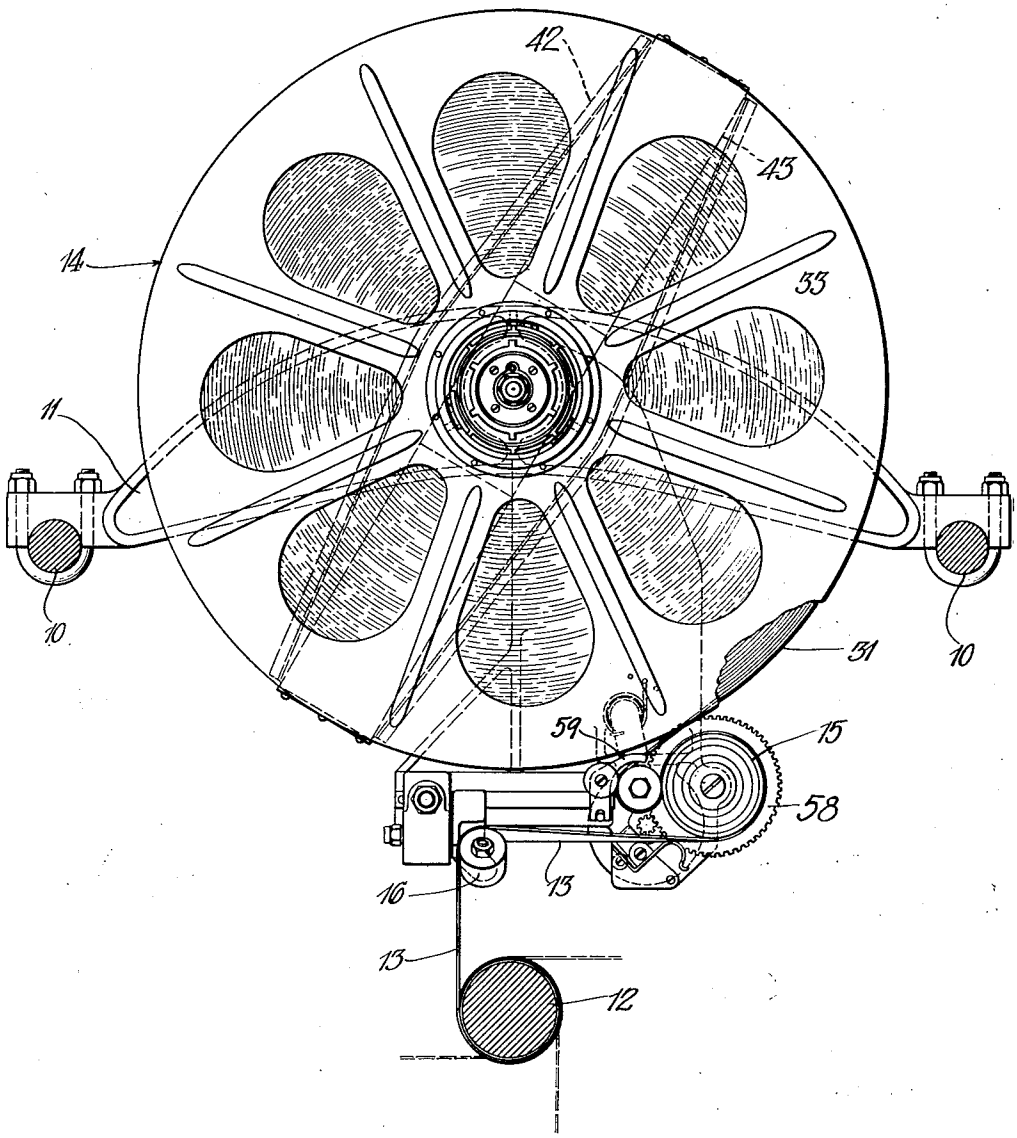
June 2, 1936. L. R. MacLEOD 2,043,051

TAPING MECHANISM

Filed June 20, 1935 5 Sheets-Sheet 1

Fig. 1.



INVENTOR.
LESTER R. MACLEOD.
BY
Usina & Rauber
ATTORNEYS

June 2, 1936. L. R. MacLEOD 2,043,051

TAPING MECHANISM

Filed June 20, 1935 5 Sheets-Sheet 2

Fig. 3.

