

Nov. 9, 1937.

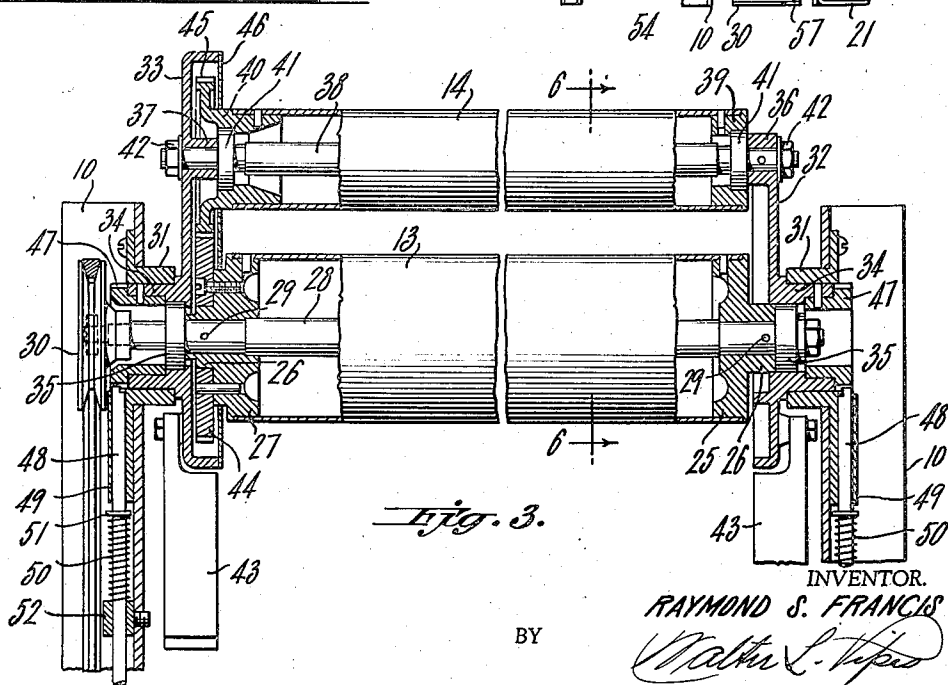
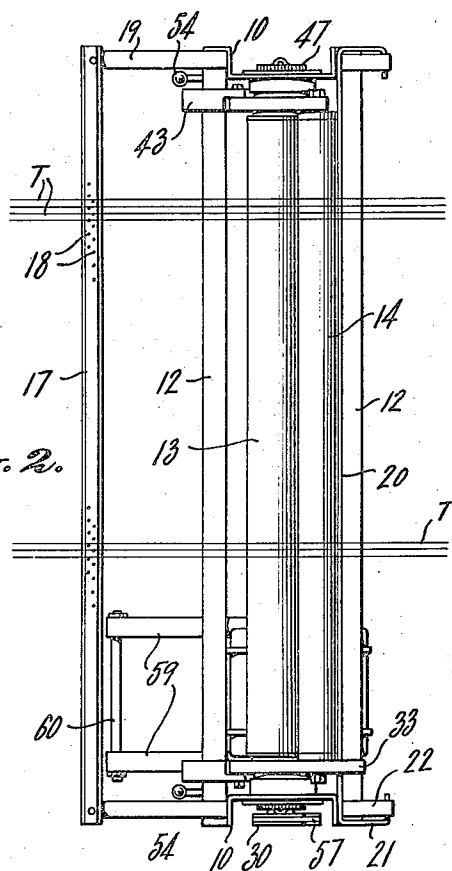
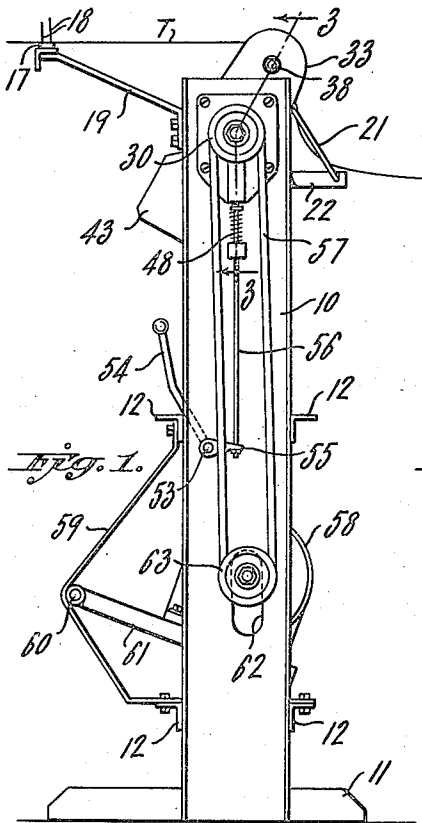
R. S. FRANCIS

