June 24, 1941. R. H. LAWSON 2,247,244

STRAND FEED-CONTROLLING MECHANISM FOR TEXTILE OR OTHER MACHINES

Filed June 28, 1939 4 Sheets-Sheet 1

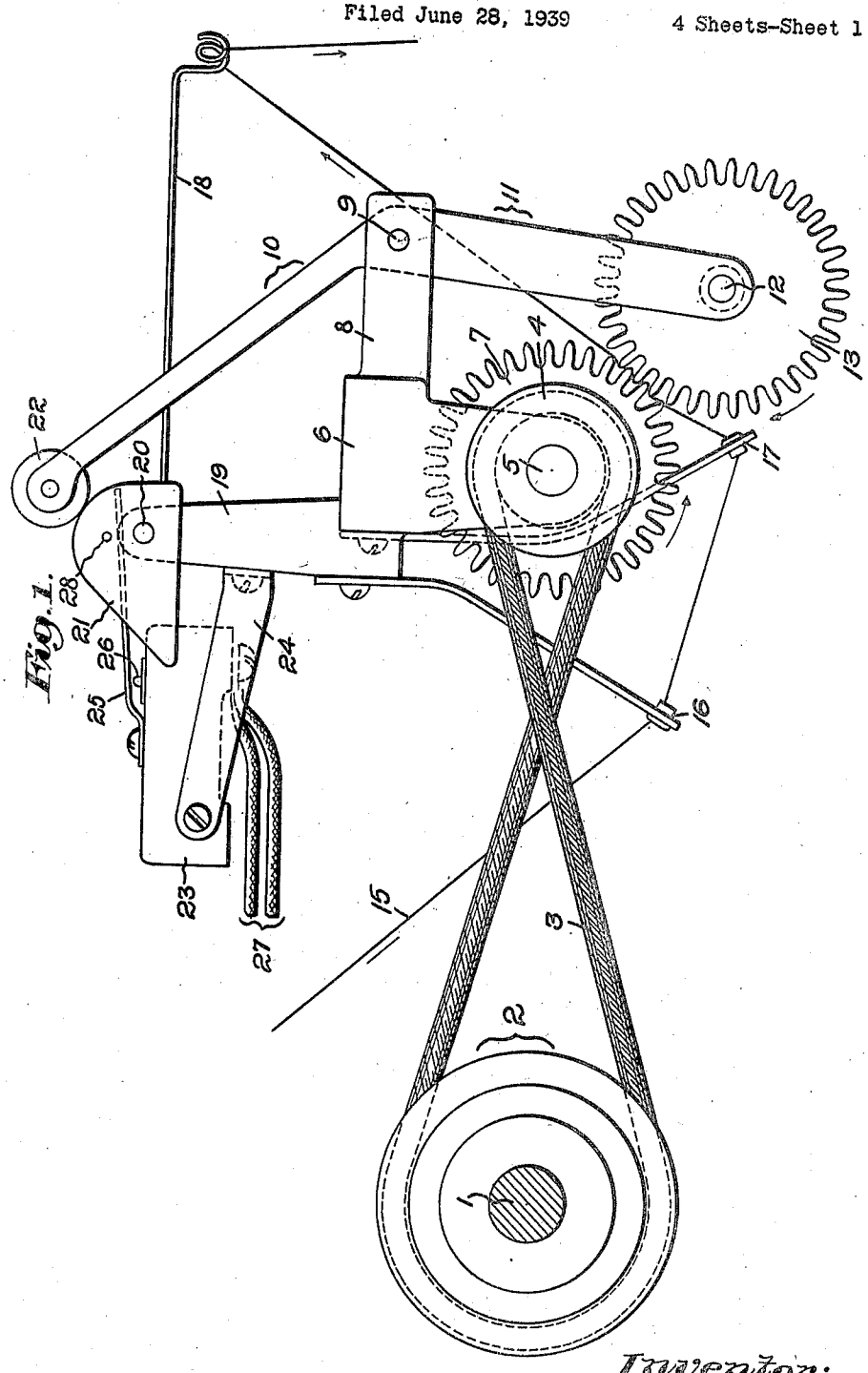


Fig. 1.

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Filed June 28, 1939 4 Sheets-Sheet 2

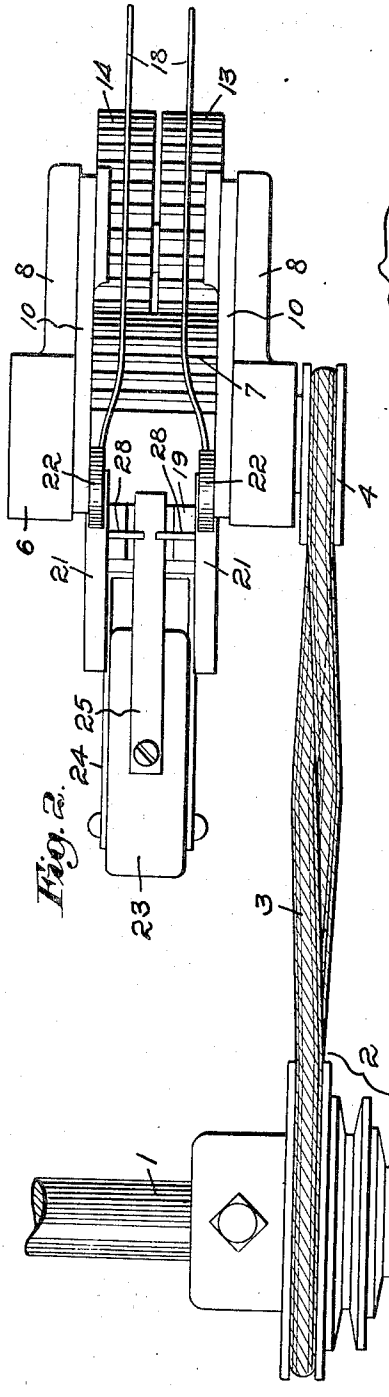

Fig. 2.

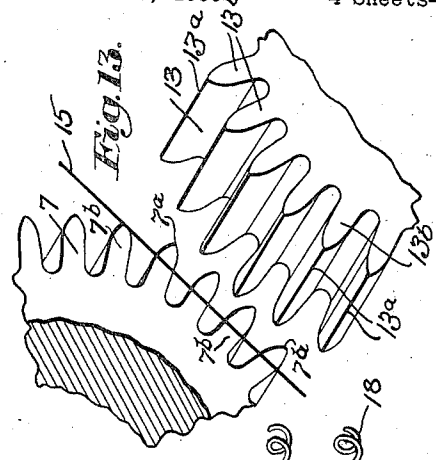

Fig. 13.

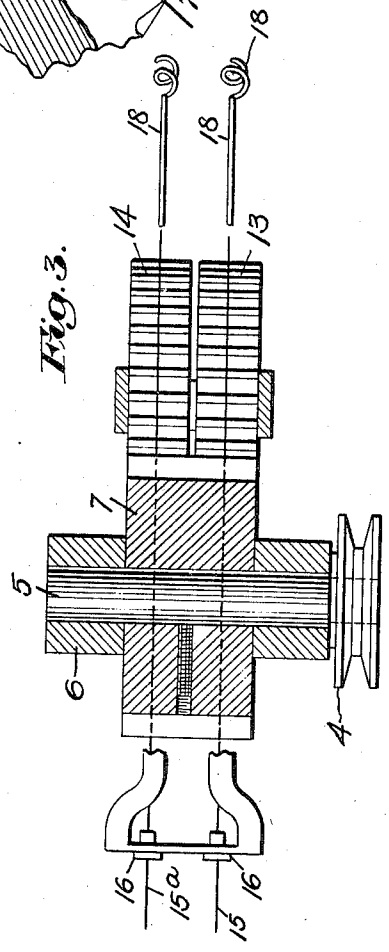

Fig. 3.