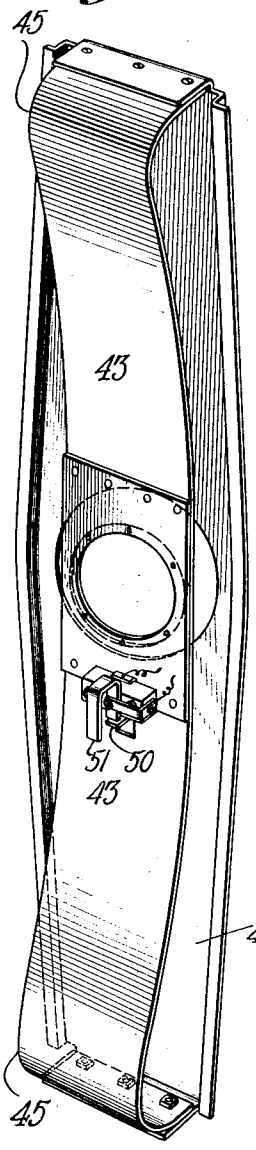
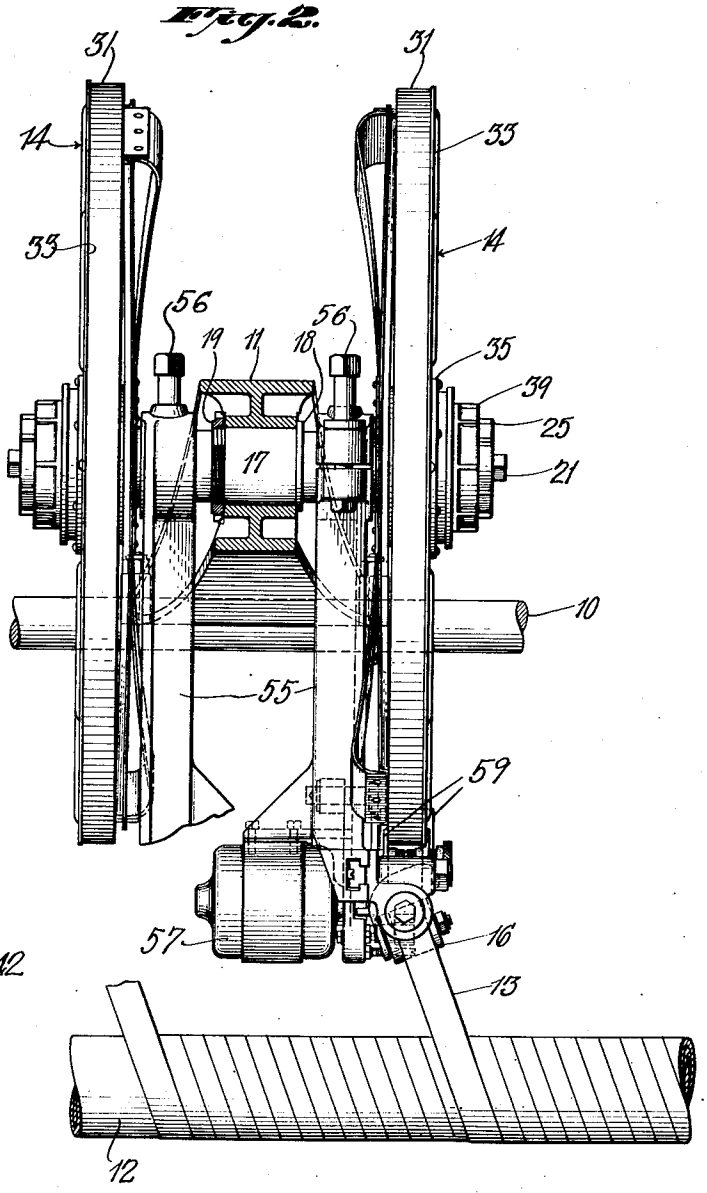


Fig. 2.



INVENTOR.

LESTER R. MACLEOD.