2,098,418

APPARATUS FOR EQUALIZING THE TENSION OF THREADS

Filed May 12, 1936

2 Sheets-Sheet 1



BY

INVENTOR.
RAYMOND S. FRANCIS
Walter L. Tupper
ATTORNEY.

Nov. 9, 1937.

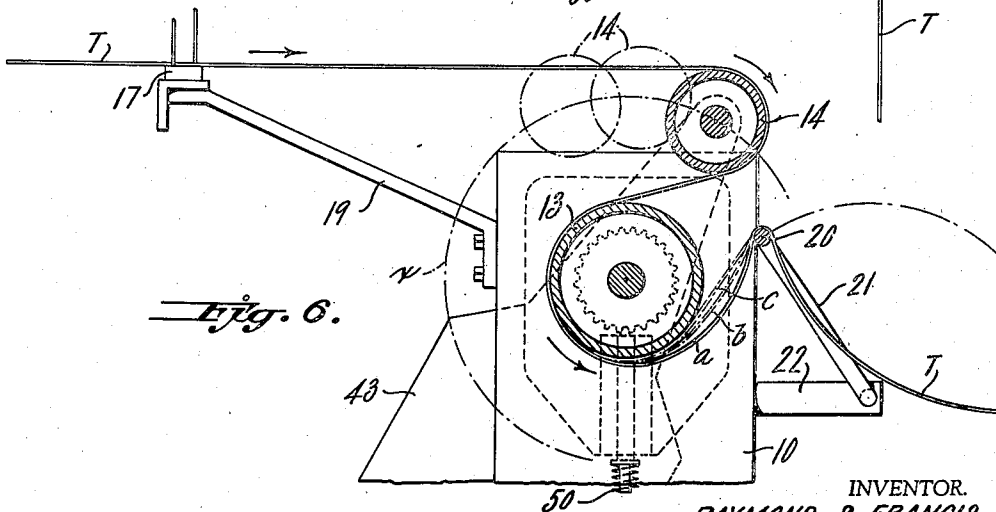
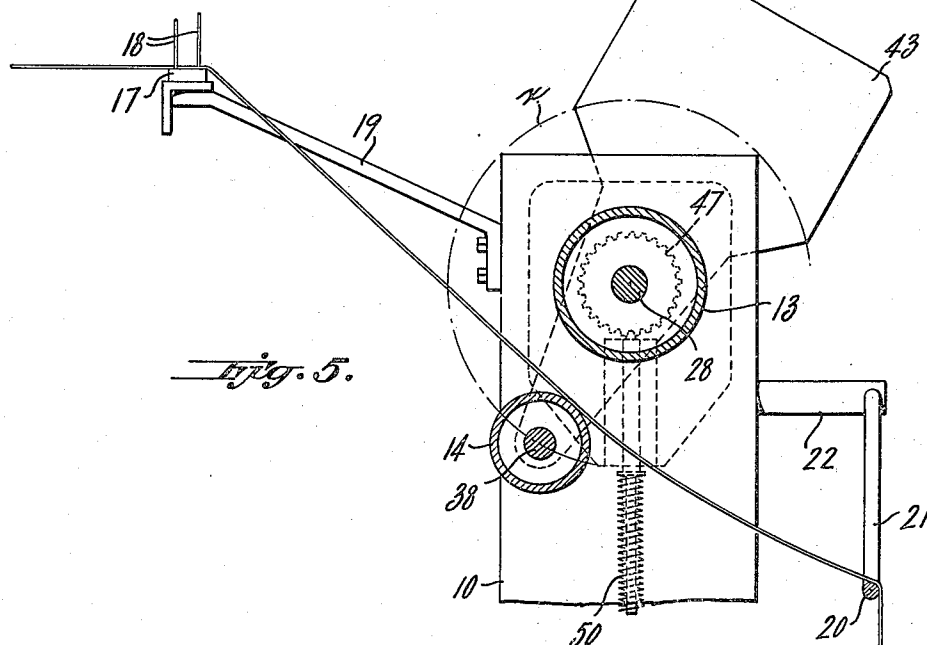
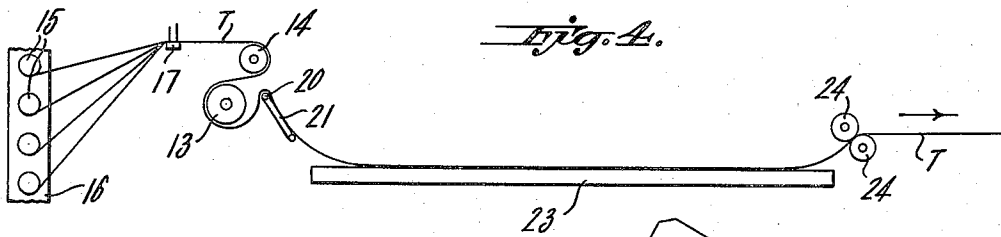
R. S. FRANCIS

