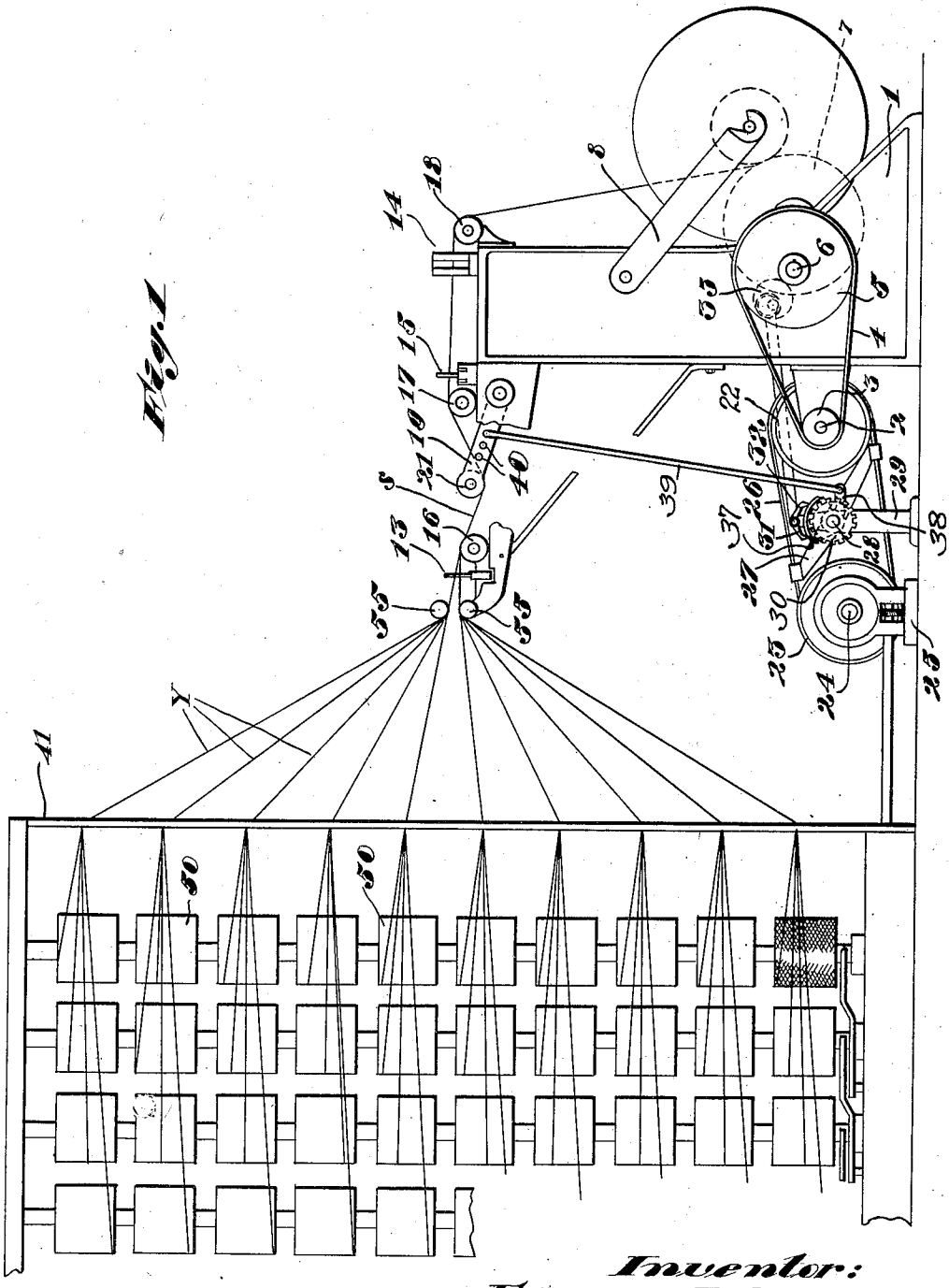
March 24, 1931. E. J. ABBOTT 1,797,391

METHOD OF AND APPARATUS FOR UNWINDING AND WINDING TEXTILE STRANDS

Filed Sept. 7, 1928 3 Sheets-Sheet 1

Fig. 1



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Filed Sept. 7, 1928 3 Sheets-Sheet 2