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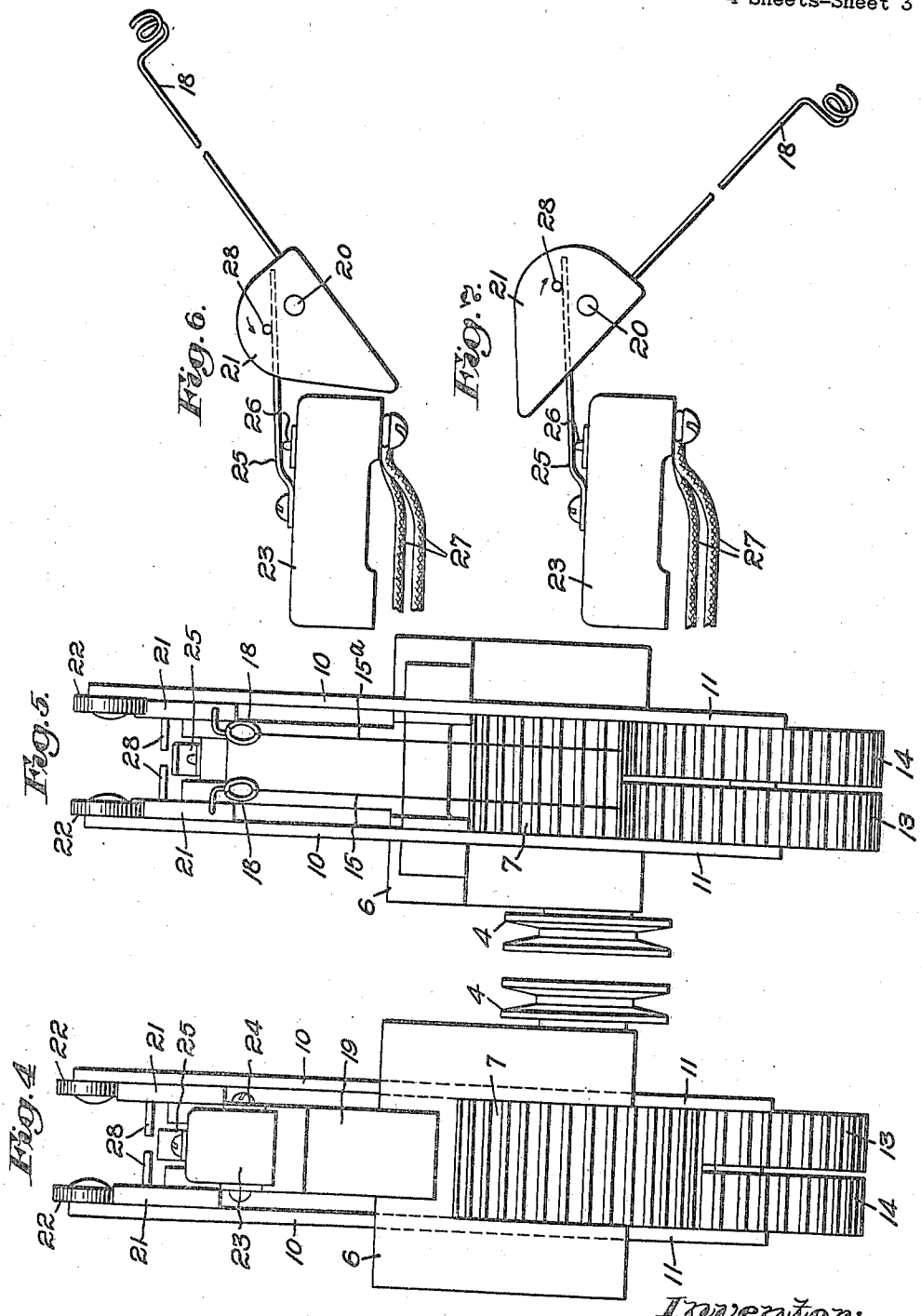
Filed June 28, 1939 4 Sheets-Sheet 3

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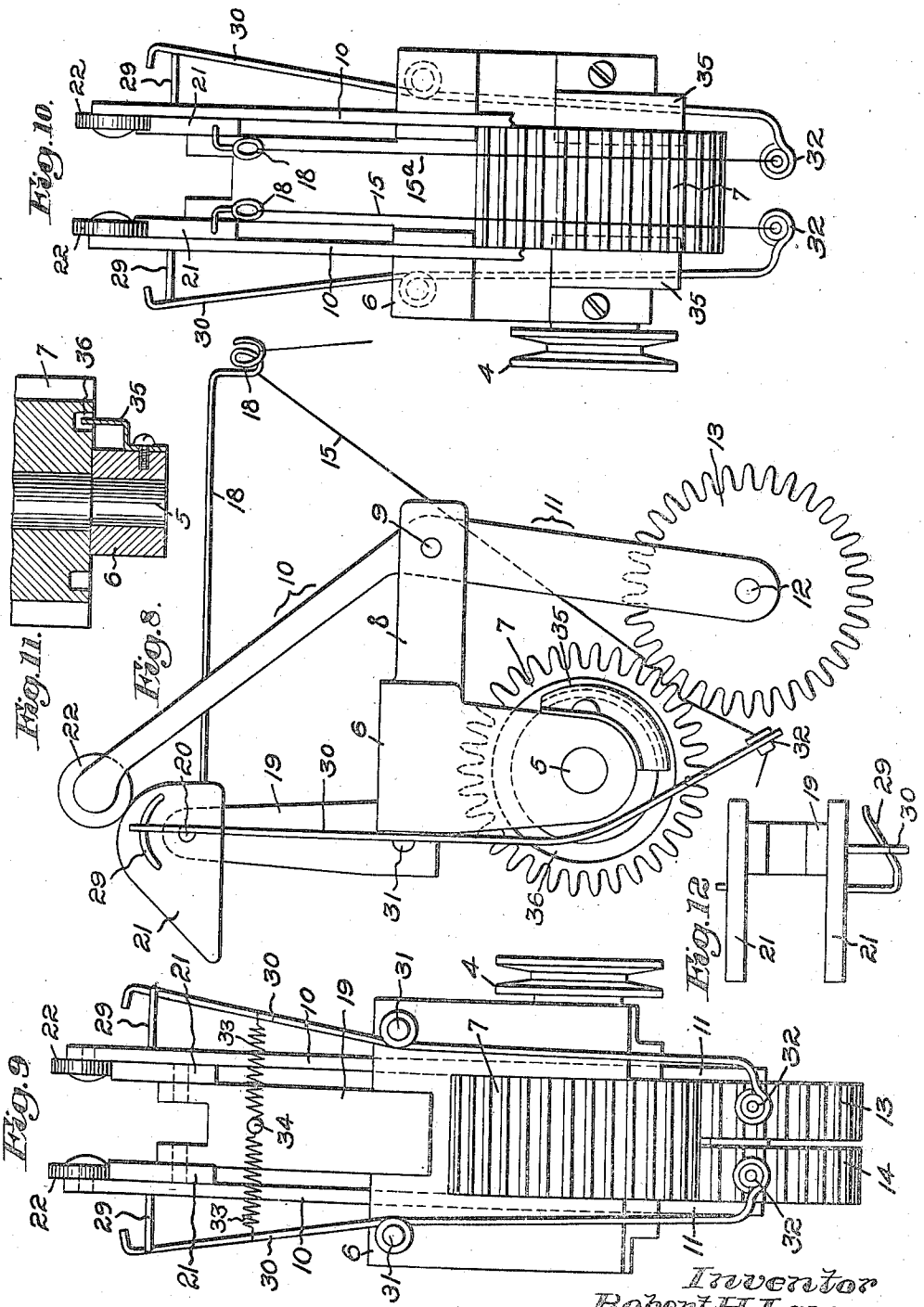
STRAND FEED-CONTROLLING MECHANISM FOR TEXTILE OR OTHER MACHINES