BY

Elsina & Rauber

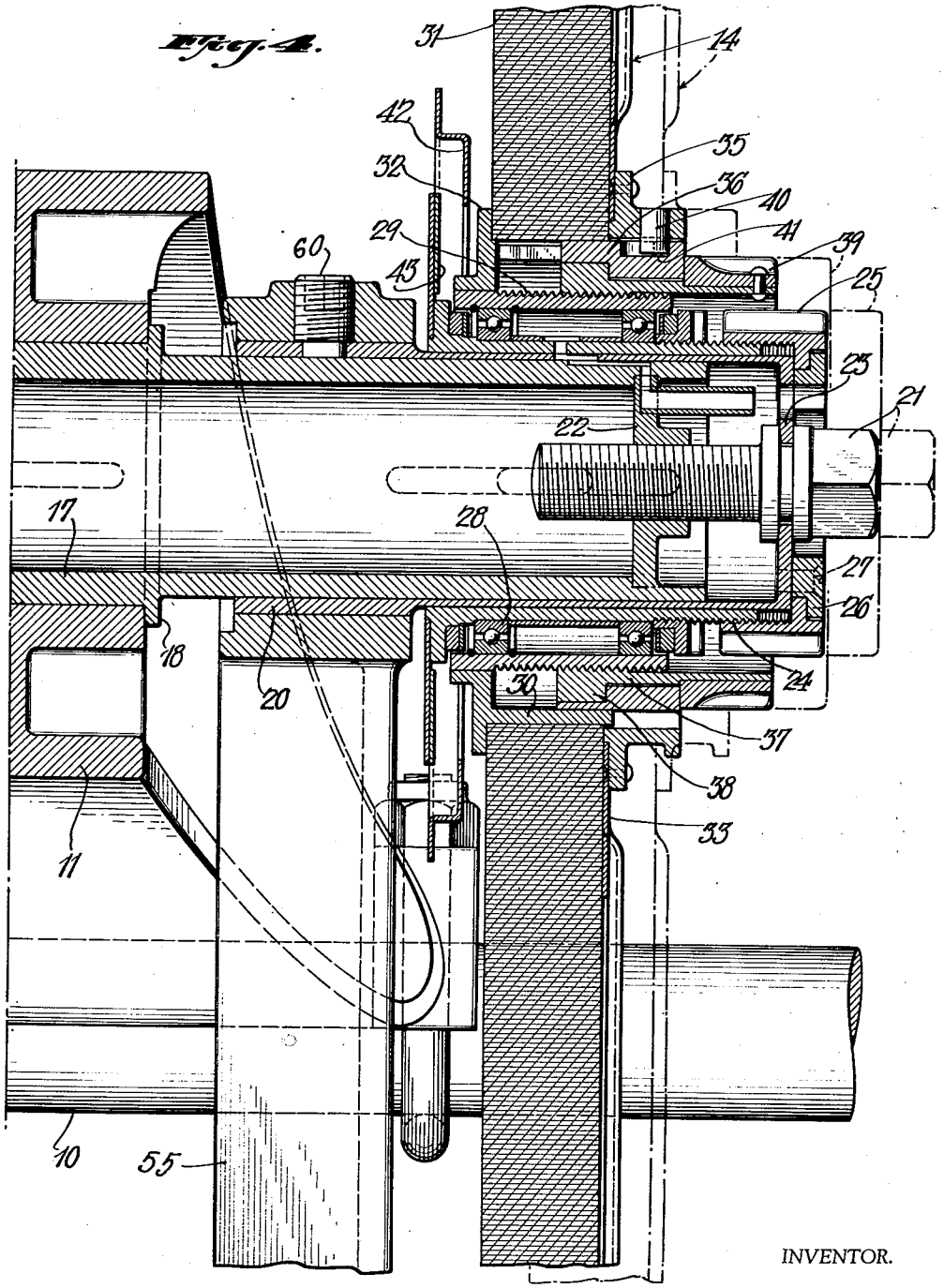
ATTORNEYS

June 2, 1936. L. R. MacLEOD 2,043,051

TAPING MECHANISM

Filed June 20, 1935 5 Sheets-Sheet 3

Fig. 4.



INVENTOR.

LESTER R. MACLEOD.

BY Ulsina & Rauber

ATTORNEYS

June 2, 1936. L. R. MacLEOD 2,043,051

TAPING MECHANISM

Filed June 20, 1935 5 Sheets-Sheet 4

Fig. 5.

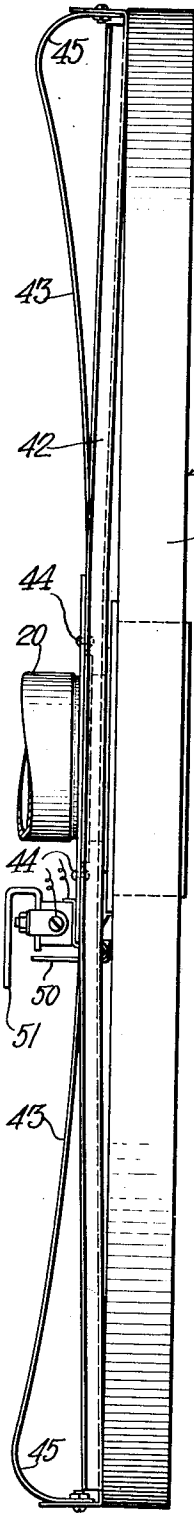


Fig. 6.

