wheel **12** to communicate with the bores **38**. This allows the vacuum in the wheel **12** to act through the openings **62** and draw the tape toward the outer surface of the bridge piece. The outer surface of the bridge piece may further be formed with small grooves (see FIG. 5) to decrease the surface area contacting the tape as it moves across the bridge thereby reducing the amount of static charge on the tape.

In the illustrated embodiment, the vacuum wheel **12** is rotated continuously at a peripheral speed equal to or exceeding the linear speed of the tape **7** as it is fed fed by the feed wheel **11**. Wheel **11** is driven intermittently through angles of rotation or for a time duration sufficient to feed the desired length of tape to the labeling area between vacuum wheel **12** and conveying

roller **26**. The drive for the wheel **11** and the reciprocating rod **54**, for the cutter blade **46**, should operate synchronously such that when feeding of the tape begins the knife is immediately opened and when feeding is stopped the cutting occurs substantially simultaneously. Also connected with the feed arrangement is a solenoid assembly **64** having a coil and an armature with a link **66** connected to the armature and depending along the frame with the lower end positioned between the feed wheel **11** and the vacuum wheel **12**. The terminal end of the link carries a pin **67** which is positioned below the path of the tape **7** in the normal operating position. Upon stopping the rotation of the feed wheel **11** the cutter blade is actuated to cut the tape and the solenoid **64** is subsequently energized to lift the tape by means of the pin **67**, for retracting the cut end of the tape strip on the bridge piece **44** to a position above the cutting edge. The separation of the severed end of the tape slightly above the cutting edge decreases the possibility of the end of the tape being directed away from the bridge piece **44** and vacuum wheel **12** when the knife opens upon a subsequent actuation of the machine.

Means is also provided for lubricating the edge of the blade **46** to limit wear thereof against the flat surface **49** of the bridge piece **44** and to resist adhesive on the tape from adhering to the blade. This lubricating is accomplished by forming a cavity in the lower face of L-shaped block **58** and disposing a felt pad **68** in the cavity which projects therebelow and engages the upper surface of the blade **46**. An opening may be formed in the top of the block **58** which communicates with the cavity, for purposes of periodically saturating the pad **68** with oil.

FIGS. 3 and 5 illustrate the open position of the blade **46** as the tape **7** is carried around the vacuum wheel **12** and its applied to an article **70**. FIGS. 4 and 6 illustrate the position of the blade **46** as it severs the tape **7** upon termination of the feed of the tape by the feed wheel **11** from the supply source **6**. As the blade **46** moves from the open retracted position to the closed severing position, continued rotation of vacuum wheel **12** carries the severed length of tape to the article **70**.

As hereinbefore mentioned, the operation of the machine may be controlled manually or by means of a program to cut the tape into the lengths desired or when desired. When feeding sheets of paper to place a strip of tape along the length of the sheet an electric eye may be used in advance of the nip area between the wheel **12** and roller **26** to energize the machine as the leading edge enters the taping area and to discontinue feed and cut the tape as the trailing edge of the paper approaches the taping area. The electric sensing switch may also be used to start a program, as the leading edge of the article approaches the transfer station, which will control the operation of the applicator to apply one or more short lengths of tape to the article as it moves past the transfer station. Thus while the article is passing through the transfer area or transfer station, either a continuous strip of tape may be applied or the machine may be programmed to apply a number of shorter lengths of tape.

In applying very limp plastic tapes the amount of air pressure and/or suction applied at the outer arcuate surface of the bridge piece **44** should be less than when applying stiffer, paper-backed tapes. Too much pressure on the bridge does not allow the limp tape to push the free end of the strip over the bridge back onto the surface of the wheel **12**.

It has been noted that different materials forming various tapes may have an affinity with relation to the material forming wheel **12** which may be the same, a similar or different material than the tape, or in some instances create a static charge which is sufficient to adhere the web to the wheel, with very little or no suction, such that the tape will be moved therewith. In these instances the vacuum force may be decreased or the wheel may be formed with circumferential ridges and grooves to decrease this affinity, if not to be utilized to aid in the transport of the tape. In any event however, whether the transporting and supporting member is the wheel, as illustrated, or a bar and whether the tape is adhered by suction or other attractive force, the tape is lifted from the surface of the member to effect severing and the free end of the strip is held in place to be guided back to the transport upon subsequent actuation to afford further feeding.