Filed June 28, 1939 4 Sheets-Sheet 4

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2,247,244

# UNITED STATES PATENT OFFICE

2,247,244

## STRAND FEED-CONTROLLING MECHANISM FOR TEXTILE OR OTHER MACHINES

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Application June 28, 1939, Serial No. 281,547

55 Claims. (Cl. 66—132)

This invention relates to strand feed-controlling mechanism for textile and other suitable machines and particularly to mechanism for controlling the feed of yarn, thread or other strands to the needles of knitting machines.

In order that the principle of the invention may be readily understood, I have disclosed two embodiments thereof in the accompanying drawings, wherein

Fig. 1 is a side elevation of strand feed-controlling mechanism constituting the preferred embodiment of my invention;

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

Fig. 3 is a view similar to Fig. 2, but partly in section;

Fig. 4 is a left-hand end elevation of the mechanism shown in Fig. 1;

Fig. 5 is a right-hand end elevation of the mechanism shown in Fig. 1;

Fig. 6 is a detail in side elevation showing stop-motion means associated in action with the strand-receiving guide arm, said arm being in the position assumed upon strand breakage;

Fig. 7 is a view similar to Fig. 6, but with the said guide arm in the position assumed in the event of excess feed of the strand, due to drawing longer loops at the knitting needles;

Fig. 8 is a side elevation of the second embodiment of my invention, wherein upon strand breakage or discontinuance of strand feed the strand is withdrawn from between the toothed rotary members.

Fig. 9 is a left-hand end elevation generally similar to Fig. 4, but of the form of my invention shown in Fig. 8;

Fig. 10 is a right-hand end elevation of the mechanism shown in Fig. 8;

Fig. 11 is a detail in transverse section showing shield means to protect the strand, when withdrawn from between the toothed rotary members upon strand breakage or discontinuance of strand feed;

Fig. 12 is a detail showing cam means functioning to withdraw the strand from between the rotary toothed members upon strand breakage or discontinuance of strand feed; and

Fig. 13 is a detail mainly in perspective to show the right-angled or square-cornered ends of the teeth of the rotary members.

The strand feed-controlling mechanism for textile and other suitable machines is particularly adapted for use in controlling the feed of one or more strands to the needles of knitting machines. Obviously, however, the knitting threads, yarns or strands may be fed in any desired relation, and for the making of many different types of knitted fabric.

Without in any respect confining myself thereto, and the said use being merely selected by way of example, I will describe the mechanism as though the strand or strands were being fed to the needles of a knitting machine.

I will first refer to the preferred embodiment of the invention represented in Figs. 1 to 7 inclusive.

The mechanism, which is composed of comparatively few and light parts compactly assembled, may be mounted at any suitable position upon the machine in question, as, for example, upon a stationary part of a circular knitting machine.

I provide a shaft 1 (best shown in Figs. 1 and 2) which takes power from the driving means for the knitting machine or other mechanism to which my invention is applied. The said shaft 1 has fast thereon a driving sheave 2 preferably formed with a plurality of grooves for receiving the power conveying element. While power may be conveyed from the shaft 1 to the other parts of the mechanism embodying my invention by gears, I preferably provide a rope or band drive 3, the driving rope or band being received upon the sheave 4 in the suitable groove. Inasmuch as the mechanism is to be stopped quickly in the event of strand breakage, I find it preferable to use a drive, such as illustrated, that permits a slippage of parts without shock or jar as would occur with the use of meshing gears. Moreover, the use of a rope or band drive, constituting the preferred embodiment of non-shock or flexible driving means, permits me to use strand-feeding gears having metal teeth for strand engagement, without risk of the said teeth injuring the strand by what might otherwise be hammer-like blows upon the strand when the machine is started up, and there is sudden demand upon the strand by such machine or upon the sudden stoppage of the machine.

The sheave 4 is fast upon a stud shaft 5, itself mounted in a suitable bearing in a bracket 6, best shown in Fig. 1. Fast upon the said stud shaft 5 is a toothed wheel or rotary member 7 preferably of some very light metal. The said rotary member 7, best shown in Figs. 4 and 5, is preferably of sufficient width to permit the feeding of a plurality of strands in contact therewith. While in Fig. 5 I have represented the feeding of two such strands, it is evident that my invention is not limited to the feeding of only two strands or of more than one strand.

Laterally extending from the bracket 6 is a two-part or spaced-membered arm 8 (best shown in Fig. 2) which has pivoted at each such part thereof at 9 a lever having an upper arm 10 and a lower arm 11. Upon the lower end of each such arm 11 is loosely mounted at 12 a toothed wheel or rotary member 13 or 14. The teeth thereof are similar in general form to the teeth of the rotary member or wheel 7 and desirably the said rotary members 13, 14 are of the same material as the rotary member 7. The rotary members 13, 14, as best shown in Figs. 2, 3, 4 and 5, are mounted side by side, preferably in slightly spaced relation, so as both to have an interengaging relation with teeth, tooth-like formations or projections of the rotary member 7. If more than two strands are to be fed to the same point, a corresponding number of lever arms would be provided, and if only one strand is to be fed, a single lever arm would be provided. It will be noted that (viewing the several figures of the drawings, and especially Fig. 1 relating to the first embodiment, and Fig. 8 relating to the second embodiment) the toothed wheels 13, 14 are so supported by the respective lever arms 10, 10, 11, 11 from the pivot 9, which is directly above the said toothed wheels 13, 14, that the said toothed wheels are capable of and do have in action a wholly free and unrestrained and very sensitive pendulum-like action or movement upon their pivotal point or points of suspension, which is the pivot 9. The said pivot 9 is a suitable, horizontal pin or stud-shaft located in the two-part arm 8 which laterally extends from the bracket 6, and the position of which arm 8 on the bracket 6 is carefully chosen for the purpose. The lever arms 10, 10 are directly acted on, above the pivot 9, by the guide arms 18 for the strand or strands.

Assuming that two strands 15, 15*a* are to be fed to needles of the knitting machine, as, for example, a circular hosiery machine, they are led from any suitable source and passing downward as indicated at 15 in Fig. 1, they pass through respective guides 16, 17, and then between the teeth of the wheels or rotary members 7, 13, 14, as indicated in Fig. 1, and also in Fig. 5.

The said strands 15, 15*a*, after passing between the tooth-like formations of the respective wheels or rotary members 7, 13, 14 pass upwardly as indicated in Fig. 1 to the respective strand-receiving guide arms 18, 18, one of said arms being shown in Fig. 1 and both of them being shown in Figs. 2, 3 and 5. The respective strands, after passing through the eyes or guiding formations of the respective guide arms, then continue down to the needles of the knitting machine.

