July 10, 1934. J. A. CAMERON 1,966,331

METHOD OF CONTROLLING A WEB OF FLEXIBLE MATERIAL IN A WINDING MACHINE

Filed Aug. 20, 1931 5 Sheets-Sheet 1

Fig. 1.

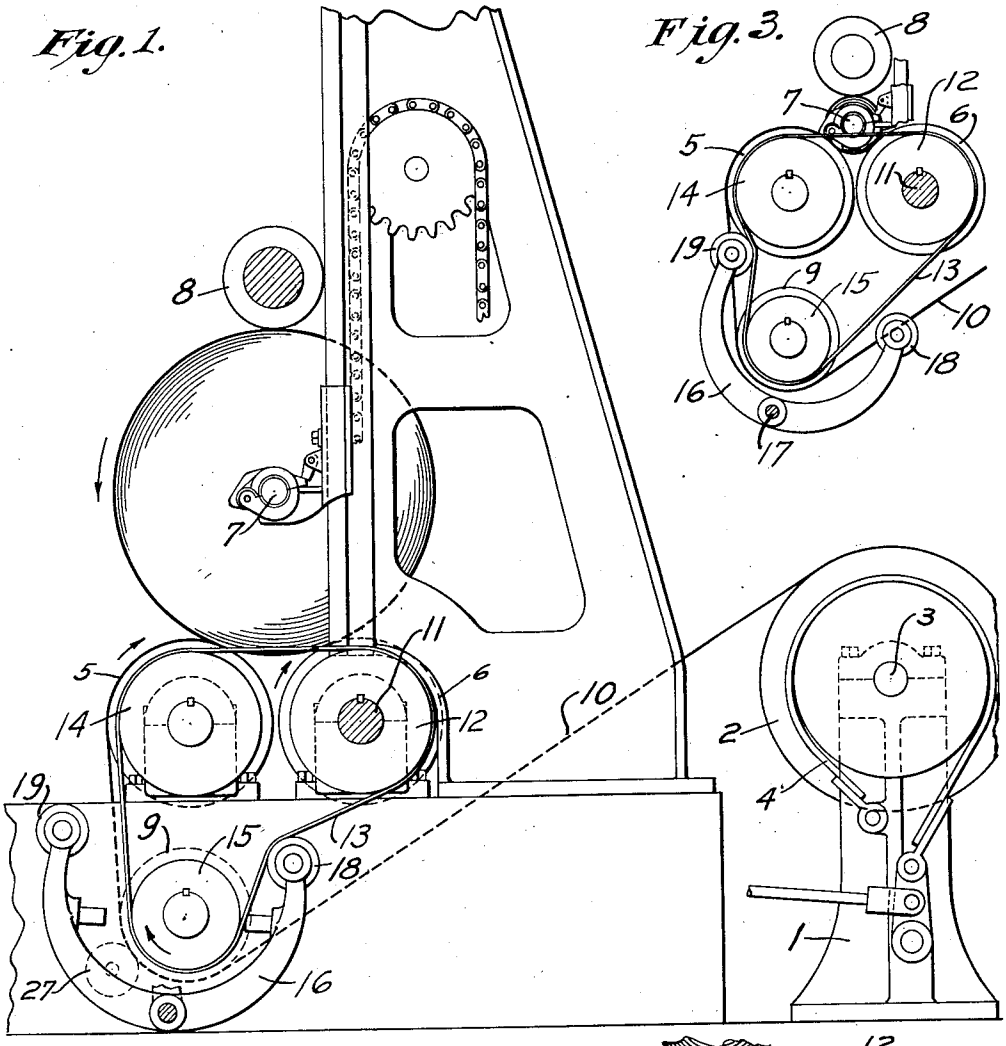


Fig. 3.

Fig. 4.