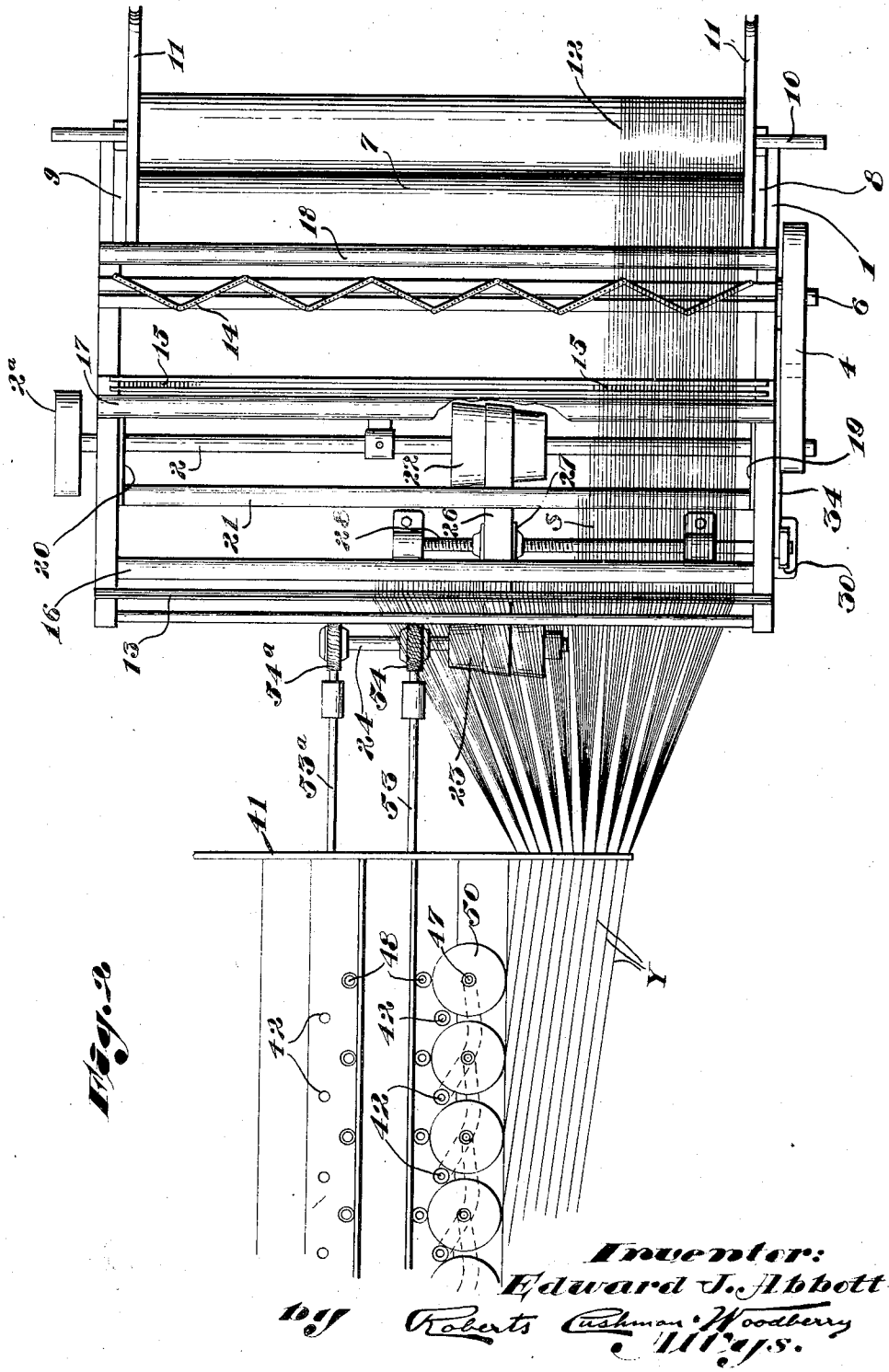


Fig. 2.