Each of the strand-receiving guide arms 18, 18, if two or other plurality thereof be employed, is supported for movement to and fro consequent upon comparatively slight variations in the strand tension of the strand pertaining thereto, but with the capacity of greater movement in the event of strand breakage or strand discontinuance or in the event of such excessive feed of the strands, or one of them at the needles, as would result in stoppage of the mechanism.

While any suitable construction may be provided for the purpose, I have, as best shown in Fig. 1, provided an arm or standard 19 extending upward from the bracket 6. Upon the said arm or standard 19 is pivoted at 20 a cam member 21 for each strand, two such cam members therefore being shown and similarly indicated by reference characters. It will be observed that the functioning surface of each said cam member is at a constantly increasing distance from the pivotal point 20, viewing said cam member at the right hand edge thereof in Fig. 1. Each strand receiving guide arm 18, 18 is fixedly connected to a cam member 21, so that there are as many guiding arms 18 and cam members 21 as there are strands being fed to the knitting mechanism.

The upper end of each lever arm 10 is provided with a roll 22 bearing lightly upon the cam surface of the corresponding cam member 21.

In the event of slight but not excessive changes in the strand tension, and such as may normally very frequently occur, the corresponding guide arm 18, in the event that the change is a slight increase in the tension, is drawn slightly downward and the cam member 21 is correspondingly slightly rocked in a clockwise direction viewing Fig. 1. In other words, the tension upon the strand is maintained substantially uniform in spite of slight irregularities in the machine-demand upon the strand from any cause, and which may be the result of inevitable slight irregularities at more or less frequent intervals, or may be due to changes in the demand of the machine for the feeding of the strand, as, for example, in cases elsewhere specified herein, or, for example, in the use of knitting machines where the strand may at times be fed to the entire series of needles, and at other times to less than all the needles, as where (in the case of a rib knitting machine) the strand is sometimes fed to all the needles (cylinder and dial) and at other times only to the dial or to the cylinder needles. By my invention, if there are any changes in the demand of the machine for the strand, these changes in demand are responded to by the strand-feeding mechanism, with the result that the tension on the strand is maintained substantially uniform at all times. Such slight clockwise movement of the cam member 21 causes a slight outward movement of the corresponding lever arm 10 with corresponding slight inward movement of the lever arm 11, thus moving the teeth or tooth-like formations of the wheel or rotary member 13 or 14, as the case may be, into deeper interengaging or meshing relation with the teeth or tooth-like formations of the wheel or rotary member 7. This slightly increases the feed of the strand in question, and therefore relieves the undue tension, so that the substantially uniform tension is maintained.

In the event that said slight change in the tension of a strand is a diminution of tension, the corresponding arm 18 will move slightly upward and consequently the cam member 21 would move slightly in a contraclockwise direction, with such movement of the corresponding lever arms 10 and 11 as to withdraw the teeth of the wheel or rotary member 13 or 14, as the case may be, slightly outward with respect to the teeth of the wheel or rotary member 7. This would cause the slower feeding of the strand in question, and so permit the corresponding arm 18 to resume its normal, level position, so that in this case also the substantially uniform tension is maintained. This movement of the toothed wheels or members 13, 14 into deeper or less deep meshing relation with the toothed rotary member 7 is facilitated by the wholly free and unrestrained pendulum-like mounting of the levers 10, 11 at the pivot 9. Therefore, the said rotary members with their teeth or tooth-like formations constitute in effect a new or secondary or rectified source of

supply in a condition of uniform tension of the strand or strands to the knitting machine or other mechanism where the strand or strands is or are to be used or accumulated, whereas the strand or strands between the original packages or supplies, such as spools or bobbins, is or may be in a condition of constantly, though slowly, changing tension, owing to numerous possible causes, such as imperfect winding upon the original package or packages or the position of such package or packages as the strands are drawn therefrom. The strand or strands issue from the outgoing side of the said rotary members in condition of uniform tension and are delivered to the knitting machine or other mechanism in a condition of uniform tension.

Thus, there is provided by said rotary members a source of supply (a new or substitute or rectified source of supply) which is independent of the primary or original source of supply in that it does not have the inequalities of tension of the former. Said new source of supply controls completely the tension of the strand or strands independent of the original source or sources of supply, in that it is not affected by the inequalities of tension of the original supply, and those inequalities of tension of the original supply are not permitted at any time to impose themselves upon or to impair the uniform tension that exists between the outgoing side of the said rotary members and the knitting machine or other mechanism that receives the said strand or strands. Said rotary members and the immediately cooperating parts create or provide such new or substitute or rectified source of supply, which possesses the capacity to feed or not to feed the strand or strands (see especially Figs. 8, 9, 10 yet to be described) as may be desired, without any mechanical connection between them and the knitting machine or other mechanism where the strand or strands is or are to be used.

Thus far the mechanism has been described as a means for correcting or compensating for or rectifying the slight irregularities in the yarn feed, this being accomplished by causing the strand or strands to take a more or less sinuous course between the teeth or tooth-like formations of the wheels or rotary members 7, 13, 14. I have provided means in addition thereto to stop the mechanism in the event that a strand breaks or suddenly feeds at such an excessive rate due to the needles drawing longer loops, or like cause, as to require stoppage of the mechanism until correction can be made. I have for this purpose associated with the mechanism thus far described stopping means, preferably of electrical character. While for this purpose I may provide any suitable means, I have preferably employed a switch indicated at 23 in Figs. 1, 6 and 7, and which may be a snap switch of the general construction shown in the patent to McGall, No. 1,960,020, May 22, 1934. The said switch or other suitable device for the purpose is supported fixedly by a bracket 24 from the upright or arm 19 centrally with respect to each cam member 21, as shown in Fig. 2, if two cam members are employed. A part of the said switch comprises a metallic spring strip 25, and a suitable contact 26. The said snap switch is wired as indicated generally at 27 to a solenoid or other mechanism or device, not illustrated, for stopping the knitting machine or other machine to which the strands are being fed.

Upon a lateral face of each cam member 21 is an inwardly projecting pin 28 which is so positioned with respect to the metallic spring strip 25 that in whichever direction the corresponding cam member 21 swings excessively (that is, due to the strand breaking or suddenly feeding excessively and making longer loops) the said pin 28 will depress the metallic spring strip 25 so as to cause it to touch the contact 26. These two movements each resulting in causing the strip 25 to touch the contact 26, are respectively illustrated in Figs. 6 and 7. In Fig. 6, it will be observed that the pin 28 has moved over to the left of the pivotal point 20 of the cam member 21, whereas in Fig. 7 the said pin 28 has moved over to the right of the said pivot 20. In the movement shown in Fig. 6, the arm 18 has suddenly moved excessively upward due to the strand breaking, whereas in Fig. 7 the arm 18 has suddenly been moved excessively downward, due to the strand suddenly being drawn into larger loops, through some cause. Either of these conditions causes the spring strip 25 to be forced into touching relation with the contact 26 and so causes the stoppage of the mechanism through suitable connections not herein necessary to illustrate.

The second form of my invention, which is shown in Figs. 9 to 12, may be and desirably is similar or the same as what is shown in Figs. 1 to 7, with the exception that instead of providing stop motion means, I provide means acting upon strand breakage or feeding discontinuance of the unbroken strand for a longer or shorter period as, for example, in horizontal striping in a hosiery or other knitting machine, to withdraw the strand in question from between the teeth or tooth-like formations of the wheel or rotary member 7 and the wheel or rotary member 13 or 14, as the case may be. Thus I provide means controlled wholly by the strand itself, not only to vary the feed of the strand by the toothed members, but also in proper cases to interrupt the feed of the strand by the said toothed members, all according to the machine demand for said strand, whereby the feeding of said strand is in entire accord with the machine demand therefor. Therefore, I have applied the same reference characters to corresponding parts, and it is unnecessary to refer thereto in detail.