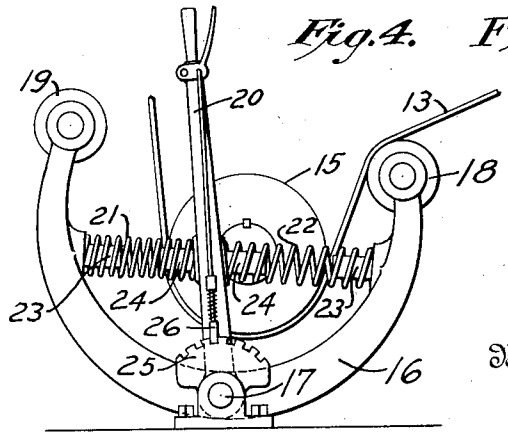
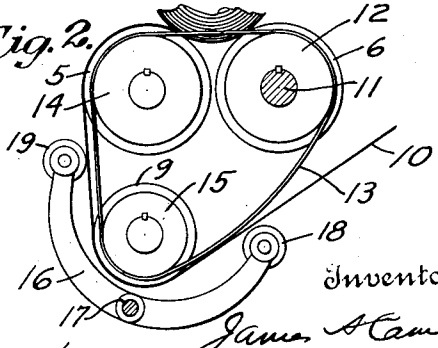


Fig. 2.



Inventor
James A. Cameron
By his Attorney
Arthur Becker

July 10, 1934. J. A. CAMERON 1,966,331

METHOD OF CONTROLLING A WEB OF FLEXIBLE MATERIAL IN A WINDING MACHINE

Filed Aug. 20, 1931 5 Sheets-Sheet 2

Fig. 5.

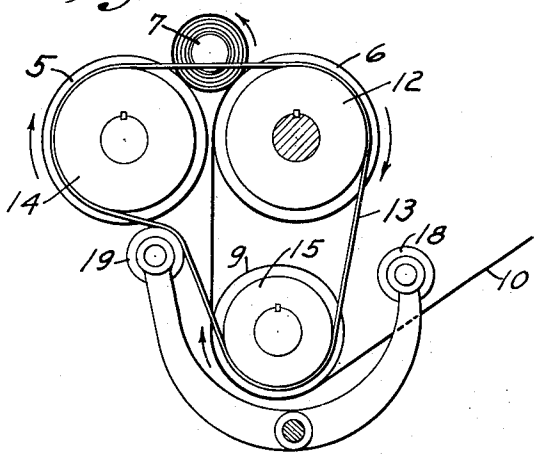


Fig. 6.

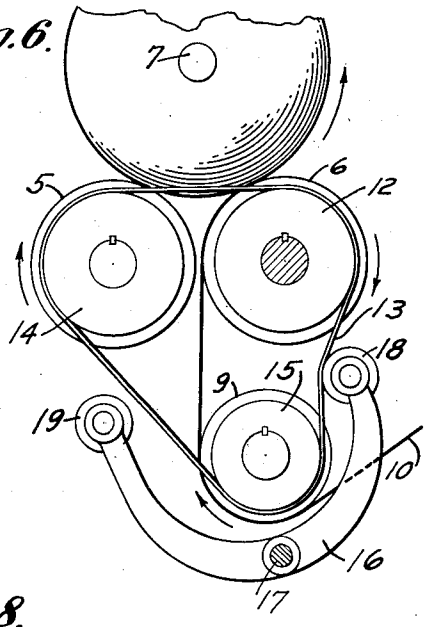


Fig. 7.