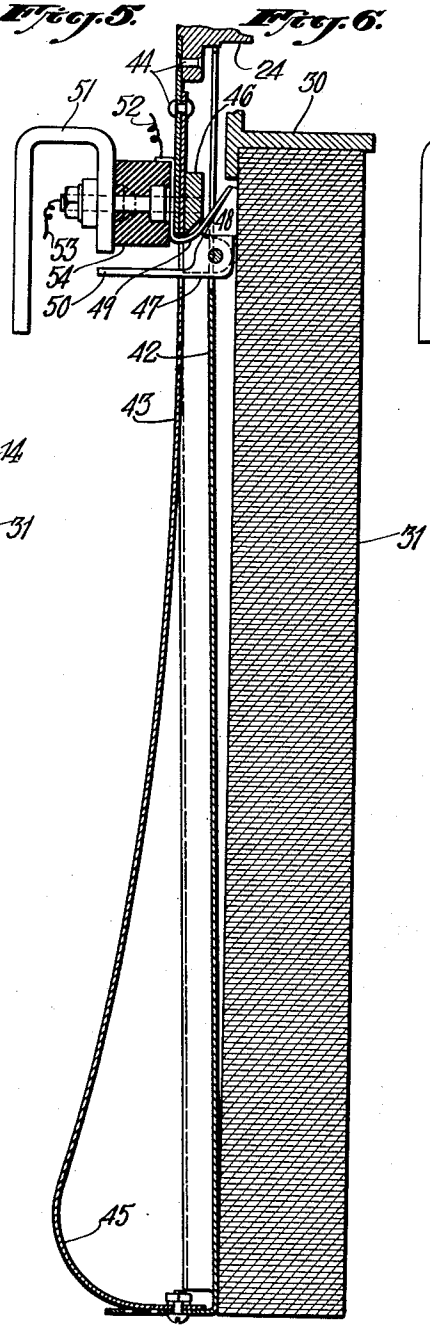
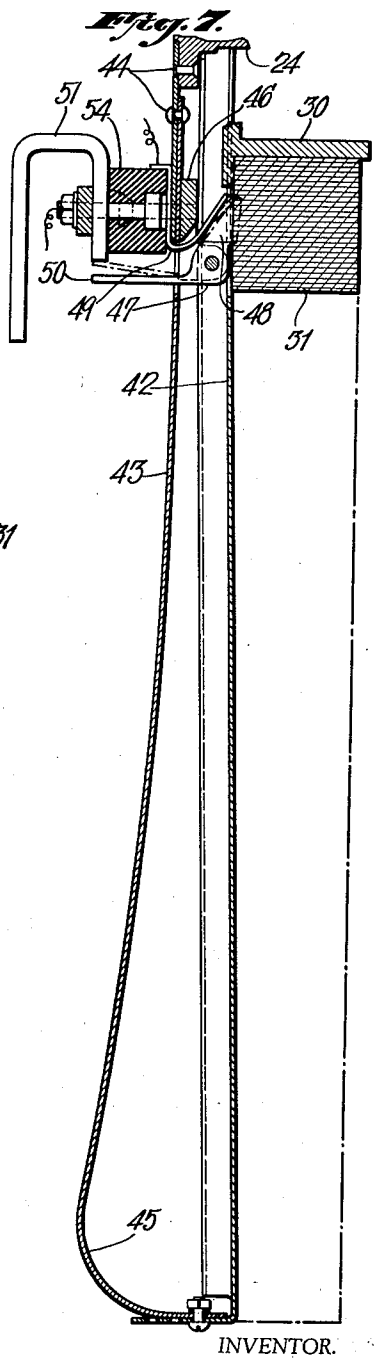


Fig. 7.



INVENTOR.

LESTER R. MACLEOD.

BY

Heina & Rauber

ATTORNEYS

June 2, 1936. L. R. MacLEOD 2,043,051

TAPING MECHANISM

Filed June 20, 1935 5 Sheets-Sheet 5

Fig. 8.

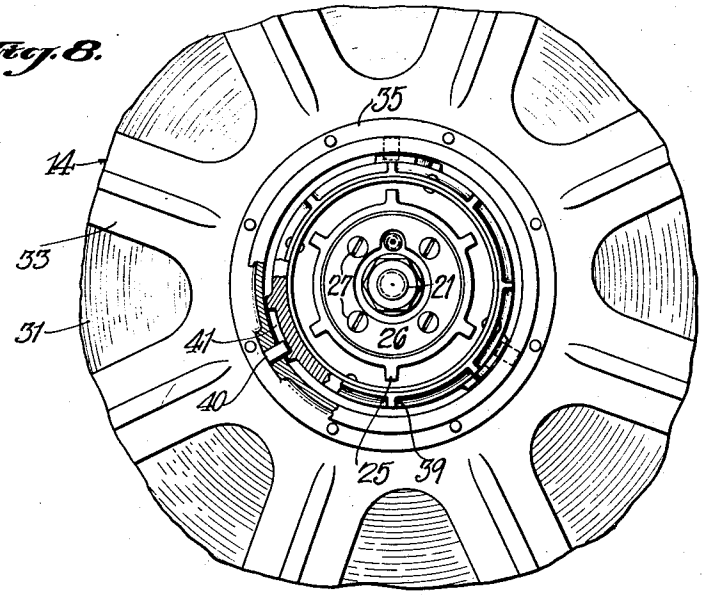


Fig. 10.