2,098,418

APPARATUS FOR EQUALIZING THE TENSION OF THREADS

Filed May 12, 1936

2 Sheets-Sheet 2



INVENTOR.
RAYMOND S. FRANCIS
BY *Walter L. Viles*
ATTORNEY.

UNITED STATES PATENT OFFICE

2,098,418

APPARATUS FOR EQUALIZING THE TENSION OF THREADS

Raymond S. Francis, Rumford, R. I., assignor to
United States Rubber Products, Inc., New
York, N. Y., a corporation of Delaware

Application May 12, 1936, Serial No. 79,255

11 Claims. (Cl. 28—35)

This invention relates to mechanism for equalizing the tension of a plurality of threads such as warp threads, and is particularly well adapted for use in balancing or equalizing the tension of a number of rubber threads.

In preparing either elastic or inelastic threads for use as warp in a loom it is important that these threads be supplied to the warp beam under equal tension, for if some of the warp threads are under greater tension than others these variations in tension will appear in the warp of the woven fabric.

It is found difficult in practice to draw a number of rubber threads from spools or other sources of supply so that they will be under uniform tension. This is due in part to the tendency of elastic threads to change their tension over a period of time when stored upon a beam or spool, and also to the fact that the rubber threads when wound upon a spool or beam tend to sink into and cling to the underlying coils, so that if rubber threads are drawn from a number of spools they will unwind more freely from some spools than others.

Therefore, in warping rubber threads heretofore it was found that if all of the supply spools were rotated at the same speed in unwinding the rubber threads therefrom a larger variation in the tension of these threads when arranged in a warp chain would result. In order to balance or equalize the tension of the rubber threads it has been the practice heretofore of unwinding these threads from their source of supply onto a long table. They are then divided while on the table into warps of the desired number of ends and are balanced by a hand operation of raising and lowering the warp and separating the threads thereof with the fingers along the table so that the threads may be freed of tension and placed in a balanced condition, after which the group of threads may be chain-looped or coiled back and forth in a container.