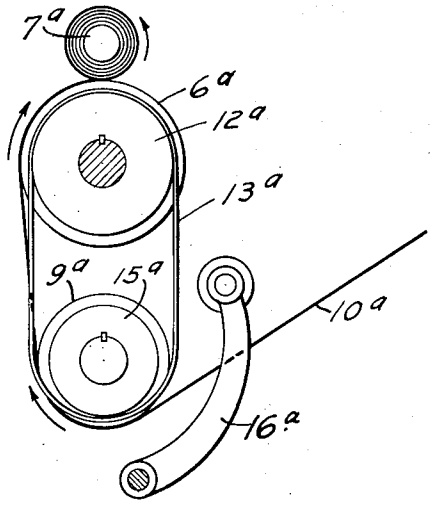
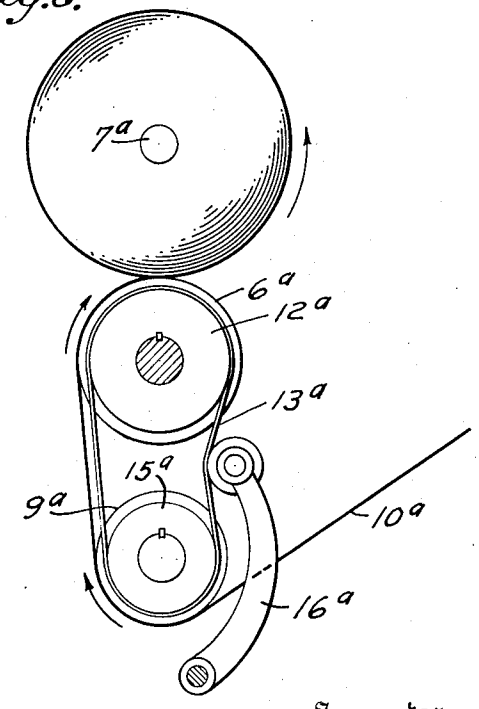


Fig. 8.



Inventor
James A Cameron
By his Attorney
Karl Becker

July 10, 1934. J. A. CAMERON 1,966,331

METHOD OF CONTROLLING A WEB OF FLEXIBLE MATERIAL IN A WINDING MACHINE

Filed Aug. 20, 1931 5 Sheets-Sheet 3

Fig. 9.

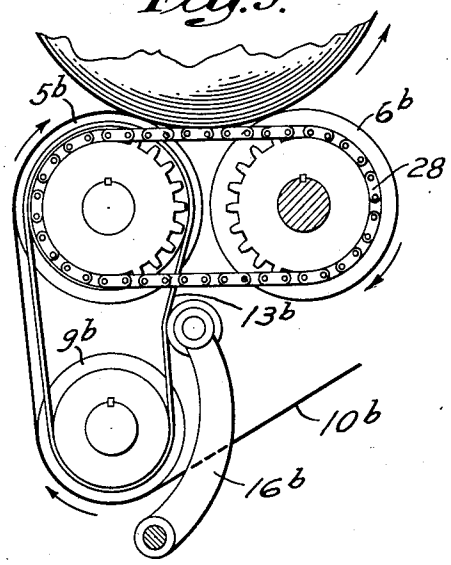


Fig. 10.

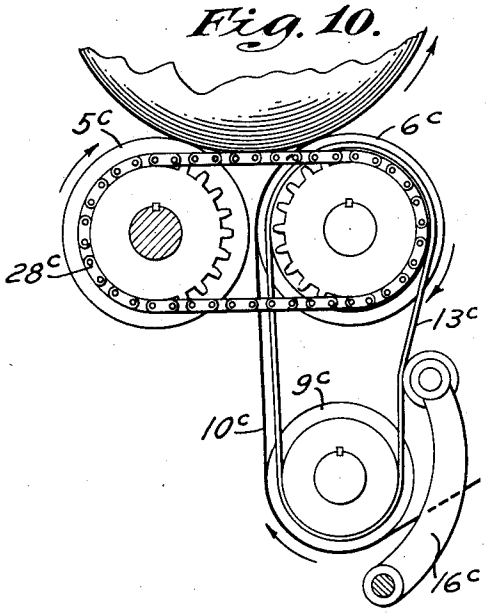


Fig. 11.

