

March 4, 1952

S. C. LILLEY

2,587,634

APPARATUS FOR SPLITTING RUBBER THREAD

Filed Feb. 17, 1950

2 SHEETS—SHEET 1

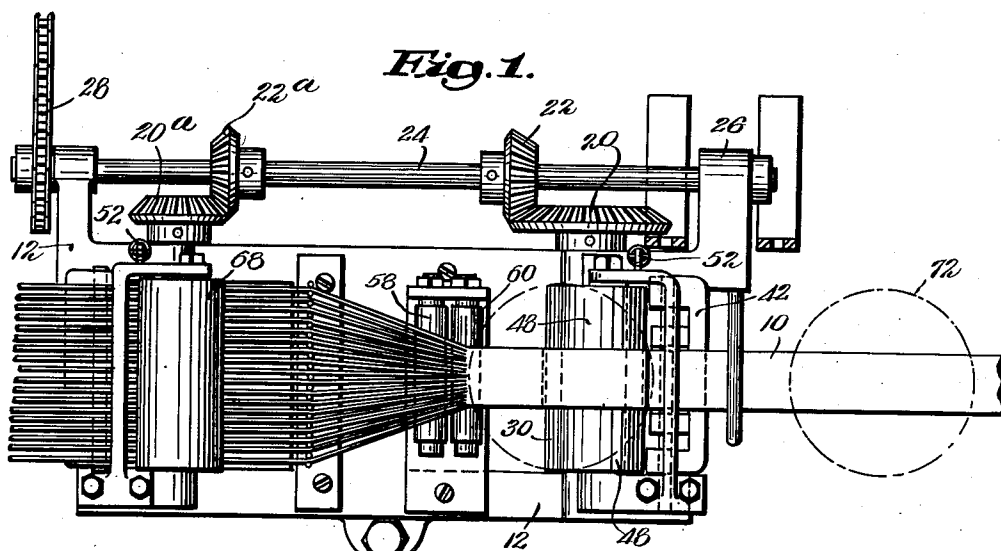


Fig. 3.

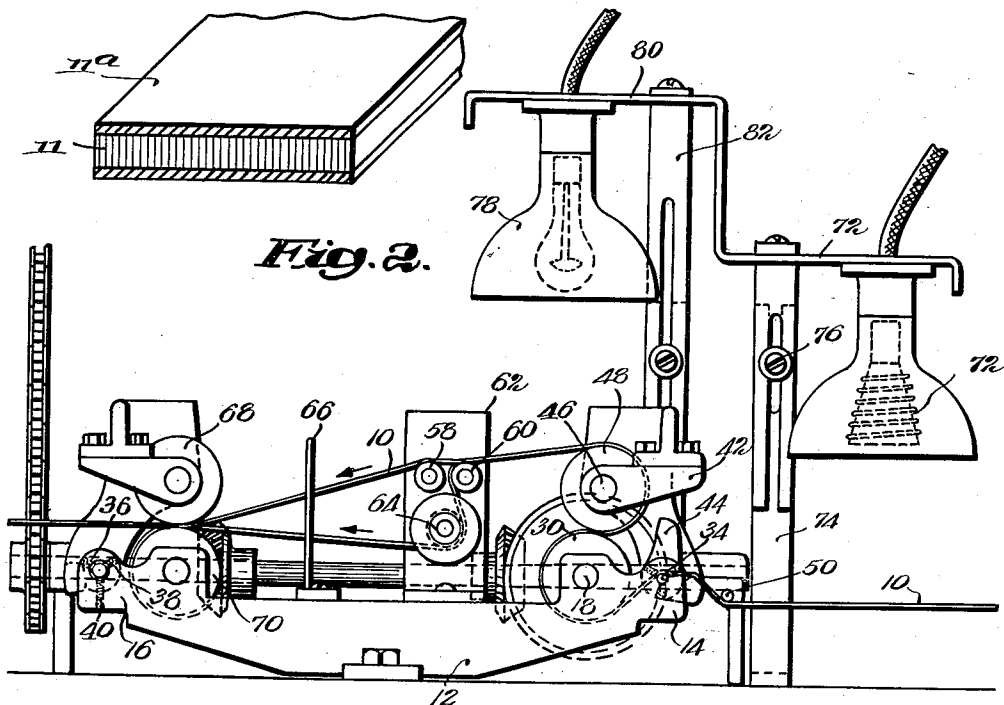


Fig. 2.