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Filed Sept. 7, 1928 3 Sheets-Sheet 3

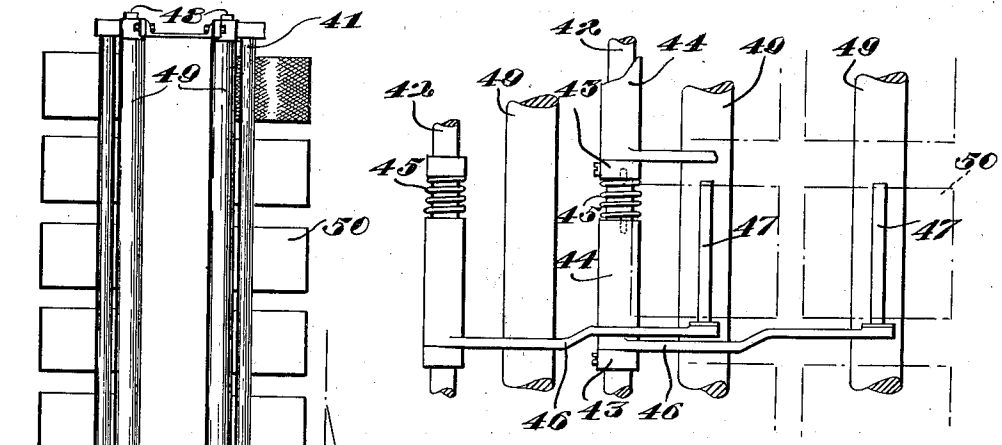


Fig. 4

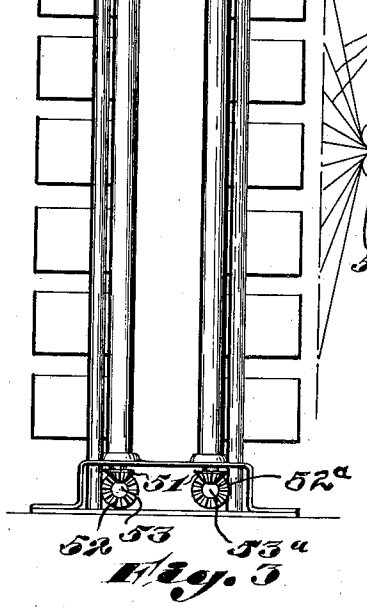


Fig. 3

Fig. 5

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UNITED STATES PATENT OFFICE

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METHOD OF AND APPARATUS FOR UNWINDING AND WINDING TEXTILE STRANDS

Application filed September 7, 1928. Serial No. 304,539.

This invention pertains to textile manufacture and relates more particularly to a method of winding and unwinding yarns or other textile strands and to apparatus adapted to wind and unwind yarns according to this method. While of more general application, I have herein chosen to disclose my invention as embodied in apparatus for unwinding yarn ends simultaneously from a plurality of spools, cheeses, or other relatively small packages conveniently mounted upon a creel or other support, having in combination therewith, if desired, means for rewinding the several ends in multiple upon a warp beam, section beam, dresser spool, or similar device mounted in a warper.

In modern automatic loom practice it is common to employ warper beams containing yarns of a length of the order of thirty thousand yards, and for winding such beams high speed warpers have been developed, capable of winding such a beam in approximately one hour, necessitating a very high linear speed of travel of the yarn. The yarn is usually delivered to the warper beam from packages (spools, cheeses, or the like) mounted on a creel or frame, and this high speed of unwinding places a great strain on the yarn each time that the warper beam is started. Moreover, the spools or cheeses from which the yarns are drawn turn at a high speed, and thus acquire a very considerable momentum. Whenever a yarn breaks, the warper beam is stopped suddenly, but the momentum of the spools or cheeses tends to cause them to overrun and deliver substantial lengths of slack yarn before they come to rest. The slack yarns from the several spools tend to snarl, kink and tangle, and when the beam is again started the sudden resumption of speed frequently results in breakage of the yarn by reason of its entanglement with others, or through the sudden strain to which it is subjected as the slack is taken up and before the spool or cheese resumes its normal speed.