Having thus described my invention by reference to a preferred embodiment and its operation, what is claimed is:

1. An apparatus for severing and dispensing lengths of tape comprising:

a movable tape transport member having a tape supporting surface and having means for applying a physical force on the end portion of a strip of tape to attract the same to said surface for movement therewith and to support the tape,

means for supporting a supply of tape with the free end portion of a said tape extending along at least a portion of said tape supporting surface,

means for mounting said member for movement to carry a said end portion of the tape from a rest position toward a dispensed position,

stationary bridge means for lifting successive portions of the tape from said member intermediate said tape rest and dispensed positions during movement of the tape by said member toward said dispensed position, and

means positioned on each side of the tape in the area where the tape is lifted for severing said tape when a desired length is dispensed.

2. An apparatus according to claim **1**, with the addition of means for applying a physical holding force on the end of a said tape after a length has been severed therefrom, which force may be overcome to afford subsequent advancement of another length of a said tape, said force being applied where a said tape is lifted from said member.

3. An apparatus according to claim **2**, wherein said means for lifting the tape comprises a bridge member positioned adjacent the transport member and over which the tape is progressively moved lifting the same temporarily from said transport member.

4. An apparatus according to claim **2**, wherein said means for severing said tape comprises a fixed cutting member positioned adjacent the tape supporting surface of said transport member and across which a said tape is moved, and a movable cutting member cooperating with said fixed cutting member to sever the dispensed length of tape.

5. An apparatus according to claim **4** wherein means are provided for retracting the free end portion of a said supply of tape along the stationary bridge means toward said supply from said means for severing said tape upon said tape being severed.

6. An apparatus according to claim **1**, wherein said means for lifting the tape comprises a stationary bridge member positioned adjacent the surface of said transport member to progressively lift the tape from said surface, and wherein means are provided for holding the free end of a said tape at the bridge member when a length of tape has been severed from said tape.

7. An apparatus for applying a severed length of adhesive tape to the surface of an article, comprising a continuously rotating tape dispensing wheel having a cylindrical pheripheral surface of substantially constant radius of curvature, disposed with its peripheral surface adjacent an area defining a tape applying station, means applying vacuum to said wheel tending to cause a said tape to adhere to the peripheral surface of the wheel

and travel therewith through a predetermined arcuate extent during its rotation, means for supporting a supply of a said tape with a free end portion trained adhesive side out around said peripheral surface in advance of the portion of said peripheral surface disposed adjacent said tape applying station, stationary bridge means intermediate said tape applying station and the portion of said peripheral surface to which the tape is first adhered for lifting successive portions of the tape from said peripheral surface as the tape is moved toward said applying station by said wheel, and means disposed on opposite sides of the area where the tape is lifted from said peripheral surface of the wheel for severing the tape.

8. An apparatus as claimed in claim **7**, wherein said means for lifting the tape comprises a stationary bridge piece positioned adjacent the periphery of said wheel and across which said tape is directed during movement of the tape toward a dispensed position at the applying station.

9. An apparatus as claimed in claim **8**, wherein means are provided for applying a force on the tape as the same is moved across said bridge piece and for applying a force on the free end of a said tape, after a length has been severed therefrom, restricting movement of a said free end away from said bridge piece until subsequent actuation of the apparatus to dispense more tape.

10. An apparatus as claimed in claim **9**, wherein said means for severing the tape comprises a stationary cutting element disposed adjacent the peripheral surface of said wheel and a movable blade cooperating with said element to sever the tape.

11. An apparatus as claimed in claim **7**, wherein said

means for lifting the tape from said peripheral surface of the wheel comprises a bridge piece, mounted in a stationary position adjacent said peripheral surface of said wheel, which piece has a concave surface mating a portion of the surface of said wheel and a convex surface over which the tape is passed, and said means for severing the tape comprises a cutting edge formed on said piece and a pivotably mounted blade cooperating with said edge to cut the tape, and comprising pressure means for holding the free end of a tape on said bridge piece after a length of tape has been severed.

12. An apparatus according to claim **11** wherein means are provided for retracting the free end portion of a said supply of tape along the stationary bridge means toward said supply from said means for severing said tape upon said tape being severed.

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BENJAMIN A. BORCHELT, Primary Examiner

J. V. DORAMUS, Assistant Examiner

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156—519; 83—152; 242—56