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2 SHEETS—SHEET 2

Fig. 4.

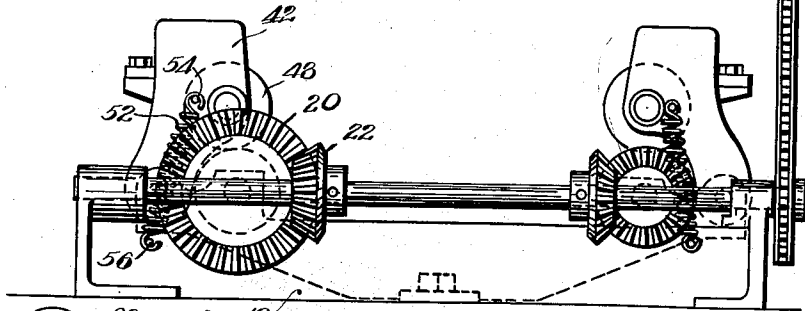


Fig. 6.

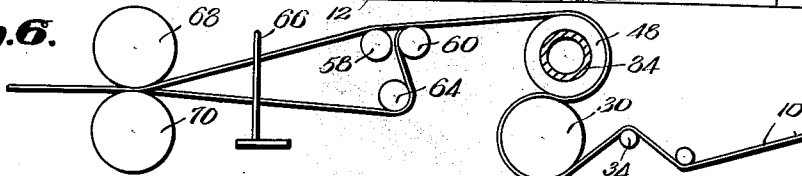


Fig. 7.

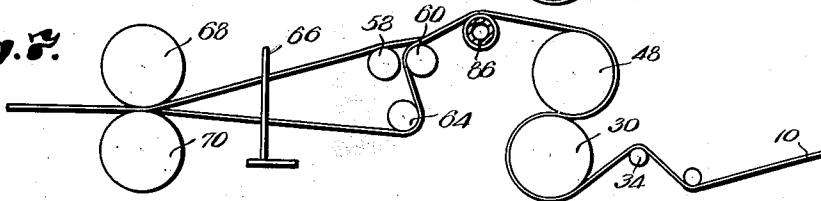


Fig. 5.

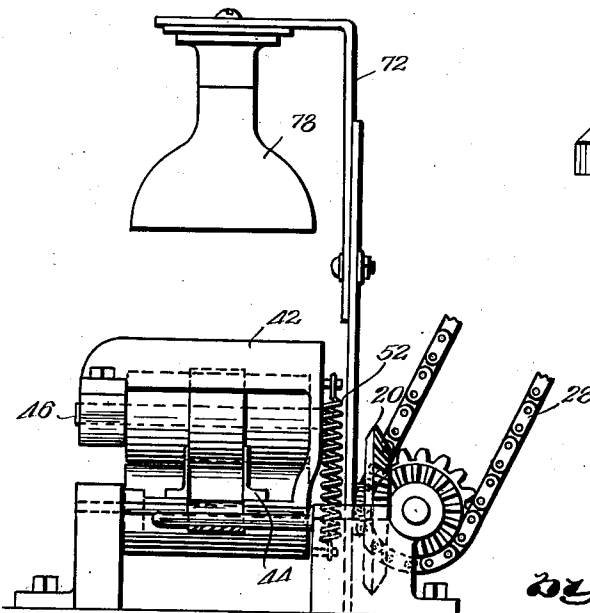
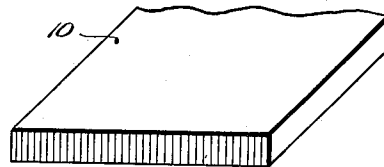


Fig. 8.



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UNITED STATES PATENT OFFICE

2,587,634

APPARATUS FOR SPLITTING RUBBER
THREAD

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6 Claims. (Cl. 164—84.5)

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This invention relates to improved apparatus for splitting rubber thread tape including the type in which individual rubber threads are adhesively but separably secured together side by side, and certain other types hereinafter described.