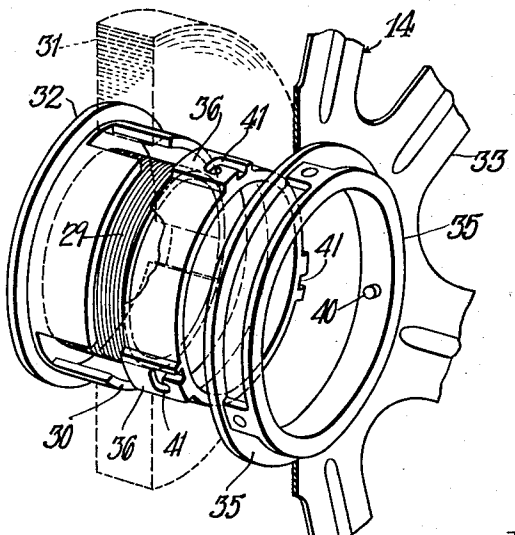


Fig. 11.

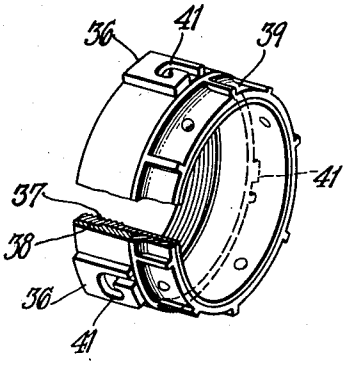
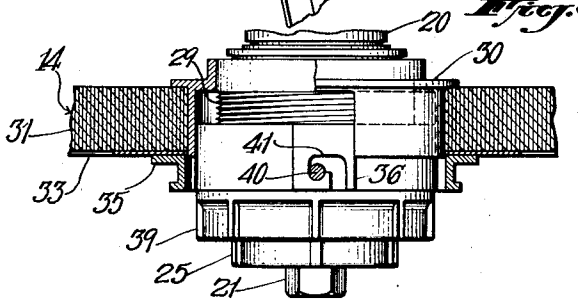


Fig. 9.



INVENTOR.

BY LESTER R. MACLEOD.

Ulmer & Rauber

ATTORNEYS

Patented June 2, 1936 2,043,051

UNITED STATES PATENT OFFICE

2,043,051

TAPING MECHANISM

Lester R. MacLeod, Ardsley, N. Y., assignor to Anaconda Wire & Cable Company, New York, N. Y., a corporation of Delaware

Application June 20, 1935, Serial No. 27,470

7 Claims. (Cl. 117—41)

My invention relates to a mechanism for supplying tape under a constant tension, and particularly to means applicable to a rotating pad of tape to apply a definite tension directly to the tape drawn from the pad and to stop the rotation of the pad when the drawing of tape therefrom stops.

In machines for tensioning tape, such as paper tape for winding onto an electric cable or conductor, it has been necessary to resist the rotation of the paper pad so as to apply tension to the tape as it is withdrawn for winding onto a core either directly or after passing through a tensioning means. Heretofore rotation has been resisted by a brake on the hub of the pad or by a friction means applied either to the outer circumferential surface or to one or both of the parallel faces of the pad.

Applying a brake to the hub has the disadvantage that it provides a variable tension on the tape being drawn from the pad because it imposes on the pad a constant frictional torque while the lever arm from the outer edge of the pad to the axis constantly decreases, thus imposing a proportionate increase in the force or tension on the tape. If the weight of the pad is not carried on anti-friction bearings, the centrifugal force of the pad revolving around the central axis of the machine causes a corresponding pressure on the parts supporting the pad. This pressure varies with the pad size and as the square of the speed of rotation. The result is a large variation in tension on the tape. When the braking force is applied to the full surface of one or both parallel faces of the pad or to a smaller area at a fixed radius, the resulting braking force causes a variable tension in the tape, the same as explained above for braking applied to the hub.

These various disadvantages are obviated by my invention which imposes a tensioning resistance independent of centrifugal force and having a torque moment varying proportionately to the moment arm of the tape being drawn from the pad, thereby avoiding errors due to variations in speed of revolution of the taping machine, in speed of rotation of the pad or of diameter of the pad. My invention also provides a very compact and easily adjustable pad supporting mechanism.

The various features of the invention are illustrated in the accompanying drawings, in which—

Fig. 1 is a view taken on a plane at right angles to the axis of the core to be wound with tape and viewing the pad holding and tensioning mechanism at right angles to its axis of rotation; Fig. 2 is a view of a pair of associated pad holding and tensioning means taken at a right angle to the plane of Fig. 1; Fig. 3 is a perspective of the tensioning means; Fig. 4 is a longitudinal section of a part of the pad holding and tensioning means; Fig. 5 is a side view of the pad and tensioning means; Figs. 6 and 7 are sectional views of the pad and tensioning means taken in different positions of the latter; Fig. 8 is an end view of the hub of the pad holding means; Fig. 9 is a side view, parts being broken away, of the pad supporting hub, and Figs. 10 and 11 are detail perspective views of parts of the pad holding mechanism.