I am aware that attempts have heretofore been made to improve the operation of warpers by providing the individual unwinding packages with electrically controlled brake mechanism or the like to prevent overrunning of the packages or to control the tension, but all such arrangements known to me are complicated, expensive to construct, difficult to keep in order, and under most conditions, unreliable and uncertain in operation.

In accordance with my present invention I provide a simple and effective means for positively controlling the unwinding of the several yarn ends and, if desired, for maintaining a substantially uniform tension upon the yarn on its way from the unwinding to the winding package, the mechanism provided comprising few parts; being certain and positive in action; substantially unaffected by variations in temperature, humidity conditions, or the presence of dust and lint; and requiring little care or expert attention to keep it in operative condition.

In accomplishing the desired result I prefer to mount the several spools, cheeses, or other supply packages upon a creel or similar support conveniently disposed with relation to the warper. In suitable bearings in the creel, or associated therewith, I arrange rolls or drums against which the peripheral surfaces of the supply or unwinding packages are constantly pressed, for example by the action of springs or gravity. These rolls or drums are positively driven whereby to unwind the supply packages at a definite rate. If the yarns from the supply or unwinding packages are to be rewound, for example upon a warper beam or the like, I drive the unwinding packages at a definite and predetermined rate with reference to the linear take-up of yarn by the winding package, thereby preventing breakage, snarling, or overrunning of the yarn.

The rate of rotation of the unwinding drums or rolls is automatically varied with reference to the peripheral speed of the winding package (warp beam, dresser spool, or the like) by speed changing devices responsive directly to variation in tension in the yarns passing from the unwinding to the winding package, and thus the tension is kept substantially constant during the entire winding operation. While such automatic control of the speed variation is preferred, certain of the broader utilities of the invention are obtain-

able even though the variation in speed be controlled manually, and I contemplate that such manual control may be desirable under certain circumstances.

The novel elements comprised in the present improvements do not interfere with the use of the usual yarn guides, yarn break detectors, and other features common to warpers of known form and it is contemplated that such usual devices will be used in association with the present improvements.

In the accompanying drawings I have illustrated the invention by way of example as embodied in an associated creel and warper, omitting many of the usual and well-known elements of such devices for clarity of disclosure of the novel features hereinafter claimed.

In the drawings:

Fig. 1 is a fragmentary side elevation, largely diagrammatic in character, showing an associated creel and warper comprising the improvements forming the subject matter of the present invention;

Fig. 2 is a fragmentary plan view of the parts shown in Fig. 1;

Fig. 3 is a diagrammatic end elevation of the creel viewed from the side opposite to the warper;

Fig. 4 is a fragmentary side elevation, to larger scale, showing certain details of the structure of the creel; and

Fig. 5 is a fragmentary side elevation of the warper, to somewhat larger scale than that of Fig. 1, and showing the parts in another position.

The warper here disclosed is, in its principal features of a usual construction, comprising a frame 1 provided with journals for a main drive shaft 2 having a drive pulley 2^a at one end. At its opposite end this shaft carries a pulley 3 which, by means of a belt 4, drives a pulley 5 on a shaft 6 mounted in the frame. Through suitable connections, not shown, the pulley 5 drives a friction drum 7 having a shaft journaled in the frame, said drum being adapted to drive the warp beam or other winding package. For supporting the warp beam or other package to be wound, the warper is provided, as here illustrated, with a pair of freely swinging arms 8 and 9 having cradles or journal slots at their free ends for the reception of the spindle 10 carrying the warp beam. As here shown this warp beam is provided with heads 11 which are secured to opposite ends of a barrel on which the multiple thread mass 12 is wound, such thread mass resting by gravity against the periphery of the driving drum 7. While the swinging arms 8 form a convenient means for supporting the warp beam, dresser spool, or other package being wound, it is obvious that other and equivalent means may be employed, such means forming no essential part of the present invention. The warper also comprises the usual reed 13, the expansion comb 14, the detectors 15, and the guide rolls 16, 17 and 18.