In prior patents such, for example, as Shaw Reissue No. 20,977, dated January 11, 1939, and assigned to the assignee of the present invention, a method of making rubber thread is disclosed which involves the production of a tape composed of a series of rubber threads positioned side by side and adhesively secured together with a controlled, but releasable, adhesion. Subsequently, as for example during the feeding of the tape to a loom, braider, covering machine, or the like, the tape is split or divided into its component threads and they can then be manipulated individually in the same manner as are threads originally produced as individual elements. The initial production of the desired number of threads for a given operation or product in the form of a tape, however, is a very important practical advantage of this method, and the invention, therefore, represents an important development in the rubber thread industry and in those arts, such as weaving, and others, in which the rubber thread is used.

The smooth operation of the final product, however, particularly when used in connection with a fabricating process, requires great care in the production of the tape, and particularly in the control of the adhesion of the threads to each other. Without extreme accuracy in such control, trouble occurs in the splitting of the tape into its individual threads, and even with much care, some difficulty is experienced at times in this splitting operation, more particularly because it produces a break in the individual thread.

The present invention is especially concerned with this operation of dividing the tape into its component threads, and it aims to improve both the methods of performing this operation and also the machines designed for this purpose with a view to eliminating the difficulty above described and even of facilitating that operation to such a degree that less care will be required in controlling the adhesion of the threads initially to each other during the production of the tape.

It is also an object of this invention to improve the methods and machines above referred to, to such a degree that this method of splitting a tape can be utilized in dividing tapes made up of a special type of covered rubber threads which are

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secured together with a considerable degree of adhesion, such as would normally prevent the splitting operation from being carried out.

An important field for such a method, and for a machine for practicing that method, is presented in the manufacture of this special type of rubber thread disclosed in my earlier Pat. No. 2,146,966, granted February 14, 1939. That thread carries a coating of thermoplastic elastic material which serves the important function of anchoring the covering thread to the rubber core in producing a covered rubber thread. I have found that the method disclosed in the reissue patent above mentioned can be used to advantage in producing my thread. That is, the rubber thread in the form of a ribbon can be produced in the manner disclosed in the first patent above mentioned, coated with the bonding material disclosed in my patent and later split into individual threads through the use of the invention hereinafter described, thus effecting a substantial economy in the manufacture of this product.

These and other objects of the invention will be more fully appreciated and understood from the following description of preferred embodiments of the invention selected for the purposes of illustration and shown in the accompanying drawings, in which

Fig. 1 is a plan view of the thread splitting machine of the invention showing a plurality of individual rubber threads having been divided out of a tape member and being led off in diverging relation;

Fig. 2 is a side elevational view further showing the splitting machine and particularly illustrating an arrangement of heating elements combined therewith;

Fig. 3 is a detailed perspective view illustrating diagrammatically a coated rubber thread tape body;

Fig. 4 is an elevational view of one side of the machine showing the driving means therefor;

Fig. 5 is an end elevational view further illustrating the arrangement of one of the heating elements shown in Fig. 2;

Fig. 6 is a diagrammatic view indicating one typical series of steps practiced in accordance with the invention with respect to heating a tape member;

Fig. 7 is another diagrammatic view showing a modified form of heating operation; and

Fig. 8 is a detailed perspective view of an uncoated form of rubber tape material.

I have discovered that the application of heat in a properly chosen degree, to a rubber thread

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tape while under tension, may be carried out with novel results in splitting the individual rubber threads of varying forms of rubber thread tape bodies, including the type disclosed in Reissue Pat. No. 20,977 noted above, and certain others hereinafter described, all of which are constituted from rubber threads occurring in a cured or finished state.

In accordance with the invention I provide for raising the temperature of a stretched rubber thread tape in such degree as to modify the bonding material which holds the threads together and to reduce the tensile strength of the bonding material to a considerable degree. The heating step is preferably carried out by subjecting the tape to the action of one or more heating elements arranged to heat the tape as it passes through apparatus for stretching and dividing the latter member, as suggested in Figs. 1 and 2 of the drawings.

In raising the temperature of the tape as it passes through the splitting apparatus, there may be employed for the heating elements noted, electrical heating members combined either internally or externally of the feeding rolls in the rubber thread splitting machine or supported on independently mounted rods in the machine, or there may be used one or more infrared lamps located above the tape, as well as various other arrangements of heating agencies.

I find that in raising the temperature of a rubber thread tape which is either under tension at the point where it undergoes heating or comes into a state of tension almost immediately upon being heated, there are encountered certain limiting factors which require that a definite range of heat be adhered to in order to obtain satisfactory results.