In my invention, a tape pad is mounted to rotate about its axis on anti-friction bearings so as to avoid any resistance to rotation resulting from bearing friction and any tensioning effect through such resistance. The rotation of the pad is resisted by friction applied to the side or end of the pad at or near its outer periphery at all sizes of the pad. That is, the friction is applied to the side face at or near its outer perimeter when the pad is at its maximum diameter and continues to be applied to the side of the pad with a diminishing diameter of the latter so that the point of application of the friction is at the same radius as the tape in which constant tension is desired.

The pressure of the friction means against the side of the pad is maintained within very close limits predetermined by the design of the parts. As a consequence, the frictional resistance to rotation is independent of the speed of revolution of the taping machine, inasmuch as it acts at a right angle to the direction of centrifugal force, and the retarding force imposed by this frictional resistance to rotation is applied at the same radius as the tape being withdrawn and thus applies a constant tension on the tape.

The invention also provides means to stop the rotation of the pad automatically when it reaches a minimum diameter at which the frictional resistance becomes ineffective. Means are also provided to remove and replace a tape pad without disturbing the adjustment of the friction applying means.

In the accompanying drawings, the invention is illustrated by way of example as applied to a cage surrounding a conductor to be wrapped. The particular apparatus illustrated is one having tape pads set at angles of 90° about the axis of the core and having the pads arranged in sets of two so that 8 pads will be mounted in approxi-

mately the same general transverse plane about the core. The arrangement of individual pad and tension device and the supporting cage of the machine, is similar to that shown in the patent to French No. 1,968,251 of July 31, 1934 and copending application No. 621,658. This new arrangement is much more compact longitudinally as well as transversely. Adjoining heads located 90° apart are so compact that they cannot interfere with each other regardless of their proximity axially of the machine.

In the particular embodiment of the invention shown in the drawings, a tension roller of the type shown in the above referred to French patent is used to add to the tension resulting from the friction applied to the tape pad.

Friction is applied to the side or end of the tape pad adjacent its periphery at all diameters of pads by means of a plate or plates bent at or near the inner or central part of the pad and pressed toward the pad so that it contacts therewith at a very slight angle near the outer edge of the pad. As the diameter of the pad decreases, the plate moves parallel to the pad axis to maintain its frictional contact near the periphery of the pad. The plate is pressed toward the pad by any suitable means as, for example, by a leaf spring.

To stop the mechanism when the pad is exhausted, a lever arm is pivoted near the center of the pad to rest against the face of the pad near its inner periphery and, in this position, to hold inactive a stopping mechanism. When the tape has been unwound from beneath this arm, the unsupported lever tilts and stops the further rotation of the pad.

Referring more particularly to the accompanying drawings, a number of rotating pads are mounted on the cross arms of a frame, of which a pair of longitudinal rods **10** and a single cross arm **11** are shown. The cage formed by a complete set of longitudinal rods **10** and cross arms **11** has a rotational movement relative to a conductor or core **12** positioned at the center of the cage. This rotational movement may be obtained either by rotating the cage about the core or conductor **12** as a center while the latter is stationary, or by rotating the core or conductor within a stationary cage, or by a combination of the rotation of the cage and core. During this relative rotation, the core is pulled or moved longitudinally of its axis. The relative rotation of the core **12** and the tape supporting cage draws tape **13** from the various taping heads **14** about a tensioning roller **15** and a lead-on or guide roller **16** to wrap the tape in helical coils onto the core **12**.

The taping head **14** is mounted on a stud **17**, Fig. 4, secured at about a mid-point of the cross arm **11**. The stud **17** may be mounted in any suitable way on the cross arm **11** as, for example, by an integral collar **18** and a clamping nut **19** on opposite sides of the cross arm **11**. The stud or shaft **17** may project from each side of the cross arm **11**, as shown in Fig. 2, and may therefore carry a pair of taping heads **14**. The taping head **14** has an inner sleeve **20** that is slidable longitudinally on the stud or shaft **17** and is adjustable thereon by means of a screw **21** that is threaded through a plate **22** on the end of the stud **17** and rotatably engages a plate **23** formed integrally on the collar or sleeve **20**. It will be understood that the screw **21** may rotate freely in the plate **23** and carries the latter inwardly or outwardly as the screw is threaded in one direction or the other in the plate **22**.

The pad and the friction elements are supported on a second sleeve **24** fitting over the inner sleeve **20**. The outer sleeve **24** may be adjusted longitudinally relative to the inner sleeve **20** by means of an internally threaded nut **25** engaging external screw threads at the free end of the sleeve **24** and rotatably secured to the plate **23** of the sleeve **20** by means of a ring **26** and screws **27** that pass through the ring **26** into the plate **23**. By rotating the nut **25**, the sleeve **24** will be shifted longitudinally on the sleeve **20**.