In accordance with the present invention I provide a pair of freely swinging arms 19 and 20 arranged at opposite sides respectively of the frame of the warper, such arms being provided with journals for the ends of a feeler or tension detector 21. This member may be very light if desired and the arms 19 and 20 counterbalanced so as to impose but little tension on the yarns, but as here shown this detector takes the form of a freely turning roll (solid or hollow) which by its weight imposes substantial tension on the yarns. This roll rests upon the sheet S of yarns passing between the rolls 16 and 17 and rises or falls in accordance with variations in tension of the sheet of yarns.

At a convenient point the shaft 2 is provided with a cone pulley 22 which drives a complemental cone pulley 23 on a shaft 24 mounted in suitable supports 25. A belt 26 transmits power from the pulley 22 to the pulley 23, and the position of this belt on the cone pulleys is determined by a belt shifter 27. This belt shifter is provided with a hub portion internally screw threaded for engagement with a screw-threaded actuating shaft 28 journaled in suitable supports 29. This shaft is provided with a ratchet wheel 30 having symmetrical teeth, and may be driven in either direction by means of pawls 31 and 32 mounted on a pawl carrying arm 33 journaled to swing freely on shaft 28. The pawl carrying arm 33 is constantly oscillated during the operation of the machine by means of a connecting rod 34 actuated by an eccentric 35 which is driven by means of intermediate gearing (not shown) from the pulley 5.

Both pawls 31 and 32 would constantly engage the teeth of the ratchet 30 were it not for the interposition of a shield member 37 mounted to oscillate freely on the shaft 28 and having a flange which overlaps the toothed edge of the ratchet wheel 30 and which is of a circumferential extent such that, when in the normal position shown in Fig. 1, it prevents engagement of either of the pawls 31 and 32 with the ratchet teeth, such pawls oscillating freely in contact with the outer face of the flange. The shield or guard member is provided with an arm 38 connected by means of a rod 39 to the arm 19 which supports one end of the tension roll 21. Preferably the arm 19 is provided with a series of openings 40 with any of which the rod 39 may be engaged, thereby providing for adjustment of the normal position of the shield or guard member. Under ordinary circumstances the parts will be so adjusted that so long as the desired tension is maintained upon the sheet S of yarns, the tension roll 21 will occupy a position substantially as shown in Fig. 1, thereby holding the shield or guard

member in such position that neither of the pawls 31 nor 32 is operative. The belt shifter thus remains in the same position and the relative speed of the pulleys 22 and 23 does not vary. If, however, the tension on the sheet S of yarns decreases or increases, the tension roller 21 will change its position accordingly and one or the other of the pawls 31 or 32 will be permitted to drop into engagement with the teeth of ratchet 30, thereby turning the screw-threaded shaft 28 in the proper direction to shift the belt 26 and thereby increase or decrease the speed of the pulley 23 for restoring normal tension conditions as hereafter more fully described.

Referring more particularly to Figs. 2, 3 and 4, the improved creel comprises a frame 41 provided with one or more series of vertical rods 42 spaced apart a distance slightly greater than the maximum diameter of the spool or cheese to be unwound. As here shown the creel comprises two substantially parallel series of such vertical rods, but any desired number and relative arrangement may be employed without departing from the spirit of the invention.

As here shown each rod 42 is provided at vertically spaced intervals with fixed collars or flanges 43, the number of such collars depending upon the capacity of the creel, it being understood that it is within the scope of the invention to mount but a single such supporting collar or flange on each shaft or to provide a greater number than here shown if circumstances so warrant.

Each collar 43 constitutes a bearing support for a swinging bracket adapted to hold a spool, cheese, or other package to be unwound. Referring to Fig. 4, each such swinging bracket preferably comprises a sleeve 44 turning freely on the shaft 42 and resting on one of the collars 43. A coiled spring 45 encircles the shaft 42 immediately above each sleeve 44, one end of the spring being attached to the sleeve and the other to the fixed collar 43 next above it. These springs are normally under tension and constantly tend to turn the sleeves 44 as hereinafter described. While I have shown a spring as the means for turning the sleeve, I wish it to be understood that other and equivalent means may be employed, such for example as a suitable weight or the like, and in this connection I regard it as within the scope of the invention to arrange the rods 42 or equivalent pivot pins at such an inclination to the vertical as to cause the weight of the sleeves 44 and the parts carried thereby to swing them in a predetermined direction under the action of gravity.