Thus, in this connection I have found that too high a temperature will result in stretching the threads undesirably as they move along under tension. This is because an increase in temperature may lower the modulus of elasticity of rubber and rubber-like materials. The temperature resorted to, therefore, must be kept within such limits as will facilitate the splitting action to a substantial degree and yet avoid the undesirable stretching noted above. A further factor to be taken into consideration in selecting a proper temperature is that too high a temperature induces undesirable oxidation effects with respect to the rubber thread and its bonding agents.

As an example of one preferred heating temperature successfully used in carrying out the method of the invention, there may be cited an operating temperature of approximately 150° F. to which the rubber tape may be raised just prior to, or during, the period in which it comes into tension between the feeding mechanism and the splitting apparatus proper.

I find that the heating temperature may vary and depend partly upon the rate at which the tape is passed through the splitting machine; partly on the gauge of the rubber into which it will be split; and partly on the composition of the rubber, as well as possibly other factors. A range of operating temperatures which has been found to provide good working results, having due regard for these variables, consists in a range of from 110° F. to 220° F. With such an operating range it is found that the splitting operation is greatly facilitated in several respects. A faster dividing action may be carried on but, more importantly, a cleaner split is achieved with less tendency to produce a break in individual threads

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and a greater amount of latitude is afforded in the control and means by which the threads are bonded to one another in tape form.

By reducing the occurrence of ragged edges on the individual threads, the utilization of these strands in subsequent textile operations is facilitated and efficient and uniform application assured, especially with respect to rubber thread tape of the type referred to in Reissue Pat. No. 20,977. A rubber thread tape of this class has been diagrammatically illustrated in Fig. 8 of the drawings and noted by the numeral 10.

The method of the invention is further exemplified by treatment of a rubber thread tape of a type not heretofore made commercially and in which the individual threads are not only secured to one another by adhesive bonds but are coated with a thermoplastic material corresponding to the thermoplastic material of Patent No. 2,146,966 above referred to and diagrammatically illustrated in Fig. 3 of the drawings. Numeral 11 denotes the tape body and numeral 11a refers to the thermoplastic body.

It is pointed out that in using the thermoplastic material of Pat. No. 2,146,966 individual threads only were coated since attempts to apply the thermoplastic as a coating to a tape of adhesively bonded threads lying side by side resulted in a product which prior to the present invention could not be satisfactorily split into individual threads.

By heating this coated type of tape in accordance with the method of the present invention, however, it becomes possible to lower the modulus of elasticity of both the intervening thread bonds and the overlying thermoplastic layer, or to otherwise modify these portions so that their tensile strength is reduced to a point where a rapid and efficient splitting of individual threads may be carried out, thus making possible practical utilization of thermoplastic coated threads in tape form for textile operations in a manner not heretofore achieved.

In attaining these desirable new results, there is also provided improved rubber thread splitting mechanism for carrying out the method of the invention in a unique and thoroughly practical manner. The invention may be more clearly understood from the following description of this mechanism.

In the structure shown in Figs. 1 and 2 of the drawings, numeral 10 denotes an uncoated rubber thread tape composed of individual rubber threads adhesively but separably secured together side by side in the manner outlined in said Reissue Pat. No. 20,977. The tape member is led forwardly to a feeding mechanism of the tape splitting apparatus, as indicated at the right-hand side of Fig. 1; then to a tape splitting apparatus under tension; and then to a thread guiding means.

As will be seen from an inspection of Figs. 1 and 2, the machine includes a rectangular frame 12 which may be bolted to a table, or other supporting member, and which includes upwardly extending extremities or ends 14 and 16. At the right-hand side of the frame, as viewed in Figs. 1 and 2, there is provided a shaft 18 rotatably mounted in bearings in the ends 14 and 16 and having fixed thereto a bevel gear 20 which meshes with a small gear 22 fast on a drive shaft 24 extending in parallel spaced relation to the frame 12. Also mounted on member 24 are gears 20a and 22a, and gear 20a is of much smaller size than gear 20 which provides for faster rotation. Op-

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posite extremities of shaft 24 are received in extensions 26 of frame 12, as is more clearly shown in Fig. 1, and at the left-hand end of shaft 24 there is indicated a driving chain 23 adapted to drive a sprocket member on the end of this shaft.