The present invention contemplates power operated mechanisms for balancing and equalizing the tension of elastic threads as they are drawn from their source of supply without requiring the hand balancing method employed heretofore, and while the present invention was developed more particularly for use in equalizing the tension of elastic threads, it may be used to equalize the tension of inelastic threads.

An important feature of the present invention resides in power driven tension regulating rolls about which the threads being drawn from the sources of supply are looped so that the slack or taut condition of each thread will control its

frictional engagement with the rolls and thereby control the forward pull to which it is subjected by these rolls.

Another feature of the invention resides in means for supporting one of said power driven rolls for angular adjustment about the other roll to thereby vary the frictional engagement between the threads and the rolls about which they are looped, and a further feature resides in manually controlled locked means for facilitating the angular adjustment of one of said rolls and in the locking of this roll in the desired position.

Still a further feature resides in the construction and arrangement whereby said adjustable roll may be swung to an inoperative position to facilitate the free passage of the threads between said roll when the machine is being threaded up.

The above and other features of the invention and novel combination of parts will be further understood from the following description and accompanying drawings which illustrate one good practical form thereof.

In the drawings:

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

Figure 2 is a top plan view of the machine of Fig. 1;

Figure 3 on a larger scale is a sectional view taken on the line 3—3 of Fig. 1;

Figure 4 is a diagrammatic side elevation of the thread balancing mechanism of the present invention;

Figure 5 is a transverse sectional view through the pull rolls of Fig. 3, these rolls being shown in their threading up position; and

Figure 6 is a sectional view taken on the line 6—6 of Fig. 3.

The operating parts of the machine in the construction shown are supported by the spaced upright channels 10 which are provided at their lower ends with the supporting feet 11 that may be bolted to the floor. These uprights are rigidly supported in spaced relation to each other by the cross braces 12.

The uprights 10 serve to support at the desired height from the floor a pair of cooperating pull rolls or tension regulating rolls 13 and 14, and in the construction shown one of these rolls 14 is supported for movement bodily in the arc of a circle about the longitudinal axis of the other roll 13, as shown in Figs. 5 and 6. This angular adjustment of the roll 14 about the axis of the roll 13 serves to increase or decrease the friction pulling action upon the threads to be described, as

will be apparent in Fig. 6, and also serves to permit the movement of the roll 14 downwardly below the roll 13 to facilitate threading up of the threads as will be apparent from Fig. 5. While it is highly desirable to support one roll for angular adjustment relative to the other roll for the purposes just mentioned, this is not essential in all embodiments of the invention since the present apparatus may be employed to equalize the tension of threads if one roll is permanently supported above the other so that the threads the tension of which is to be equalized may be looped in one direction about one roll and in the opposite direction about the other roll.

The mechanism of the present invention may be employed to equalize the tension of either elastic or inelastic threads but is designed more particularly for use in equalizing the tension of bare rubber threads or covered elastic threads. These threads T may be supplied to the tension equalizing mechanism of the present invention from the individual spools 15 which spools may be supported upon a creel, rack or stand 16 and in practice it is found desirable to provide the spools 15 with supporting trunnions, not shown, but which may be journaled in wooden bearing blocks so that the spools may rotate freely as the threads T are withdrawn therefrom but will not overrun. In the construction shown the various threads T supplied by the spools 15 are led over a spacing comb 17 having the teeth 18 adapted to separate the threads and prevent them from becoming tangled. It is desirable to provide a considerable space between the spools 15 and the comb 17 such for example as a distance of 20 feet to facilitate the equalizing of the tension of each thread throughout a substantial length thereof as it is unwound from its spool.