Instead of providing stop motion means cooperating with the cam members 21, I have provided means preferably associated therewith for withdrawing whatever strand may break or be discontinued for any reason whatsoever from between the teeth or tooth-like formations of the wheels cooperating therewith. For this purpose, as shown in Figs. 8, 9, 10 and 12, I have provided on a side face of each cam member 21 a member 29 desirably of arcuate form, and also set at an angle to the face of the corresponding cam member 21, as best indicated in Fig. 12, I provide such a member 29 for each of the cam members 21, as is clearly apparent from Figs. 9 and 10. Cooperating with each member 29 is a lever preferably of light wire indicated at 30 and pivoted at 31 upon the bracket 6. The lower end of each lever 30 has an eye 32 through which the strand passes. The levers 30 are normally drawn toward each other at their upper ends by two light coiled springs 33 under tension, being secured to said levers 30 and to a pin 34 on the arm or standard 19.

It will be evident that when a cam member 21 is moved to an excessive extent in a contra-clockwise direction and the corresponding guide arm 18 flies upward, due to the breaking or discon-

tinuance for any reason, as, for example, for horizontal striping in knitting of the strand, the broken or discontinued strand is by the corresponding lever **30** laterally withdrawn from between the teeth or tooth-like formations of the rotary members **7** and **13** or **14**, as the case may be, the shape of the member **29** permitting this movement. When so withdrawn, the broken or discontinued strand is guarded, by a shield **35** fastened upon the bracket, from entangling with the wheel **7** or any other moving part. Preferably the wheel **7** is annularly grooved as at **36** to receive the edge of the shield **35**.

When the broken strand has been repaired or it is desired to reintroduce the discontinued strand which has been temporarily withdrawn from action or use for any purpose, as, for example, in effecting horizontal striping in knitting, and the guide arm **18** has been returned to normal position, the eye **32** of the corresponding lever **30** will cause the feeding strand to re-enter laterally between the teeth of the wheels or members **7** and **13** or **14**, as the case may be.

It is to be understood that my invention is applicable not only to the lateral withdrawing of a broken strand, but also to the lateral withdrawal of an intact strand for any purpose, as, for example, to permit the feeding of another strand for horizontal striping in knitting or to permit the knitting to continue with the remaining strand, which would cause a horizontal striped condition. Or it may be for the purpose of floating a thread or strand past some of the knitting needles, as in the knitting of a high splice, and then reintroducing the same strand after a longer or shorter time. In fact there are many uses to which this portion of my invention may be put in knitting operations. Within the scope of my invention an intact strand may be laterally withdrawn and then reinserted. My invention in this respect is broad and is not limited to the lateral withdrawal of an intact strand.

I have discovered that the ends of the teeth or tooth-like formations of the wheels or gears, such as **7**, **13** and **14** must be square or right angled, as indicated in Figs. 9, 10 and 11, and also as shown in Fig. 13, to permit the thread or strand to be introduced or reintroduced laterally. I have found it to be impossible to introduce or reintroduce the thread or strand if the ends of the teeth are beveled off or tapered or recede at their ends from the end face of the wheel or member. In other words, the ends of the teeth must come out at least flush with the face at each end of each wheel or member **7**, **13**, **14**. If the parts be so constructed, the thread or strand, if presented at the end face of a wheel **7**, **13** or **14**, will be taken in immediately by the rotating teeth, or substantially so.

Referring to the numerous figures of the drawings, and particularly Fig. 13, which shows upon a larger scale the shape of the teeth (represented in Figs. 4, 5, 9, 10 and 11) of the rotary members or gears **7**, **13**, **14**, I have in Fig. 13 indicated at **7***a* and **13***a* respectively the top or ridge of each tooth, this being the part of each tooth that is most remote radially from the center of rotation of the respective rotary members or gears **7**, **13**, **14**. Such top or ridge **7***a* or **13***a* is a straight line terminating at, and bounded at its ends by, the end walls of the teeth, one of which ends I have indicated at **7***b* or **13***b*. The other end wall of each tooth is, in these embodiments of the invention, similar to the end wall **7***b* or **13***b* (that is to say, it is preferably parallel or substantially parallel thereto), in other words, an active end wall does not recede or extend toward the other end wall at the toothed corners of the periphery, since that would constitute a tapering or conical end which is not effective for the purpose of my invention. The end walls **7***b* or **13***b* of all the teeth of each rotary member or gear, in the disclosed embodiment of the invention, lie all in the same plane, which is desirably substantially at right angles to the axis of rotation of the respective gears **7**, **13**, **14**. This construction is desirably employed at and is shown at both ends of the several rotary members or gears, even though the entrance and withdrawal of a strand occur only at one end of the teeth of the gear or rotary member **13** or **14**, with respect to which, in the embodiment of the invention shown in Figs. 8 to 12, the strand **15** (Fig. 10) is entered and withdrawn at one side of the gear **7** and the strand **15***a* at the other side. As just stated, in the case of the rotary members or gears **13** and **14**, said strands enter at the respective opposite sides of the rotary members or gears **13**, **14**. My invention is, therefore, not limited to employing the described construction at both ends of all the rotary members or gears, but such is the preferred construction.

Assuming that a strand **15** or **15***a* has been laterally withdrawn from between the teeth of the construction described, or that such strand is to be initially introduced laterally between the teeth, it is evident that what I have referred to as square or right angled corners of the teeth, (and which is the meeting point of the top or ridge of a tooth, and the end wall of a tooth, which point should not be back of the rest of the face constituting the end wall), will grab any strand there presented, provided, of course, that the strand is not presented exactly perpendicular to the axes of rotation of the rotary members, such as **7** and **13** or **7** and **14**, as it could not then obtain an entrance. The strand being presented at an inclination to such axes of rotation is instantly grabbed by the meshing teeth of the rotary members **7** and **13** or **7** and **14**, as the case may be, and "flows," as it were, or travels along the tops or ridges of the meshing teeth to a more or less central position between the end walls of the teeth, as indicated by the position of either eye **32** in Fig. 9. The strand that is at some part of its extent, between an eye **32** and the companion eye **18**, laterally beyond the end of the teeth, but which, somewhere between such eyes **32** and **18**, touches a corner of a tooth, is instantly seized by the corner of such tooth, since the strand does not lie precisely parallel to a plane surface coinciding with the end walls of the teeth at the end of a rotary member, such as **7** and **13** or **7** and **14**, but is inwardly inclined because of the relative position of the companion eyes **32** and **18** pertaining to that strand, and the said corners; that is, the tops or ridges **13***a* of the teeth close to the end wall **13** thereof suddenly engage the strand so presented to them, with the result that the said strand is immediately fed to the knitting or other mechanism by the continued rotation of the rotary members **7** and **13** or **7** and **14**, as the case may be.

The described structure, therefore, is such that the teeth of the rotary member, such as **7**, **13**, **14**, take sudden "bites" of such strand, which therefore causes the strand to enter quickly between such rotary members and facilitates its movements laterally along the tops or ridges of the teeth to a more or less central position be-

tween the lateral faces of the rotary members considered as a whole.