Each sleeve 44 carries an arm 46 provided adjacent to its free extremity with a spindle 47 or other suitable device for positioning the unwinding package. This package may be a spool, cheese, cop, bobbin or the like, and the spindle 47 may be fixed in the end of the arm 46 or may be arranged to rotate freely, as desired, in accordance with the type of package to be unwound.

Associated with each of the rods 42 is a substantially vertical shaft 48 journaled at its upper and lower ends at suitable bearings in the creel frame. Each of these shafts, as here shown, is provided with an integral drive roll of somewhat larger diameter than the shaft and of uniform radius from end to end. Each such drive roll is adapted to engage the peripheral surface of each of the vertical series of yarn packages mounted upon the swinging brackets carried by the adjacent rod 42. While I have here shown the roller 49 as integral with the shaft, this arrangement is not necessary as the roller and shaft may be made separately and associated in any desired manner, while, furthermore, I contemplate that the roller 49 may be divided into a series of short rollers or drums each adapted to engage a single one of the yarn packages. This latter arrangement is particularly suitable when the yarn packages are in the form of spools having heads, since in the latter case a continuous roller would engage the heads of the spools rather than the yarn masses thereon, so that a uniform linear speed of unwinding could not be obtained. While the vertical or substantially vertical arrangement of the unwinding spindles and of the unwinding drive rollers is convenient and desirable in the illustrated apparatus, I contemplate other arrangements, for example a horizontal disposal of the spindles and rollers, as within the broad invention.

As indicated in Fig. 2, the unwinding thread packages 50 are mounted on the spindles 47, and by the action of the springs 45 or equivalent means the peripheral surfaces of these thread packages are constantly pressed against the unwinding drive rollers 49, and since the roller engages the surface of the thread mass itself, the linear speed of unwinding remains constant regardless of the diameter of the thread mass.

If the creel is to be used alone, or in combination with other devices than the warper here illustrated, the shafts 48 may be driven from any appropriate source of power, through any desired intermediate mechanism, but as here arranged each shaft 48 is provided at its lower end with a beveled pinion 51, and these pinions mesh with pinions 52 or 52^a fixed to substantially horizontal shafts 53 and 53^a journaled in bearings in the lower part of the creel frame. These shafts are provided with worms, one of which is shown in Fig. 5 at 53^b, which engage worm wheels 54 and 54^a on the shaft 24. The yarns Y from the several unwinding packages 50 are led through suitable guides on the creel frame in usual manner and after engaging guide rolls 55 enter the reed 13, passing over the roller 16, under the tension roller 21, over

the roller 17, through the bank of drop wires 15, thence through the expansion comb 14, and over the guide roller 18 to the winding package 12.

As above described, the tension roller 21 normally occupies a position substantially such as shown in Fig. 1 in which position the pawls 31 and 32 are inoperative and the belt 26 is preferably so adjusted that the speed of the shaft 24 (and thus the linear speed of the unwinding drive drums 49) is such relative to the speed of the winding drive drum 7 as to maintain a slight tension on the yarns on their way from the unwinding to the winding package. In suggesting that the linear speed of winding is slightly greater than that of unwinding, I do not wish to imply that the broad invention is necessarily restricted to such speed ratio since I contemplate that equal and even a lesser speed of winding than unwinding might possibly be desirable. However, this tension does not turn the unwinding packages, since the latter are positively controlled and turned by engagement with the unwinding drums 49. The speed of winding may be thus maintained at a predetermined constant ratio to that of unwinding regardless of the size of the unwinding or winding packages, and although the winding may be performed at very high speed and although the momentum of the unwinding package may be great, the sudden stoppage of the warper in response to breakage of a yarn can not cause overrunning of the unwinding packages, since the unwinding drums 49 perform the function of brakes in that they turn the unwinding packages positively and stop such packages instantaneously when the drums themselves stop. On the other hand, when the warper is again started the positive action of the unwinding drums 49 immediately starts the unwinding packages into motion without putting any substantial strain on the yarns or appreciably increasing the tension thereon. It is thus possible, if desired, to dispense with the usual slow starting mechanism employed on warpers so that the loss in time in starting which results from the use of such slow starting mechanisms is avoided with a consequent increase in production.