The comb 17 in the construction shown is supported in spaced relation to the uprights 10 by the arms 19 secured to the upper portion of these uprights and when the machine is in operation the threads T pass in a general horizontal direction through the teeth of the comb and are looped about the upper roll 14 in one direction and about the lower roll 13 in the opposite direction as best shown in Fig. 6. It is desirable to provide means for holding these threads looped about the lower roll 13 so that each thread is free to sag away from this roll as it becomes slack and embraces this roll to be pulled forward thereby as it becomes taut. The means shown for supporting these threads looped about the lower roll comprises the bar 20 which extends transversely of the machine throughout its width and this bar in accordance with the present invention is provided near its ends with the laterally extending arms 21 which are pivotally secured to the supports 22 that project materially from the uprights 10. The construction is such that the thread supporting bar 20 may occupy the position in which it is shown in Fig. 5 during the threading up operation, and during the operation of the machine to equalize the tension of the threads this bar 21 occupies the raised position in which it is shown in Fig. 6. The arms 21 at the opposite ends of this bar serve to support it so that it may be swung through the arc of a circle from its lower position of Fig. 5 to its raised position of Fig. 6 and in the latter position it may rest against the uprights 10 to thereby maintain this bar spaced the desired distance from the roll 13.

The function of the rolls 13 and 14 is to frictionally pull each thread T forward independ-

ently of the tension of the other threads and to accomplish this the rolls 13 and 14 are driven at a speed considerably in excess of the maximum speed at which the threads T are to be supplied to the take-up means to be described. These two rolls may be driven at the same speed, or the roll 13 which in the present case is shown as larger in diameter than the roll 14 may be driven at either a faster or slower surface speed than the roll 14. The threads T upon leaving the tension regulating mechanism shown in Figs. 5 and 6 may be drawn along a relatively long table or supporting surface 23 and may then pass between the co-operating feed rolls 24 which serve to pull the threads forwardly at a uniform rate of travel over the surface of the table 23 and to deliver these threads in the form of warp threads in a well balanced condition with their tension equalized, whereupon they may be wound upon a warp beam or they may be chain-looped or coiled back and forth in a container.

It is desirable that pull rolls 13 and 14 have a smooth and accurately formed cylindrical surface and the roll 13 in the construction shown comprises a tube of steel having a highly polished outer surface which may be chrome plated and this tube has rigidly secured in one end thereof the supporting head 25 which head is provided with a central hub or boss 26 and rigidly secured in the opposite end of this tube is the head 27 having a similar central boss 26. The roll 13 thus formed is rigidly secured to a central supporting shaft 28 and the heads 25 and 27 may be secured to this shaft by the pins 29. The shaft 28 has rigidly secured to one end thereof the driving pulley 30.

The roll 14, as above stated, is preferably so supported that it may be swung through the arc of a circle about the axis of the roll 13 and the means of the present invention for supporting the roll 14 for this swinging movement will now be described. Each upright 10 is provided near its upper end with a hole or opening in which is rigidly mounted a bearing sleeve 31. These sleeves 31 serve to pivotally mount the brackets or castings 32 and 33 which serve to swingingly support the roll 14. To this end each of these brackets is provided with a hub 34 adapted to be journaled in the bore of the sleeve 31. Within each hub 34 in the construction shown is mounted a ball or anti-friction bearing 35 which is adapted to rotatably support the shaft 28 within the hubs of the brackets 32 and 33.

The bracket 32 is provided near its outer end with a boss 36 and the bracket 33 is provided with a similar boss 37. Within these aligned bosses 36 and 37 is mounted a shaft 38 which serves to rotatably support the roll 14. This roll as shown is formed of a highly polished steel tube like the roll 13 and has rigidly mounted in one end thereof the head 39 and in the opposite end thereof the head 40. The roll 14 is rotatably supported upon the shaft 38 by the ball or anti-friction bearings 41. The shaft 38 is preferably provided near each end thereof with a shoulder adapted to form abutments for the inner faces of the bosses 36 and 37 so that the ends of the shaft 38 may be rigidly clamped within these bosses by tightening up the nuts 42 at the outer ends of the shaft 38. As a result of this construction the brackets 32 and 33 are rigidly clamped in spaced relation to each other and serve to rotatably support both rolls 13 and 14 and also support the latter roll for swinging movement about the axis of the roll 13 in the arc

of a circle indicated by x in Figs. 5 and 6. The weight of the roll 14 is preferably counterbalanced by bolting to the castings 32 and 33 the counter-balancing weights 43.