The action just described will be evident from a consideration of Fig. 10. The strand 15 or 15a is, of course, received in an eye marked 18 of the guide arm 18 (see Figs. 8 and 10). Such eye 18 may move up or down in a vertical path, owing to slight and inevitable variations in the tension of the strand or the machine demand therefor, but it necessarily moves up or down in a vertical path, which is essentially at substantially right angles to the axes of rotation of the members or gears 7, 13 and 14. When the cam 21 (Fig. 8) moves in a direction to cause the cam wire 29 on cam 21 to press the eye 32 of that strand inwardly (that is, toward a line passing through the eye 13 and eye 18, and cutting the axes of rotation of the three members or gears 7, 13, 14 at right angles to such axes, and more or less midway between the ends of the teeth of such members), it is evident that the portion of the said strand between such eye 18 and such eye 32, which is companion thereto, is presented to the teeth of the rotary members 7 and 13 or 7 and 14, as the case may be, in a path which is oblique to and not perpendicular to the said end walls of the said rotary members or gears.

It has been proposed by others to provide markedly tapered ends upon a pair of furnishing non-toothed rollers for the purpose of permitting a guiding arm or part to place the yarn or strand in the open space between the said tapered ends of said rollers for the purpose of having the cylindrical portions of such rollers then seize upon and feed the yarn or strand. Such structure would not carry out the purposes of my invention, even though the said rollers between the cylindrical parts were provided with teeth. I have discovered that tapered ends of toothed rolls, or smooth rolls with or without tapered ends, tend to cam the strand away from the said rolls instead of grabbing it in, as is done by the construction of the parts described by me, particularly with reference to Fig. 13, and Figs. 9, 10, 11. In prior structures, it has been proposed when using smooth surfaced rollers having conical ends, to pass the yarn through sweeps in addition to drawing the strand mechanically between the conical ends of the rollers. The presence of such sweeps indicates that the strand does not quickly and readily enter between the smooth conical ends.

By the employment of the construction above described as an embodiment of my invention, and having what I may briefly and generally refer to as the square cornered teeth or strand seizing corners, I am enabled to do away with mechanical means for throwing the strand between the furnishing rotary members and also to do without any such sweeps, inasmuch as the said corners of the teeth immediately grab any strand presented, as fully described by me in connection with Figs. 9 to 13.

It will be evident from the foregoing description and from the figures of the drawings (particularly Figs. 1 and 8) that the entire control mechanism is built light and with the heavier parts thereof kept close to center, with the result of reducing inertia particularly when starting, since in such case the strand (for example, in the case of the yarn of a knitting machine) is thrown into the knitting machine while the knitting machine is running at full speed. In such case, it is necessary for the arm 18 to come down to the position where it will provide for feeding enough yarn smoothly without overthrowing.

The strand speed-controlling mechanism herein disclosed feeds the strand at a substantially uniform tension throughout its range regardless of the machine demand for or upon the strand. In other words (as in the case of a knitting machine), as the knitting machine demands more yarn, the guide arm 18 moves downward, causing the gears or toothed members 7, 13, 14 to mesh more deeply, and thereby to feed more yarn. As the machine demand is diminished, the guide arm 18 moves upward, allowing the said gears or toothed members to move into less deep mesh, thus feeding less yarn. The said guide arm 18 is so balanced, as will be evident from the drawings, that it applies substantially the same tension to the yarn throughout its motion, so that, so far as the yarn tension is concerned, it is substantially the same whether the said guide arm 18 is in a low position or is in a high position, or, in other words, whether it is feeding more or less yarn. The mechanism at all times maintains a substantially uniform tension in spite of slight irregularities in the demand of the yarn (that is, in spite of the demand of the knitting machine upon the yarn). The tension is therefore the same regardless of the precise character of the machine demand for the yarn.

It will be evident from the foregoing description that I have provided strand feed-controlling mechanism for textile or other machines, including a set of toothed members for feeding the strand to a machine for use according to the demand of such strand by the machine, together with means to drive at least one of the said toothed members such as 7 and 13 or 7 and 14, in this embodiment of the invention, so long as the knitting machine or other machine is itself being driven, whether or not the demand of the knitting machine, or other machine, for the strand is interrupted, together with means controlled wholly by the said strand itself to vary and also to interrupt the feed of the said strand by the said toothed members, according to the machine demand for said strand, whereby the feeding of said strand is in entire accord with the machine-demand therefor.

It will also be evident from the foregoing description that my invention comprehends strand feed-controlling mechanism for textile or other machines wherein there is a set of toothed members for feeding the strand with controlled tension independent at all times of the primary source of supply, said set of toothed members being capable of varied meshing relation, thereby to maintain said controlled tension in accordance with the strand demands of the machine to which the strand is fed by said mechanism, and independent of the primary source of supply of said strand, at least one of the said toothed members of the set being power driven, means being also provided which is delicately responsive to inevitable slight irregularities of the machine demand upon the feeding strand, for automatically controlling said meshing relation of said toothed members, in accordance with the strand demand of said machine, to maintain such tension substantially uniform.

It will be evident from the foregoing description, and particularly from the description and illustration of the second embodiment of my invention, but to the mechanical details whereof my invention is not limited, that I have provided strand feed-controlling mechanism for textile and

other machines, comprising or including a set of meshing toothed members for feeding between them the strand to a machine for use, according to the demand for use of such strand by said machine, with means to drive at least one of said toothed members so long as the machine is being driven, whether or not the demand of the machine for the strand is interrupted, the strand itself controlling the variation in the feed by said toothed members in suitable manner, of which I have herein shown certain embodiments, and also interrupting or stopping the feed of the strand by said toothed members, according to the machine demand for the strand, whereby the feeding or non-feeding of the strand is in entire accord with the machine demand therefor, the said strand, when not fed by the toothed members being positioned in consequence of the cessation of the machine demand, in such relation to the teeth of the said feeding members that it is not, when in such relation, fed by them so long as the said cessation in machine demand for the yarn continues.

My invention may be used for other widely varying purposes and in other relations than herein stated. While an important use of my invention is in connection with knitting machines, my invention is not restricted to that use, as it may be used in other types of textile machines, such as winding machines, etc.

Having thus described two embodiments of the invention, it is to be understood that although specific terms are employed, they are used in a generic and descriptive sense and not for purposes of limitation, the scope of the invention being set forth in the following claims.

I claim:

1. Strand feed-controlling mechanism for textile and other machines comprising, in combination, a set of rotary, toothed, intermeshing members for feeding a strand between them, at least one of said members being driven; the teeth of said members each having a top or ridge bounded at one end at least thereof by an end wall of the tooth, such end walls of the teeth of each of said toothed members constituting an encircling series of rotary strand-seizing corners; and guiding means to present a strand at such teeth corners for immediate seizure thereby and consequent immediate feeding by such intermeshing teeth of said members to the textile or other machine.

2. A combination according to claim 1 in which the guiding means presents a strand from a position laterally beyond co-acting faces of said members at such teeth corners thereof.

3. A combination according to claim 1 in which the guiding means presents a strand from a position laterally beyond co-acting faces of said members at such teeth corners thereof, and effects the withdrawal of the strand laterally from between the said teeth by reverse movement of said guiding means.