While the mechanism herein described performs the desired function in an extremely satisfactory and efficient manner, it is very simple, inexpensive to construct, is not substantially affected by accumulations of lint or dust; it contains no small or delicate parts such as would readily be broken or injured; it does not require expert attention to keep it in running condition such as is commonly necessary in mechanisms employing electrical or similar brake devices; and it presents no difficulty to the attendant so far as ease of mounting fresh spools or cheeses or the piecing up of broken ends is concerned.

While I have herein disclosed one desirable embodiment of the invention by way of example, I wish it to be understood that various changes in size, proportion, and relative arrangement of parts may be made, as well as the substitution of equivalents, without departing from the spirit of the invention.

I claim:

1. That method of rewinding yarns from a plurality of individual packages which comprises simultaneously and positively driving the several individual yarn packages to unwind their yarns, and rewinding the several yarns at a linear speed greater than the linear speed of unwinding to form a single multiple wound yarn mass, the unwinding and winding packages being so driven that the linear speed of the yarn is substantially unaffected by the varying size of the packages.

2. That method of rewinding yarns from a plurality of independent packages which comprises positively rotating each of the packages to unwind it, winding their several yarns under a substantially uniform tension to form a single multiple wound yarn mass, the unwinding and winding packages being so driven that the linear speed of the yarn is substantially independent of the size of the package, and automatically maintaining such tension by varying the ratio of winding and unwinding in response to incipient variations in tension.

3. That method of controlling yarn while winding it from one package to another which comprises positively rotating both the winding and unwinding packages in such a way that under normal conditions of winding the linear speed of the yarn is substantially unaffected by the varying size of the winding package, and automatically varying the relative speeds of the winding and unwinding packages in response to variation in tension of the yarn whereby to keep the linear take-up of the yarn by the winding package different by a predetermined and substantially constant amount from the surface speed of the unwinding package.

4. In combination with means including a tractor roll for winding a multiple yarn mass by frictional contact with the peripheral surface thereof, means for supporting a plurality of individual yarn packages, and means including tractor rolls for positively unwinding the individual yarn packages each at such a surface speed as to maintain a substantially uniform tension upon the winding yarn, and mechanical means responsive to incipient variations in such tension for relatively varying the surface speeds of the unwinding and winding yarn masses.

5. In combination with means including a tractor roll for winding a multiple yarn mass, means for supporting a plurality of individ-

ual yarn packages, means including tractor rolls for positively unwinding the individual yarn packages, and automatic means for so determining the rate of unwinding relative to the rate of winding as to maintain a predetermined tension upon the yarns on their way from the several packages to the winding mass.

6. In combination with mechanism including a tractor roll for winding a multiple wound yarn mass, means for supporting a plurality of yarn packages to be unwound with the axis of each package substantially vertical, means including tractor rolls for positively rotating the yarn packages, and mechanical means for automatically varying the relative speeds of the packages and mass whereby to keep the effective surface speed of the winding mass slightly different from the surface speed of the unwinding packages.

7. Apparatus for winding yarn from one package onto another comprising mechanical means for positively rotating both the winding and unwinding packages, said means being so constructed and arranged that the linear speed of the yarn is substantially independent of the size of the packages, and means including a feeler engaging the unwinding yarns for so controlling the relative speeds of unwinding and winding as to maintain a substantially constant and predetermined tension on the yarns.

8. Apparatus for winding yarn from one package onto another comprising mechanical means for positively rotating both the winding and unwinding packages, said means comprising driving elements having frictional engagement with the peripheral surfaces of the several packages, and means including a yarn tension detector for automatically varying the relative speeds of winding and unwinding whereby to maintain the speed of winding different from the speed of unwinding at all times.