5 The roll 13 is driven by the pulley 30 above mentioned and the roll 14 in the construction shown is driven by providing the roll 13 at one end thereof, inside the casing 33, with a gear 44 which is bolted or otherwise secured to the head 10 27. This gear may be formed of fiber or other non-metallic material and meshes with a gear 45 which may be bolted to or formed integrally with the head 40 provided in one end of the tube forming the roll 14. These two gears are housed by 15 the casing 33 and are preferably enclosed by the covering plates 46 bolted to the inner face of the casing 33.

It is desirable to provide means whereby the roll 14 may be easily and quickly locked in any 20 position of angular adjustment about the driving shaft 20. This is accomplished in the construction shown by rigidly mounting in each of the above mentioned hubs 34 a toothed locking ring or gear 47 and upon each upright 10 is slidably 25 mounted a bolt 48 adapted to cooperate with the teeth of the rings 47 to lock the swinging brackets 32 and 33 in any desired position of angular adjustment.

The bolts 48 are slidably mounted in the guide- 30 ways 49 and each bolt is continuously urged to its locking position by a coiled spring 50 surrounding the bolt and confined between a shoulder 51 upon the bolt and a guide block 52 rigidly secured to the upright. It is desirable to provide 35 means whereby the bolts 48 may be manually retracted from either side of the machine. This is accomplished in the construction shown by providing the operating shaft 53 supported by the uprights 10 for rocking movement, and projecting 40 laterally from this shaft adjacent its ends are the operating handles 54. The shaft 53 is also provided at each end thereof with an operating arm 55 and extending upwardly from each arm 55 to a locking bolt 48 is a connecting rod 56. 45 The arrangement is such that both bolts 48 may be retracted simultaneously by pressing upon the operating lever 54 at either side of the machine to move the same in a clockwise direction, viewed as in Fig. 1.

50 In the construction shown the pulley 30 is driven by a belt 57 by an electric motor 58 and the proper tension is maintained upon this belt in the construction shown by floatingly mounting the motor so that the weight of this motor 55 will serve to tension the belt. To this end in the construction shown a pair of motor supporting brackets 59 are provided which are bolted to the transverse braces 12 in spaced relation to each other and these brackets are connected by 60 the shaft 60 upon which are swingingly mounted the motor supporting arms 61. The motor casing is bolted upon the swinging arms and the armature shaft of the motor projects through an elongated slot 62 formed in an upright 10 and 65 mounted upon this armature shaft at the outer face of the upright 10 is the belt driving pulley 63.

The operation of the present machine is as follows, when it is desired to thread up the present machine ready to start operation, the roll 14 70 is swung downwardly to the approximate position in which it is shown in Fig. 5. The various threads T are then led from the supply spools 15 over the comb 17 so that they are separated by the teeth of the comb and then downwardly 75 between the rolls 13 and 14 and over the bar 21

as shown in Fig. 5. The roll 14 is then swung upwardly to the position in which it is shown in section in Fig. 6 or if a less degree of pulling tension is desired, to one of the positions indicated in dot-and-dash lines of Fig. 6. The other supporting bar 20 is then swung upwardly from the position in which it is shown in Fig. 5 to its operating position of Fig. 6. The adjustments just described serve to loop the threads about the upper roll 14 in one direction and about the lower 10 roll 13 in the opposite direction and these threads are held looped about the lower roll 13 by the supporting bar 20. The threads lying upon the table or supporting surface 23 are drawn forward by the feed rolls 24 and this will tend to 15 tension the threads where they are looped about the lower side of the pull roll 13. Any tensioning of these threads at this point will cause them to move from the full line position indicated by a in Fig. 6 to the dotted line position indicated 20 by b or c to thereby increase the pulling action which the rolls 13 and 14 will exert upon the threads T to draw them forward from their source of supply 15. As a result of this construction the rate at which each thread T is pulled 25 forward from its source of supply by the rolls 13 and 14 will be controlled by the taut or slack condition of this thread about the lower side of the roll 14 and if the rolls 13 and 14 are driven at a surface speed at least 75% in excess of the 30 maximum amount required to take care of the stretch of the elastic threads and their normal rate of delivery all threads will be delivered at the nip of the feed rolls 24 under uniform tension irrespective of the tension to which they 35 may be subjected at the time they leave the supply spools 15.