4. Strand feed-controlling mechanism for textile and other machines, comprising in combination, a set of rotary, toothed, intermeshing members for feeding a strand between them, at least one of said members being driven; the teeth of said members each having a top or ridge bounded at one end at least thereof by an end wall of the teeth, each such end wall of the teeth constituting a rotary-member plane-surface lying substantially normal to the axes of the respective rotary members, to constitute strand-seizing corners, and guiding means to present a strand at such teeth corners at an inclination to the axes of said members for immediate seizure thereby and consequent immediate feeding by such intermeshing teeth of said members, to the textile or other machine.

5. Strand feed-controlling mechanism for textile and other machines comprising, in combination, a set of rotary, toothed, intermeshing members for feeding a strand between them, at least one of said members being driven; the teeth of said members each having a top or ridge bounded at one end at least thereof by an end wall of the teeth, each such end wall of the teeth constituting a rotary-member plane-surface lying substantially normal to the axes of the respective rotary members, to constitute strand seizing corners, and guiding means to present a strand from a position laterally beyond co-acting plane faces of said members at such teeth corners thereof, at an inclination to the axes of said members, for immediate seizure thereby and consequent immediate feeding by such intermeshing teeth of said members, to the textile or other machine.

6. Strand feed-controlling mechanism for textile and other machines comprising, in combination, a set of rotary, toothed, intermeshing members for feeding a strand between them, at least one of said members being driven; the teeth of said members each having a top or ridge bounded at one end at least thereof by an end wall of the teeth, each such end wall of the teeth constituting a rotary-member plane-surface lying substantially normal to the axes of the respective rotary members, to constitute strand-seizing corners; and guiding means to present a strand from a position laterally beyond co-acting plane faces of said members at such teeth corners thereof, at an inclination to the axes of said members, for immediate seizure thereby and consequent immediate feeding by such intermeshing teeth of said members, to the textile or other machine, said guiding means effecting the withdrawal of the strand laterally from between the said teeth by reverse movement of said guiding means.

7. Strand feed-controlling mechanism for textile or other machines comprising in combination, a set of interengaging toothed members for feeding the strand between and by such interengaging teeth to a machine for use according to the machine demand for strand use, as indicated by said strand stress or tension; means to drive at least one of said toothed members so long as such machine is being driven, whether or not the demand of the machine for the strand is interrupted; and movable means equally delicately responsive to slight inevitable irregularities in strand stress or tension, and also to sudden, entire, brief cessations of machine demand for the strand while intact, so as in the case of such slight irregularities to vary said intermeshing toothed relation and in the case of such brief cessations to interrupt wholly during such cessations the feeding of the strand by said toothed members.

8. Strand feed-controlling mechanism for textile or other machines comprising in combination, a set of interengaging toothed members for feeding the strand between and by such interengaging teeth to a machine or use according to the machine demand for strand use, as indicated by said strand stress or tension; means to drive at least one of said toothed members so long as such machine is being driven, whether or not the demand of the machine for the strand is in-

terrupted; and movable means equally delicately responsive to slight inevitable irregularities in strand stress or tension, and also to sudden, entire, brief cessations of machine demand for the strand while intact, so as in the case of such slight irregularities to vary said intermeshing toothed relation and in the case of such brief cessations to interrupt wholly during such cessations the feeding of the strand by said toothed members, and upon the termination of each brief cessation to resume the feeding of the strand by said toothed members, all in response to the said indications of machine demand given by the strand itself.

9. Strand feed-controlling mechanism for textile or other machines comprising in combination, a set of interengaging, cylindrical, toothed, flat sided members for feeding the strand between and by such interengaging teeth to a machine for use according to the machine demand for strand use, as indicated by said strand stress or tension; means to drive at least one of said toothed, cylindrical members so long as such machine is being driven, whether or not the demand of the machine for the strand is interrupted; and movable means equally delicately responsive to slight inevitable irregularities in strand stress or tension, and also to sudden, entire, brief cessations of machine demand for the strand while in use, so as in the case of such slight irregularities to vary the extent of the intermeshing relation of said teeth, and in the case of such brief cessations to withdraw the strand at such sides of the cylindrical members, and upon the termination of each such brief cessations to return the said strands between the interengaging teeth at such flat sides, all in response to the said indications of machine demand given by the strand itself.

10. Strand feed-controlling mechanism for textile or other machines comprising in combination, a set of rotary, toothed, interengaging members for feeding a strand or strands between the teeth of said members, at least one of said members being driven, a strand-receiving guide arm or arms supported for movement to and fro in unrestrained, free response to the stress or tension of the strand that is indicative of the machine demand for the strand, and means cooperatingly related and connected to said guide arm, and therefore entirely controlled by such stress or tension of the strand, and acting upon entire cessation of machine demand to move the strand to a position with respect to the teeth of said interengaging members where in such position said strand is not fed by said toothed members during such cessation of machine demand.

11. Strand feed-controlling mechanism for textile or other machines comprising, in combination, a set of interengaging, toothed members for feeding the strand between and by such interengaging teeth feeding the strand to a machine for use according to the demand for use of such strand by said machine as indicated by strand stress or tension; means to drive at least one of said toothed members so long as such machine is being driven, whether or not the demand of the machine for the strand is interrupted; and means unrestrainedly controlled by the strand itself, in response to the machine-demand-indicating stress or tension of the strand, to vary the feed of the strand by correspondingly varying the toothed relation of said feeding members, and also to interrupt the feed of the strand by said members, whereby the varied feeding and also the non-feeding of said strand by said members is in entire accord with the machine-demand therefor as indicated by the strand stress or tension.

12. A combination according to claim 11 in which the said means controlled by the strand maintains the same tension upon the strand during the feeding thereof.

13. Strand feed-controlling mechanism for textile or other machines comprising, in combination, a set of interengaging, toothed members for feeding the strand between and by such interengaging teeth to a machine for use according to the demand for use of such strand by said machine as indicated by strand stress or tension; means to drive at least one of said toothed members so long as such machine is being driven, whether or not the demand of the machine for the strand is interrupted; and means unrestrainedly controlled by said strand itself, in response to the machine-demand-indicating stress or tension of the strand, to interrupt the feeding of said strand by said toothed members upon entire cessation, temporary or otherwise, of machine demand for said strand.

14. Strand feed-controlling mechanism for textile or other machines comprising, in combination, a set of interengaging, toothed members for feeding the strand between and by such interengaging teeth to a machine for use according to the demand for use of such strand by said machine as indicated by strand stress or tension; means to drive at least one of said toothed members so long as such machine is being driven, whether or not the demand of the machine for the strand is interrupted; and means unrestrainedly controlled by the strand itself, in response to the machine-demand-indicating stress or tension of the strand, to remove the said strand from between the said toothed members upon entire cessation, temporary or otherwise, of machine demand for the strand.

15. Strand feed-controlling mechanism for textile or other machines comprising, in combination, a set of toothed members for feeding strand with controlled tension independent at all times of the primary source of supply, said members being capable of varied meshing relation, thereby to maintain said controlled tension in accordance with the strand demand of the machine to which the strand is fed by said mechanism, and independent of the primary source of supply of said strand, at least one of said members being power driven; and means movably mounted for sensitive response to inevitable slight irregularities in the machine-demand upon, and consequent stress of the feeding strand and also to cessation of machine-demand, for automatically controlling said meshing relation of said members, in accordance with the strand-demand of such machine, to maintain such tension substantially uniform and for withdrawing the strand from feeding relation to the said feeding members upon cessation of machine-demand for the strand.