9. In combination with means for winding a multiple yarn mass including a driving element having frictional contact with the periphery of the winding mass, means for supporting a plurality of yarn packages with their axes substantially vertical, friction drive means for each package, independent means for urging each individual yarn package into driving engagement with its driving means, and mechanical means for moving the driving means for the several packages at a surface speed so much less, relatively to the surface speed of the winding mass, as to keep the yarns under constant tension.

10. A machine for winding and unwinding yarn comprising a winding tractor roll and a plurality of unwinding tractor rolls, means associated with the winding tractor roll for positioning a yarn mass to bear frictionally against the peripheral surface of said roll, means for supporting a plurality of yarn packages and for urging them into contact with the peripheral surface of the unwinding tractor roll, means responsive to the tension of the winding yarns for determining the ratio of surface speeds of the respective tractor rolls.

11. In combination with means for winding a multiple yarn mass, said means including a tractor roll engaging the peripheral surface of the winding mass for turning the latter, means for supporting a plurality of yarn packages in superposed relation with their axes substantially vertical, a shaft arranged with its axis substantially vertical, friction drive means carried by the shaft, means for urging each of the yarn packages into driving engagement with the friction drive means on the shaft whereby positively to unwind said packages, and automatically controlled means for turning said shaft at such a rate that the surface speed of said drive means is always slightly less than the linear take-up of yarn by the winding means.

12. In combination with means for winding a multiple yarn mass, said means including a tractor roll frictionally engaging the winding mass for turning the latter, a creel frame having a plurality of series of vertically spaced movable brackets each having a spindle for receiving a yarn package, a drive shaft associated with each of said series, friction drive means on each shaft, means urging each bracket toward the corresponding shaft whereby to press a yarn package mounted on its spindle into contact with the drive means on said shaft, a feeler device engaging the yarns on their way from the several packages to the winding yarn mass, and means responsive to the position of said feeler for varying the speeds of the drive shafts relatively to the speed of the winding yarn mass whereby to maintain a substantially constant tension on the yarn during winding.

13. In combination with means for winding a yarn mass, a frame having means for supporting and for positively unwinding a plurality of yarn packages, variable speed mechanism for driving said unwinding means including a shaft, means adapted to turn said shaft in either direction, and means for determining the direction of rotation of said shaft, said latter means being responsive to variation in tension of the yarns on their way from the unwinding packages to the winding yarn mass.

14. In combination with means for winding yarn, a frame having means for supporting and for positively unwinding a plurality of yarn packages, variable speed mechanism for driving said unwinding means including a ratchet wheel, pawls adapted respectively to turn the wheel in opposite directions, a movable shield for determining the engagement of said pawls with the wheel, and means for shifting the shield.

15. In combination with means for winding yarn, a frame having means for supporting and for positively unwinding a plurality of yarn packages, variable speed mechanism for driving said unwinding means including a pair of cone pulleys, a belt for transmitting motion from one pulley to the other, a belt shifter, and means for moving the belt shifter, said latter means being responsive to variation in tension of the yarns on their way from the unwinding packages to the winding means.

16. In combination with a warper having means for winding a multiple yarn mass, a creel having means for supporting and for positively unwinding a plurality of yarn packages, variable speed mechanism for driving said unwinding means including a ratchet wheel, pawls adapted respectively to turn the wheel in opposite directions, a movable shield for determining the engagement of said pawls with the wheel, and means for shifting the shield, said shield shifting means comprising a feeler responsive to variation in tension of the yarns on their way from the packages to the winding yarn mass on the warper.

17. In combination with a warper having means for winding a multiple yarn mass, a creel having means for supporting and for positively unwinding a plurality of yarn packages, variable speed mechanism for driving said unwinding means including a pair of cone pulleys, a belt for transmitting motion from one pulley to the other, belt shifter means including a screw-threaded shaft, means for turning the shaft comprising a ratchet wheel fixed to the shaft, a constantly moving pawl carrier, pawls on the pawl carrier adapted respectively to turn the ratchet wheel in opposite directions, a pawl lifting shield for the ratchet wheel, and a yarn engaging feeler responsive to variation in tension of the unwinding yarns from the packages to determine the position of the shield.

Signed by me at Wilton, N. H., this 4th day of September, 1928.

EDWARD JAMES ABBOTT.