The driving means described rotate the shaft 18 and fixed to this shaft is a lower roll member 30. The frame ends 14 are formed with two bearings arranged to receive therebetween a rod 34 which extends through the machine transversely thereof and has one end secured with a loose pressed fit in the metal of the bearing in which it is mounted. The opposite end of the rod fits into a hole in the casting with considerable clearance and three set screws corresponding to the set screws 36, 38 and 40 (indicated at the left-hand side of Fig. 2) are threaded through the casting along axes arranged 120° apart to bear on the rod and adjustably position this member in a fixed manner.

A roll supporting bracket 42 is pivotally mounted on the rod 34 and includes a lower U-shaped section extending between the two side portions of the frame 12 and having mounted intermediate thereof on the rod 34 a tape guiding member 44. The roll supporting bracket 42 extends upwardly and forwardly above the roll 30 and carries between its two sides a shaft 46 secured to which is an upper roll 48. It will be seen that the bracket, by means of its pivoted arrangement on the rod 34, may be swung forwardly and rearwardly through a position of dead center with respect to the lower roll 30, thus providing for moving the upper roll out of an operative position to facilitate threading of the tape between the two roll members. The latter operation is conducted by passing the tape 10 under a guide 50, then over the central portion of the roll supporting bracket 42; then across the rod 34 under the roll 30; around this member, and up over roll 48.

Numeral 52 refers to a coiled spring member, more clearly shown in Figs. 4 and 5, the upper end of which is adjustably secured to a pin 54 extending outwardly from the roller supporting bracket 42 and having its lower end anchored to a second pin 56 in the frame member 12. Spring 52, by its mounting described, is adapted to swing through the position of dead center and to resiliently hold the roll 48 in either an operative position in which it is in rolling contact with roll 30, or in an inoperative position in which it is thrown back in spaced relation to the lower roll.

It will also be observed that the adjustable bearing arrangement consisting of the angularly disposed set screws functions to align the rod member 34 and thus cooperates with the spring and bracket assembly to adjustably position roll 48 in parallel relation to roll 30 so that a uniform nip on the tape 10 may be provided for at all times and yet a quick and simple adjustment for engaging tape between the rolls is available to the operator.

At it leaves the upper roll 48 in the manner suggested in Figs. 1 and 2, tape 10 passes to an apparatus for dividing individual threads consisting of a pair of small rolls 58 and 60 supported in an upright member 62, in turn fastened to the frame 12 at a point approximately in the center of this member. The small rolls lie in slightly spaced-apart relation and are supported just above a third larger roll 64 also mounted in the upright 62. The individual threads of tape 10 are divided from one another such that alternate threads pass under and over

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the roll 58, with those threads passing under roll 58 being guided around roll 64 and then forwardly, as shown. A comb element 66 continues to guide the diverging threads in spaced-apart relation and furnishes the individual threads to a second pair of guide rolls 68 and 70. The latter rolls include a drive and mounting which is similar to the construction already described with respect to rolls 48 and 30 and accordingly require no further description at this point. The individual threads leaving the rolls 68 and 70 are thus positioned to be conveniently employed in various textile working operations of the type known to the art.

In combination with the structure described, I provide heating elements of the type above referred to and consisting, for example, of the heating element 72, shown at the right-hand side of Figs. 1 and 2, and located in a raised position with respect to ribbon 10 to direct heat thereagainst at a point just as it enters the feeding mechanism of the machine. The heating element 72 may be supported in some suitable manner as by an arm 74 adjustably secured in a post 76 by means of a fastening 76. There may also be provided a second heating element 78 mounted on an extension 80 of the arm 72, further supported by the upright 82. The position of heating element 78 may also be above the tape 10 as it leaves the upper roll 48 so heat is directed against the tape to maintain a desired temperature therein at points between roll 48 and the splitting apparatus consisting of rolls 58 and 60.

I may also desire to modify the arrangement of the heating elements in various ways. For example, I may construct the roll 48 in the manner illustrated in Fig. 6 wherein is shown an inner heating sleeve 84 interposed between the roll and its drive shaft to allow heat to be applied by direct contact of the roll surface to the tape at the point where stretching of the tape begins to take place.

Another desirable arrangement may consist in a separately furnished heating roll 86 independently driven and located between the roll 48 and the rolls 58 and 60 of the splitting apparatus. This arrangement serves to further apply heat while the tape is being stretched and further tends to maintain a desired temperature at a point approximately corresponding to the splitting point in the process. Other arrangements of heating elements may also be utilized and it is intended that heating may be carried out to facilitate splitting of tapes bearing various forms of adhesives and coatings.