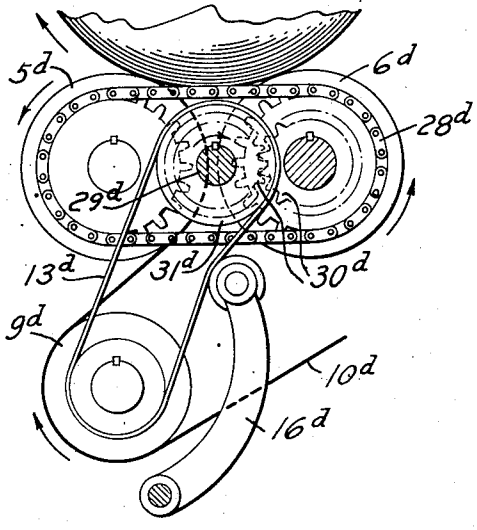
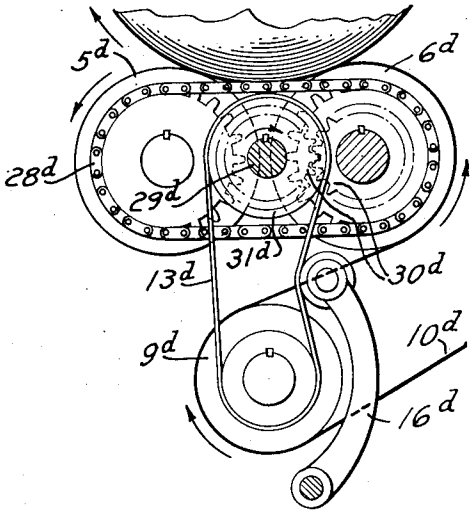


Fig. 12.



INVENTOR-
James A. Cameron
BY
Arthur Becker
ATTORNEY-

July 10, 1934. J. A. CAMERON 1,966,331

METHOD OF CONTROLLING A WEB OF FLEXIBLE MATERIAL IN A WINDING MACHINE

Filed Aug. 20, 1931 5 Sheets-Sheet 4

Fig. 13.

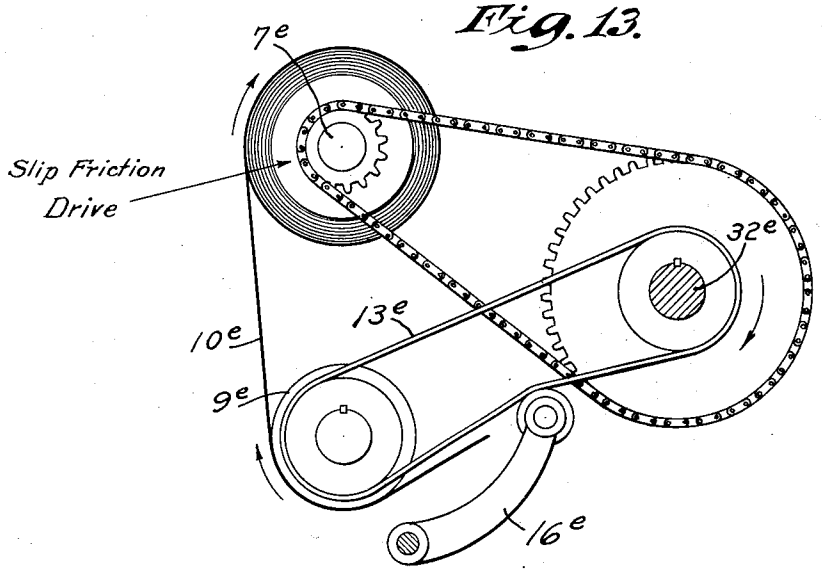


Fig. 14.

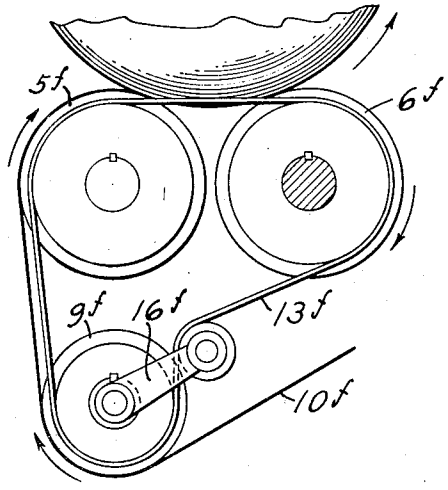
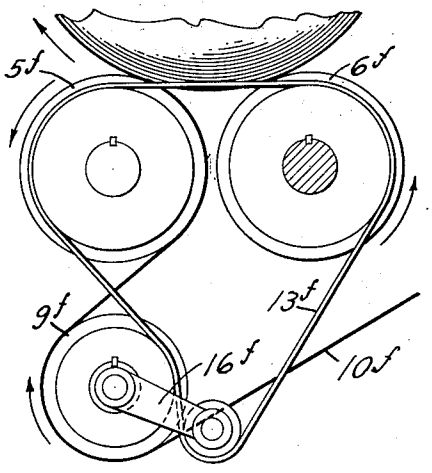


Fig. 15.