Having thus described my invention what I claim and desire to protect by Letters Patent is:

1. In a machine of the class described, in combination, mechanism for drawing forward simultaneously a number of threads, means for equalizing the tension of the individual threads supplied to said mechanism, including a pair of power driven tension regulating rolls spaced apart 45 to provide a free passage for the threads therebetween and one of which rolls is supported at a higher level than the other, said rolls being positioned so that said threads pass over and part way around the upper roll and form a loop about 50 the lower roll, and a thread support spaced laterally from the lower roll to hold the threads in a looped condition about the lower roll, whereby each thread is free to sag away from the lower tension regulating roll as it becomes slack and 55 embraces this roll as it becomes taut, the arrangement being such that the slack or taut condition of each thread controls independently of the other threads its gripping engagement with said rolls and the rate at which it is pulled forward 60 thereby.

2. In a machine of the class described, in combination, mechanism for drawing forward simultaneously a number of threads, means for equalizing the tension of the individual threads supplied to said mechanism including a pair of power driven tension regulating rolls spaced apart so that the threads may pass freely therebetween and positioned so that said threads pass part way around the first roll and form a loop about the 70 second roll, and a thread support positioned to hold the threads in a looped condition about said second roll, whereby each thread is free to sag away from the second roll as it becomes slack and embraces this roll as it becomes taut, the 75

arrangement being such that the slack or taut condition of each thread controls independently of the other threads its gripping engagement with said rolls and the rate at which it is pulled forward thereby.

3. In a machine of the class described, in combination, mechanism for drawing forward simultaneously a number of threads, means for equalizing the tension of the individual threads supplied to said mechanism, including a pair of power driven tension regulating rolls spaced apart to provide a free thread passage between them and positioned so that said threads pass part way around the first roll and are looped about the second roll, and a thread support positioned to hold the threads in a looped condition about said second roll, whereby each thread is free to sag away from the second roll as it becomes slack and is brought into embracing contact with said roll as it becomes taut, the arrangement being such that the slack or taut condition of each thread controls independently of the other threads its gripping engagement with said rolls and the rate at which it is pulled forward thereby.

4. In a machine for equalizing the tension of a number of threads arranged side by side, in combination a pair of power driven tension regulating rolls spaced apart so that the threads may pass freely therebetween and positioned so that said threads pass part way around the first roll and form a loop about the second roll to be frictionally pulled forward by these rolls, and a thread support positioned to hold the threads in a looped condition about said second roll, whereby each thread is free to sag away from the second roll as it becomes slack and embraces this roll as it becomes taut, the arrangement being such that the slack or taut condition of each thread controls independently of the other threads its gripping engagement with said rolls and the rate at which it is pulled forward thereby.

5. In a machine for equalizing the tension of a number of threads arranged side by side, in combination a pair of power driven tension regulating rolls spaced apart so that the threads may pass freely therebetween and positioned so that said threads pass part way around the first roll and form a loop about the second roll to be frictionally pulled forward by these rolls, a thread support positioned to hold the threads in a looped condition about said second roll, whereby each thread is free to sag away from the second roll as it becomes slack and embraces this roll as it becomes taut, the arrangement being such that the slack or taut condition of each thread controls independently of the other threads its gripping engagement with said rolls and the rate at which it is pulled forward thereby, and means for supporting one roll for adjustment about the axis of the other roll to thereby vary their frictional engagement with said threads.