The inner raceway **28** of a ball bearing is mounted on the outer surface of the sleeve **24** and the outer raceway **29** of the ball bearing carries a threaded sleeve **29** permanently connected to a hub **30**, for a rotating or rotatable tape pad carrier, Figs. 4 and 8 to 11 inclusive. A tape pad **31** is mounted on the hub **30** and is pressed against an outwardly projecting circular flange **32** of the hub by means of a holding plate **33** which is mountable indirectly on sleeve **29** and longitudinally adjustable thereon for different thicknesses of tape pads. The disc **33** is supported at its inner periphery by a ring **35**, to which it is riveted, and this ring is detachably mounted on an inner ring **36** which, in turn, is rotatably secured on a sleeve **37** screwed onto the threaded sleeve **29** so as to be adjustable longitudinally thereon. The sleeve **37** is rotatable relative to the supporting ring **36** and holds the latter in fixed longitudinal relation between a flange **38** and a collar **39** riveted to the outer end of the sleeve **37**. The disc **33** and its hub **35** are secured in position on the ring **36** by a bayonet engagement comprising an inwardly projecting pin **40** on the hub **35** engaging in a bayonet slot **41** on the ring **36**. In placing a tape pad it is, therefore, slid onto the hub **30** until its inner face engages the flange **32**, then the disc **33** is placed in position and the hub **35** engages the ring **36** by means of the bayonet joint. Thereupon, the sleeve **37** is rotated to move the disc **33** inwardly, clamping the pad tightly against the flange **32**. The disc is then rotatable on the shaft or stud **17**. When the sleeve **24** has once been set for a certain pad thickness, subsequent pads of the same thickness may be substituted by merely removing and replacing the ring **35**.

The above mounting means enable pads of different thicknesses to be mounted and securely held by means adjustable to the thickness of the pad, and also permit pads to be removed and replaced by a simple movement without interfering with the adjustment for any given pad thickness. The pad may be removed and replaced from one side and with a movement in a single longitudinal direction, leaving the other side free for the tensioning means of my invention. This mounting means also enable two pads to be mounted on opposite sides of the stud **17**, as shown in Fig. 2, so that a large number of pads may be easily and compactly mounted in a small space about the core **12**.

The tensioning means on the opposite face of the pad **31** comprises a plate or strip **42** which is pressed against the pad **31** by means of a spring **43** and which is slightly concave to the pad so that it bears against the peripheral edge of the latter. The plate **42** is movable longitudinally relative to the supporting stud **17** and the sleeve **20**, but is prevented from rotating with the rotating pad. For this purpose, the inner ends of the leaf spring **43** may be riveted to a plate which

is in turn riveted directly to the stationary sleeve 24, as at 44 in Fig. 6. As strip or tape is unwound from the pad 31 and the diameter of the latter decreases, the spring 43 will move the plate 42 to hold it against the peripheral edge of the pad 31 with substantially constant pressure, inasmuch as the movement of the spring 43 is slight and, therefore, its tension does not vary greatly with the movement of the plate 42.

It will be understood that the above specific form of spring is, however, given only by way of example, and that other types of resilient pressure means may be employed.

Associated with the tensioning means is a stopping device to stop the rotation of the winding or wrapping means when the pad has been unwound and the end of the strip or tape is reached. This stopping means comprises a bracket 46 mounted preferably on the spring 43 and near the sleeve 24 and carrying a lever 47, one arm 48 of which extends parallel to the face of the pad 31 and is pressed against the latter by means of a spring 49. When the pad 31 has decreased to such a diameter that the lever arm 48 is no longer supported by the face of the pad, the spring 49 rotates it in a clockwise direction so that the opposite arm 50 of the lever is brought into contact with a terminal 51, thus establishing an electric circuit between a conductor 52 connected to the spring 49 and a conductor 53 connected to the terminal 51. The terminal 51 is separated from the spring 49 by means of a block of insulation 54 which is secured with the bracket 46 and spring 49 to the plate 43 and which, in turn, supports the terminal 51.

In the operation of the device, it will be understood that when a pad is mounted in the hub 30 it displaces the plate 42 and thus provides the required pressure friction at the peripheral edge of the pad. As the diameter of the pad decreases, the plate 42 will be pressed against this peripheral edge by the spring 43, thus continually applying a substantially constant friction at the edge of the pad.

When the pad decreases to such a diameter as to no longer form a support for the lever arm 48, the latter is rotated by the spring 49 to make contact between the wires 52 and 53. The latter wires control a stopping mechanism for the entire machine which is not illustrated as it forms no part of the present invention, and is a mechanism in present use and of known construction.

It will be obvious that upon the replacement of the pad, the lever 47 is automatically rotated counter-clockwise to break the circuit and to permit the rotation of the pad.

It will be understood that the friction means may be used in association with a tension roller 15, as indicated in Fig. 1, or may be used alone without such tension roller.