INVENTOR-
James A Cameron
BY
Arthur Peeler
ATTORNEY-

July 10, 1934. J. A. CAMERON 1,966,331

METHOD OF CONTROLLING A WEB OF FLEXIBLE MATERIAL IN A WINDING MACHINE

Filed Aug. 20, 1931 5 Sheets-Sheet 5

Fig. 16.

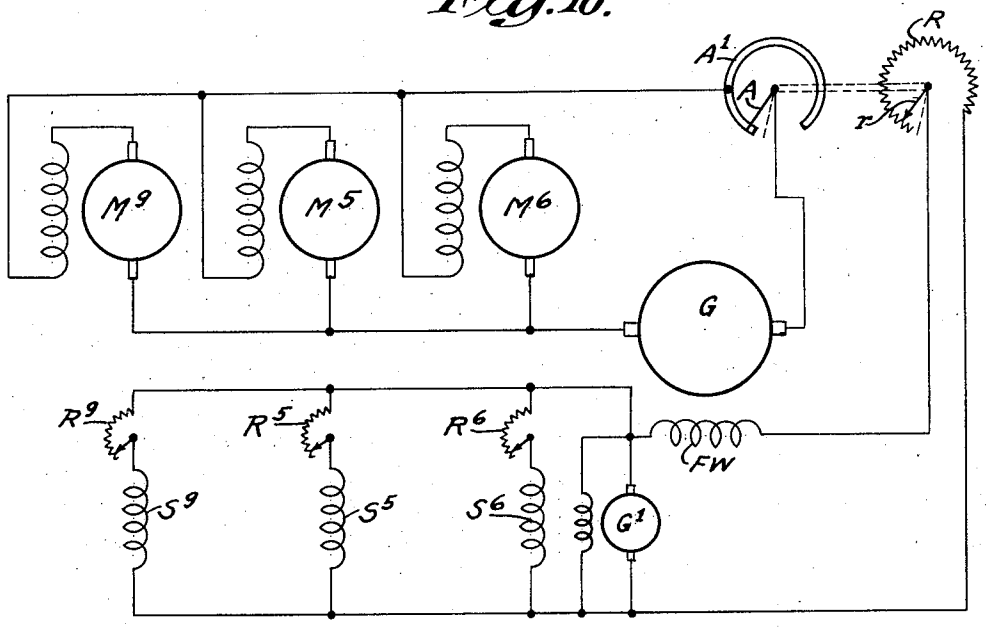
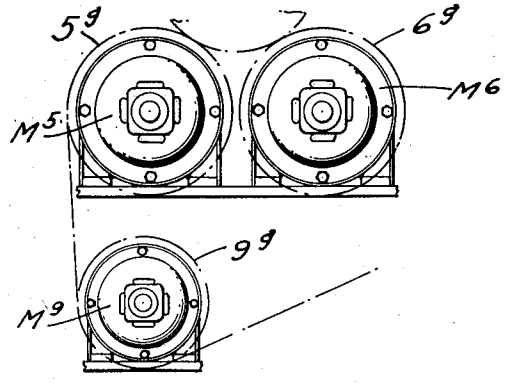


Fig. 17.



Inventor

James A Cameron

By Attorney

Arthur Becker

Patented July 10, 1934 1,966,331

UNITED STATES PATENT OFFICE

1,966,331

METHOD OF CONTROLLING A WEB OF FLEXIBLE MATERIAL IN A WINDING MACHINE

James A. Cameron, Brooklyn, N. Y., assignor to Cameron Machine Company, Brooklyn, N. Y., a corporation of New York

Application August 20, 1931, Serial No. 558,195

1 Claim. (Cl. 242—66)

This invention relates generally to methods of controlling a web of flexible material in a winding machine, and has for its main object and feature the prevention of such undue longitudinal tension in the web as will tend to disrupt the material being wound.