6. In a machine for equalizing the tension of a number of threads arranged side by side, in combination, thread advancing mechanism, a pair of power driven rolls supported in spaced relation to each other between said mechanism and the source of thread supply and operable to frictionally pull the threads forward, said threads being looped about one roll in one direction and about the other roll in the opposite direction, and a support for supporting the threads looped about the latter roll so that each thread is free to sag away from the latter roll as it becomes

slack and embraces this roll as it becomes taut, the arrangement being such that the slack or taut condition of each thread controls independently of the other threads its gripping engagement with said rolls and the rate at which it is pulled forward thereby.

7. In a machine for equalizing the tension of a number of threads arranged side by side, in combination a pair of power driven tension regulating rolls spaced apart so that the threads may pass freely therebetween and positioned one above the other and so that said threads pass part way around the first roll and form a loop about the second roll to be frictionally pulled forward by these rolls, a thread support positioned to hold the threads in a looped condition about said second roll, whereby each thread is free to sag away from the second roll as it becomes slack and embraces this roll as it becomes taut, the arrangement being such that the slack or taut condition of each thread controls independently of the other threads its gripping engagement with said rolls and the rate at which it is pulled forward thereby, and means for supporting one roll so that it may be swung bodily about the other sufficiently for the threads to pass in a straight line therebetween in threading up the machine.

8. In a machine for equalizing the tension of a number of threads arranged side by side, in combination, a pair of friction pull rolls, means for supporting one of said rolls for adjustment in the arc of a circle about the axis of the other roll, driving means for said rolls, said threads being looped about one roll in one direction and about the other roll in the opposite direction, a support for supporting the threads looped about the latter roll so that each thread is free to sag away from the latter roll as it becomes slack and embraces this roll as it becomes taut, the arrangement being such that the slack or taut condition of each thread controls independently of the other threads its gripping engagement with said rolls and the rate at which it is pulled forward thereby, and means for securing said roll supporting means in different positions of angular adjustment to vary the frictional pulling action of said rolls.

9. In a machine for equalizing the tension of a number of threads arranged side by side, in combination, a pair of friction pull rolls, spaced brackets for supporting one of the rolls therebetween for swinging movement about the axis of the other roll, a toothed locking member rigidly secured to each bracket, locking means engageable with the teeth of said locking members to lock the brackets in the desired position of angular adjustment so that said threads may be looped about one roll in one direction and about the other roll in the opposite direction, and a support for supporting the threads looped about the latter roll so that each thread is free to sag away from this roll as it becomes slack and embraces this roll as it becomes taut, the arrangement being such that the slack or taut condition of each thread controls independently of the other threads its gripping engagement with said rolls and the rate at which it is pulled forward thereby.

10. In a machine for equalizing the tension of a number of threads arranged side by side, in combination, a pair of friction pull rolls, spaced brackets for supporting one of the rolls therebetween for swinging movement about the axis of the other roll, a toothed locking member rigid-

idly secured to each bracket, a lock bolt for each
toothed locking member to secure said brackets
in the desired position of angular adjustment so
that said threads may be looped about one roll
5 in one direction and the other roll in the oppo-
site direction, means for supporting the threads
looped about the latter roll so that each thread
is free to sag away from this roll as it becomes
slack and embraces this roll as it becomes taut,
10 and manually operable means for simultaneously
retracting said bolts.

11. In a machine for unwinding elastic threads
simultaneously from a number of spools and for
equalizing the tension of these threads, in com-
15 bination, a pair of friction pull rolls spaced apart

so that the thread may pass freely therebetween,
means for driving said rolls, said threads being
looped about one roll in one direction and about
the other roll in the opposite direction, a sup-
port for supporting the threads looped about the 5
latter roll so that each thread is free to sag
away from the latter roll as it becomes slack and
embraces this roll as it becomes taut, the ar-
rangement being such that the slack or taut 10
condition of each thread controls independently
of the other threads its gripping engagement
with said rolls and the rate at which it is pulled
forward thereby.

RAYMOND S. FRANCIS.