The tension roller 15 and associated elements are mounted on a bracket 55 positioned on sleeve 20 near its inner end by a dog pointed set screw 60 and clamped by means of a split hub contracted by clamp screw 56. The bracket 55 carries an electric motor 57 geared to the roller 15 through gearing 58 to apply torque in a direction opposite to the movement of the tape 13. The bracket 55 also supports guides 59 for guiding the tape onto the tension roller.

All adjustments of the pad holding means for different widths of pad, etc., are made upon the stud 17 without changing the position of the arms 11 along the rods 10. When the pad supporting means is to be adjusted for a particular width of tape or thickness of pad, the sleeve 24 is adjusted longitudinally on the supporting sleeve 20 by rotating the nut 25, as indicated in broken lines in Fig. 4, until the inner edge of the pad 31 is aligned with the inner guide 59 which will have been set to the thickness of the tape so that the center line of the tape will be properly centered on the tension roller 15.

Then the pad is mounted on the hub 30 and the ring 35 positioned on the ring 36 and locked thereon by means of the bayonet joint connection. It may then be tightened on to the pad 31 by rotating the ring 37 to secure the latter on the sleeve 29. When the position of the pad carrying and guiding means is to be varied or adjustable as a whole, the screw 21 is rotated in one direction or the other until the pad supports and guiding means are properly positioned by means of clamp screw 56, Fig. 2, which contracts the split hub of bracket 55 and the split end of sleeve 29. The above adjusting means enable all adjustments to be made without changing the position of the cross arms 11, which would be very troublesome in a cage type apparatus.

What I claim is—

1. Tensioning mechanism which comprises means to support a pad of strip material to rotate as said material is unwound, a non-rotating friction plate having a surface intersecting a side of said pad at the peripheral edge thereof at all diameters of said pad, and a leaf spring having its ends bent parallel with the axis of rotation of said pad and supporting said plate at said ends.

2. Tensioning mechanism which comprises means to support a pad of tape to rotate with the unwinding of said tape therefrom, a non-rotating friction plate, and a leaf spring secured in fixed axial relation with one face of said pad and bearing against said friction plate at the outer edges thereof, said friction plate being dished so that its surface intersects the face of said pad at the peripheral edge of the latter for all diameters of said pad.

3. Tensioning mechanism which comprises a supporting stud, a sleeve adjustable longitudinally on said stud, said sleeve having an anti-friction bearing and said bearing having a support for a pad mounted thereon, a disc mounted on said bearing and adjustable toward one face of said pad and dished to intersect said pad at its peripheral edge, a spring pressing said friction plate toward said pad, and a bayonet joint connection between said disc and said friction bearing.

4. Tensioning mechanism which comprises a supporting stud, a sleeve adjustable longitudinally on said stud, said sleeve having an anti-friction bearing and said bearing having a support for a pad mounted thereon, a disc mounted on said bearing and adjustable toward one face of said pad, a plate movable axially toward the other face of said pad and dished to intersect said pad at its peripheral edge, a spring pressing said friction plate toward said pad, tension and guiding means at the peripheral edge of said pad, and means mounted on said sleeve to support said friction means.

5. A friction means which comprises a supporting stud, a supporting sleeve slidably mounted on said stud, an adjustable means for adjusting the position of said sleeve on said stud, an anti-friction bearing on said sleeve, a friction disc and a supporting spring therefor mounted on said sleeve in fixed position to said anti-friction bearing, pad supporting means on said anti-friction

bearing, and a disc adjustable on said anti-friction bearing for contact with the face of said pad opposite said friction plate, said friction plate being dished toward said pad to bear against one face thereof at its peripheral edge.

6. Tape wrapping and frictioning means which comprises a frame having longitudinal members and cross arms, supporting studs, one on each of said arms and projecting from opposite sides of said arm, pad supporting and frictioning means mounted on each projecting end of each of said studs, said pad supporting and frictioning means comprising a supporting sleeve, a friction plate and a supporting spring therefor mounted on said sleeve, a pad supporting anti-friction bearing also mounted on said sleeve in fixed relation to said plate supporting spring, said bearing being adjustable longitudinally on said sleeve, and a disc longitudinally movable to abut the face of said pad opposite said friction plate.

7. Tape wrapping and frictioning means which comprises a frame having longitudinal members and cross arms, supporting studs, one on each of said arms and projecting from opposite sides of said arm, pad supporting and frictioning means mounted on each projecting end of each of said studs, said pad supporting and frictioning means comprising a supporting sleeve, a friction plate and a supporting spring therefor mounted on said sleeve, a pad supporting anti-friction bearing also mounted on said sleeve in fixed relation to said plate supporting spring, said bearing being adjustable longitudinally on said sleeve, a disc longitudinally movable to abut the face of said pad opposite said friction plate, a tension means and a supporting bracket therefor depending from said sleeve.

LESTER R. MACLEOD.