In the accompanying drawings the invention is disclosed in several concrete and preferred forms in which

Fig. 1 is a more or less fragmentary view of a winding machine, showing one preferred form of the invention;

Figs. 2 and 3 are detail views showing parts of Fig. 1 in differently adjusted positions;

Fig. 4 is a detail view of the belt tightener;

Figs. 5 and 6 are two diagrammatic views showing the same elements as in Figs. 1 to 4, but with the web threaded differently;

Figs. 7 and 8 are diagrammatic views showing the invention applied to a one drum surface winding machine;

Fig. 9 shows a further modification of the invention in which both drums are positively driven;

Figs. 10, 11 and 12 are modifications of the construction shown in Fig. 9;

Fig. 13 shows the invention applied to a center wind;

Figs. 14 and 15 show a construction by means of which the web may be wound either side out; and

Figs. 16 and 17 show the use of electric motors instead of belt drives.

In order to properly control a wide web of flexible material moving at a relatively high speed in a winding or in a slitting and winding machine, it is customary to apply considerable longitudinal tension to the web as it passes from the unwinding or other web supply means to the winding means. The necessity for doing this is occasioned by several factors which need not be gone into here except to instance that, unless the web is under considerable tension, a flapping of the side edges of the web occurs which renders control thereof difficult. So also, in winding the web or the slitted web sections, considerable tension must be applied in order to obtain a hard roll, and it has therefore been assumed that a high tension applied to a web as it travels from the supply means to the winding means contributes both to the proper control and slitting of the web and also to advantageous winding. This is true, in a sense, but I have found that considerably more tension is necessary to unwind and to properly control the web than is required to obtain efficient winding, and that therefore, if the web is wound under as great tension as that to which the web is subjected in unwinding, the flexible material will not only be taut (a condition necessary to produce a hard roll) but will be under such stress that the slightest tear in an outer convolution of the wound material may create a severance of the web across the roll.

I have found that it is possible to create zones of different longitudinal tension in the taut web that extends between the web supply and winding means, in such a way that the web can be unwound or supplied under greater longitudinal tension than the longitudinal tension to which it is subject during winding. In other words, there can be created a zone of high tension adjacent the unwinding means and a zone of lesser tension adjacent the winding means, and the tension of this latter zone can be varied. In this way it is possible to obtain the required amount of tension to control the web, during its advance, without winding the web under too severe a stress, while at the same time obtaining a hard roll.

The character both of the web supply means and the winding means may vary greatly. Thus the web supply means can be a paper-making machine or an unwinding mill roll. So likewise the winding means can be of the surface or center wind type or a combination of the surface and center wind types. Slitting means, if employed, may be of the score-cut or the shear-cut type.

In Figs. 1 to 4 inclusive is shown one embodiment of the invention. As there disclosed, the web supply means consist of a mill roll stand 1 having a mill roll 2, the shaft or core 3 of which is provided with a brake mechanism 4 to exert a retarding influence. The winding means here consist of two surface winding drums 5 and 6 supporting a winding shaft 7 on which latter the wound material is accumulated. A top pressure roll 8 may or may not be employed. 9 indicates a breast roll, and the path of web 10 is here from the mill roll, around the breast roll and up over front winding drum 5 and thence to back winding drum 6 and winding shaft 7.

If breast roll 9 were a stationary guide it will be seen that the entire work of propelling the web would be thrown upon the winding means and that therefore said web would be wound under greater tension than is present in the web section between the mill roll and the breast roll, because the winding means would have to overcome not only the retarding effect of the mill roll and its brake, but also the frictional resistance of said stationary breast roll. If the effect of

the breast roll is next considered as being neutral—that is: as neither retarding nor advancing the web, then the web would be under equal tension from the point where it leaves the mill roll to the point where it engages the nip between front winding drum 5 and the wound material. But if, as is contemplated here, the net effect of breast roll 9 is a tendency to urge the web forward, that is: if the propelling force of said roll 9 is greater than its frictional resistance, then said breast roll will assist the winding means, and the winding means will wind the web under less tension than is present in the web between the mill roll and the breast roll. In making this analysis, any guide rollers or bars, other than those mentioned, over which the web may travel, have been disregarded, but it will be understood that the presence of such other rollers or bars will not change the principle above expressed. It will further be understood that by varying the tendency of said breast roll to urge the web forward the tension of the zone between said breast roll and the winding means can be varied. In this manner one zone of tension is created between the mill roll and the breast roll, and a lesser and variable zone of tension is created between the breast roll and the winding means.