It will be evident from the foregoing description that I have provided a novel and highly important method and apparatus for splitting cured rubber threads in tape form and while in a state of tension such as is necessary to the splitting operation. A more efficient handling of rubber threads is made possible and greater utilization of rubber threads in specific tape forms such as those involving thermoplastic material or other coating materials may be realized.

Having thus described my invention, what I desire to claim as new is:

1. A machine for splitting rubber thread tape including apparatus for acting on a tape composed of rubber threads adhesively but separably united to each other, side by side, to split said tape into its component threads, adjustable roll means for feeding the tape to said apparatus, means for guiding the separated threads away from the apparatus, mechanism for driving both

the feeding means and the guiding means at such speeds as to maintain the tape and said threads stretched as they pass through the splitting apparatus, the feeding means comprising an upper and a lower roll, a roll supporting bracket arranged to move the upper roll forwardly and rearwardly through a dead center position with respect to the pivot of the bracket, and spring means arranged and secured to swing through the dead center and resiliently hold the upper roll.

2. A machine for splitting rubber thread tape including apparatus for acting on a tape composed of rubber threads adhesively but separably united to each other, side by side, to split said tape into its component threads, adjustable roll means for feeding the tape to said apparatus, means for guiding the separated threads away from the apparatus, mechanism for driving both the feeding means and the guiding means at such speeds as to maintain the tape and said threads stretched as they pass through the splitting apparatus, the feeding means comprising an upper and a lower roll, a roll supporting bracket arranged to move the upper roll forwardly and rearwardly to a dead center position with respect to the pivot of the bracket, a rod adjustably supported in the machine for carrying the bracket, and spring means arranged and secured to swing through the dead center and cooperating with the rod to resiliently hold the upper roll in varying positions of adjustment with respect to the bottom roll.

3. A machine for splitting rubber thread tape including apparatus for acting on a tape composed of rubber threads adhesively but separably secured to each other side by side to split said tape into its component threads, means for feeding the tape to the apparatus, means for guiding the separated threads away from the apparatus, mechanism for driving both the feeding means and the guiding means at such speeds as to maintain the tape and said threads stretched as they pass through the splitting apparatus, the feeding means and guiding means including two pairs of rolls, each of which pairs consist of an upper and a lower roll, bracket members pivotally mounted in the machine in position to move the upper rolls forwardly and backwardly through dead center positions with relation to the pivots respectively of the brackets, and spring means arranged to swing through the dead centers and adjustably hold the top rolls in rolling contact with respect to the bottom rolls.

4. A rubber thread tape splitting machine, in-

cluding a frame, an apparatus mounted on the frame for acting on a tape composed of rubber threads adhesively but separably secured together to split the tape into its component threads, means for feeding the tape to the apparatus consisting of a lower driven roll transversely disposed in the frame, an upper roll movable into rolling contact with the lower roll, a roll supporting bracket having the upper roll rotatably received therein, the bracket being pivotally mounted in the frame and adapted to swing the upper roll through a dead center position with respect to the pivot of the bracket, and spring means for resiliently holding the upper roll in two positions of adjustment.

5. The structure defined in claim 4, and further including a rod fixed in the frame for receiving the roll supporting bracket, and adjustable bearing means for varying the position of one end of the rod and moving the axis of the upper roll into parallel relation with respect to the axis of the lower roll, and heating means included in one of the rolls.

6. In a machine of the character described, a frame having a driven roll rotatably mounted therein, a rod located on the frame in spaced relation to the roll, adjustable bearing means for securing one end of the rod, a roll supporting bracket pivoted on the rod and extending upwardly above the driven roll, a second roll supported for rotation in the bracket in a position to be swung forwardly and rearwardly by the bracket through a dead center position with respect to the pivot of the bracket, spring means attached to the bracket and cooperating with the adjustable bearing means to align and resiliently hold the second roll with its axis in parallel relation to the driven roll, and a heating element located adjacent to the rolls in the path of a tape passing from the rolls.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
Re. 21,718	McFarland	Feb. 18, 1941
490,824	Hille	Jan. 31, 1893
2,258,428	Stalder	Oct. 7, 1941
2,297,622	Herman	Sept. 29, 1942
2,425,123	Quayle	Aug. 5, 1947