The means for creating these different zones may vary widely. In the present embodiment of the invention, shaft 11 of the rear winding drum is the driving element, and this shaft carries a pulley 12 over which is trained a belt 13 that also passes over pulley 15 on breast roll 9 and over pulley 14 of the front winding drum. This belt is slack as indicated in Fig. 2. 16 is a belt tightener pivoted on shaft 17 and carrying a roll 18 or 19 at each end. 20 is a rocker arm, also pivoted on shaft 17 but independently of the belt tightener, and interposed between said rocker arm and the arms of the belt tightener are springs 21 and 22 supported on projections 23 and 24. 25 is a stationary toothed or notched sector and 26 is a latch carried by arm 20 to engage the notches in the sector. It will be seen that the action of the belt tightening device is cushioned or yielding on account of springs 21 and 22. It will now be seen that, if the parts are in the position shown in Fig. 2, belt 13 will tend to drive front drum 5 and breast roll 9 but slightly. It will be noted, however, that the wound material on the winding shaft will tend to assist in driving front drum 5, and the reluctance of both 9 and 5 to turn will tend to increase the tension on the web. If the parts are in the position shown in Fig. 3, belt 13 will tend to drive both front drum 5 and breast roll 9 with greater urgency but unequally nevertheless because, preferably as shown, the amount of wrap of the belt (13) is greater around the pulley of 5 than it is around the pulley of 9. Again, if the parts are adjusted to the position shown in Figs. 1 and 4, belt 13 will urge breast roll 9 very strongly because now the area and the amount of pressure of the belt, on its oncoming side, against the pulley of 9 has been greatly increased. At the beginning of the winding operation, it may be desirable to adjust the parts as in Fig. 2 or as in Fig. 3 because during the initial winding the wound material has but little weight and therefore relatively great tension may be applied to produce a hard core without danger of tearing the material. As the winding proceeds and the weight of the wound material increases, the parts may be adjusted to the position shown in Figs. 1 and 4 to thereby winding the material under less tension while still producing a hard core. The particular character of the material being wound or exigencies of operation may, of course, dictate different adjustments as will be understood. So also, it may be desired to adjust the brake of the mill roll.

A word about the different zones of tension: it is not intended that the web shall be slack between the breast roll (9) and the winding means; it is intended that the web shall be taut all the way from the mill roll to the winding means, and that portion which extends from the breast roll (9) to the winding means shall (under certain circumstances, at the will of the operator and while the machine keeps on running) be under less tension than the web portion between the mill roll and the breast roll.

Slitting means of any kind can be employed, and if used the breast roll may be utilized as a platen or backing roll to coact with one or more score-cut slitters 27.

In Figs. 5 and 6 is shown a construction substantially identical with that of Figs. 1 to 4, the only real difference being that the web, instead of passing from the breast roll to the front drum, is threaded from the breast roll over the back drum from whence it passes to the winding shaft. Fig. 5 shows a preferable adjustment of the parts at the beginning of the winding operation and Fig. 6 a preferable adjustment at a later point in the winding operation.

In Figs. 7 and 8 a construction is shown in which but a single surface winding drum is employed. As there indicated, drum 6^a is the driven element and carries a pulley 12^a from which extends a slack belt 13^a to pulley 15^a of breast roll 9^a. Web 10^a passes over the breast roll to the drum and thence to winding shaft 7^a. Belt tightener 16^a consists here of a single arm pivotally mounted and actuated as before, whereby more or less driving force can be applied to the breast roll.

In Fig. 9, rear winding drum 6^b is the driving member, but front drum 5^b is likewise positively driven through suitable gearing such as chain and sprocket mechanism 28. Belt 13^b here connects pulleys on drum 5^b and breast roll 9^b and a belt tightener 16^b is employed as before. Web 10^b is here threaded over the breast roll and front winding drum.

In Fig. 10 I have substantially the same arrangement as in Fig. 9, but here the front drum (5^c) is the driver and rear drum 6^c is driven from the front drum by a chain and sprocket drive 28^c. Belt 13^c connects pulleys on the rear drum and breast roll 9^c. Web 10^c is threaded over the breast roll, and over rear winding drum between the drums. A belt tightener 16^c is employed as before.

In Fig. 11, rear winding drum 6^d is the driver and drives front winding drum 5^d by means of chain and sprocket drive 28^d. The direction of rotation of the drums is however the reverse of that shown in Fig. 9, and web 10^d is threaded over breast roll 9^d, between the drums and over the front winding drum. In order to maintain the correct direction of rotation of the breast roll, a shaft 29^d is employed which is connected by pinions 30^d to the shaft of the rear winding drum. Shaft 29^d carries a pulley 31^d connected by belt 13^d to the pulley on breast roll 9^d. 16^d indicates the belt tightener.

Fig. 12 shows the same arrangement as Fig. 11, but the web is here threaded from the breast roll over the outer side of the rear winding drum, instead of between the drums as in Fig. 11.

Fig. 13 shows the invention applied to a center-wind machine. Here winding shaft 7^e is driven, through a slip-friction drive in a well-known manner from positively driven shaft 32^e, and web 10^e is threaded direct from breast roll 9^e to said shaft 7^e. Belt 13^e extends from a pulley on shaft 32^e to a similar pulley on breast roll 9^e, and this belt is controlled by belt tightener 16^e as before.

In Figs. 14 and 15 are shown means whereby the web can be wound either side out in the same machine. As there indicated, belt tightener 16^f is adjustable on a center that is coincident with the center of breast roll 9^f. If the paper is to be wound with the "wire side" out, the parts will be arranged as shown in Fig. 14 in which web 10^f passes from the breast roll to the front winding drum (5^f), and drums 5^f and 6^f as well as breast roll 9^f all rotate in the same direction. The belt tightener will then occupy a position below belt 13^f and may be used to supply more or less force to the breast roll. If it is now desired to wind the paper with the "wire side" in, the direction of rotation of the drums is reversed while the direction of rotation of the breast roll remains the same. Belt 13^f is therefore brought over the back of the breast roll and the belt tightener is above said belt in which position it may likewise be adjusted to supply more or less energy to said breast roll. Web 10^f is now threaded over the breast roll, between the drums to the front winding drum.

In the preceding exemplifications of the invention, a belt has been utilized to drive the breast roll. It is not intended by this to indicate that a belt must necessarily be used, because it will be clear that any transmission device which will accomplish the desired function can be used. In Figs. 16 and 17 is shown an all-electric driving device. As there indicated, drums 5^g and 6^g as well as breast roll 9^g each has a motor M^5, M^6 and M^9, said motors being energized by generator G. The shunt windings S^5, S^6 and S^9 of the motors are supplied with current from generator G^1, and field winding FW of generator G is controlled by rheostat R. The shunt windings of the motors are controlled by individual rheostats R^5, R^6 and R^9. It will now be seen that when arm A closes the circuit from generator G through the motors by being brought in contact with segment A^1, arm *r* of the rheostat, which is connected to move with A, will be in position to control the field winding of generator G and also the shunt windings of the motors and that by advancing arm A, and with it the rheostat arm *r*, the motors will gradually be brought up to speed. If it is now desired to vary the power supplied to either of the drums or to the breast roll, the individual rheostats R^5, R^6 or R^9 can be manipulated. Thus rheostat R^9 or R^9 and R^5 become equivalent to the belt tightener of the other views.

I claim:

The method of controlling a taut web of flexible material in a winding machine which consists in: advancing the web toward the winding machine while subjecting said web to longitudinal tension in excess of the tension needed to wind it to thereby prevent flapping of the side edges of said web, then reducing said longitudinal tension without rendering the web slack, and then winding said web.

JAMES A. CAMERON.