16. Strand feed-controlling mechanism for textile or other machines comprising, in combination, a set of toothed members for feeding strand with controlled tension independent at all times of the primary source of supply, said members being capable of varied meshing relation, thereby to maintain said controlled tension in accordance with the strand demand of the machine to which the strand is fed by said mechanism, and independent of the primary source of

supply of said strand, at least one of said members being power driven; movably mounted means sensitively responsive to changes in the stress of the strand and to cessations of the strand itself, for automatically governing said meshing relation of said members, in accordance with the strand demand of such machine, to maintain such tension substantially uniform and for effecting a non-feeding relation of the strand and the said feeding members upon cessation of machine-demand for said strand.

17. Strand feed-controlling mechanism for textile or other machines comprising, in combination, a set of metallic-toothed members for feeding the strand to the machine for use according to the demand for use of such strand by said machine; belt driving means to drive directly one only of said metallic-toothed members so long as such machine is being driven, whether or not the demand of the machine for the strand is interrupted, whereby injury of the strand by the said metallic teeth is prevented; and movably mounted means sensitively responsive to changes in stress of and to cessations of the said strand itself, to interrupt the feeding of the strand by the said metallic-toothed members upon cessation of machine-demand for the strand, and also to vary the feed of said strand by the said metallic-toothed members, according to variations in the machine-demand for the strand, whereby the feeding or non-feeding of said strand is in entire accord with the machine demand therefor.

18. Strand feed-controlling mechanism for textile or other machines comprising, in combination, a set of metallic-toothed members including a directly driven member and a co-acting feeding member for together feeding the strand to the machine for use according to the demand for use of such strand by said machine, non-shock driving means to drive directly one only of said metallic-toothed members so long as such machine is being driven, whether or not the demand of the machine for the strand is interrupted, whereby injury of the strand by the said metallic teeth is prevented, and movably mounted means on which is supported the said co-acting feeding member, said movably mounted means being governed wholly by and sensitively responsive to changes in the stress of the strand itself, according to the machine-demand for the strand and to cessations in the machine-demand for the strand, to control, by varying or by terminating, the feeding of the strand by said metallic-toothed members, according as the machine-demand varies or ceases.

19. Strand feed-controlling mechanism for textile or other machines comprising, in combination, a set of metallic-toothed members including a directly driven member and a co-acting feeding member for together feeding the strand to the machine for use according to the demand for use of such strand by said machine, non-shock driving means to drive directly one only of said metallic-toothed members so long as such machine is being driven, whether or not the demand of the machine for the strand is interrupted, whereby injury of the strand by the said metallic teeth is prevented, and movably mounted means on which is supported the said co-acting feeding member, said movably mounted means being controlled wholly by and sensitively responsive to entire cessations, temporary or otherwise, in the stress of the strand itself, to interrupt the feeding of the said strand by said metallic-toothed members upon entire cessation, temporary or otherwise, of machine-demand for said strand.

20. Strand feed-controlling mechanism for textile or other machines comprising, in combination, a set of rotary members having intermeshing teeth constituting their strand feeding surfaces and which entirely control the feed of said strand so long as it is engaged by said intermeshing teeth, at least one of said members being driven; a strand-receiving guide arm supported for movement to and fro consequent upon comparatively slight variations in strand tension; an element having a cam surface, which element is operatively connected with said guide arm and moved by strand-tension movements of said guide arm; and operative connections between said cam surface of said element and one of said rotary, toothed members for effecting (without unmeshing said teeth) a change in the depth of mesh of the teeth of said rotary members consequent upon movement of said cam surface, so as to compensate for the said variations in strand tension whereby the strand is constantly fed at a uniform tension as long as it is engaged by said teeth, said operative connections between the cam surface and one of the rotary toothed members including means to support such rotary toothed member for pendulum movement with respect to another toothed member of said set to change the depth of mesh of the teeth.

21. Strand feed-controlling mechanism for textile or other machines comprising, in combination, a pair of gears having intermeshing teeth constituting their strand feeding surfaces and which entirely control the feed of said strand so long as it is engaged by said intermeshing teeth, at least one of said gears being driven; a strand-receiving guide arm supported for movement to and fro consequent upon comparatively slight variations in strand tension; an element having a cam surface, which element is operatively connected with said guide arm and moved by strand-tension movement of said guide arm; and operative connections between said cam surface of said element and one of said intermeshing gears for effecting (without unmeshing said teeth) a change in the depth of meshing relation of said gears consequent upon movement of said cam surface, so as to compensate for the said variations in strand tension whereby the strand is constantly fed at a uniform tension as long as it is engaged by said teeth, said operative connections between the cam surface and one of the said gears including a lever carrying such gear, the pivot of said lever being substantially directly over said gear, so that said lever and gear may swing with a pendulum-like movement with respect to the other gear of the pair to change the depth of mesh of the teeth.

22. Strand feed-controlling mechanism for textile or other machines comprising in combination, a set of rotary members having intermeshing teeth constituting their strand feeding surfaces and which entirely control the feed of a plurality of strands so long as engaged by said interengaging teeth, at least one member of the said set being driven; a corresponding plurality of strand-receiving guide arms supported for movement to and fro consequent upon comparatively slight variations in strand-tension; a corresponding plurality of elements having cam surfaces, which elements are operatively connected with said guide arms respectively and

moved by strand-tension movements of said guide arms respectively; and operative connections between each said cam surface of an element and one of said rotary toothed members, for effecting a change in the interengaging relation of certain of said rotary members consequent upon movement of said cam surfaces respectively, so as to compensate for the said variations in strand tension.

23. Strand feed-controlling mechanism for textile or other machines comprising, in combination, a set of rotary members having intermeshing teeth constituting their strand feeding surfaces and which entirely control the feed of said strand so long as it is engaged by said intermeshing teeth, at least one of said members being driven; one of said members being supported for pendulum-like movement toward and from another of said set; a strand-receiving guide arm supported for movement to and fro consequent upon comparatively slight variations in strand tension for effecting through such pendulum-like movement (without unmeshing said teeth) a change in the depth of mesh of said teeth, whereby the strand is constantly fed at a uniform tension so long as it is engaged by said teeth, and stop motion means operatively connected with said to and fro movable guide arm and operated by excessive movement of said arm, to stop the mechanism.

24. Strand feed-controlling mechanism for textile or other machines comprising, in combination, a set of rotary members having intermeshing teeth constituting their strand feeding surfaces and which entirely control the feed of said strand so long as it is engaged by said intermeshing teeth, at least one of said members being driven; one of said members being supported for pendulum-like movement toward and from another of said set; a strand-receiving guide arm supported for movement to and fro consequent upon comparatively slight variations in strand tension for effecting through such pendulum-like movement (without unmeshing said teeth) a change in the depth of mesh of said teeth, whereby the strand is constantly fed at a uniform tension so long as it is engaged by said teeth, and stop motion means operatively connected with said to and fro movable guide arm and operated by excessive movement of said arm, to stop the mechanism, and an element having a cam surface, which element is operatively connected with said guide arm and moved by the movement of said guide arm to operate said stop motion means.

25. Strand feed-controlling mechanism for textile or other machines comprising, in combination, a set of rotary members having intermeshing teeth constituting their strand feeding surfaces and which entirely control the feed of said strand so long as it is engaged by said intermeshing teeth, at least one of said members being driven; one of said members being supported for pendulum-like movement toward and from another of said set; a strand-receiving guide arm supported for movement to and fro consequent upon comparatively slight variations in strand tension for effecting through such pendulum-like movement (without unmeshing said teeth) a change in the depth of mesh of said teeth, whereby the strand is constantly fed at a uniform tension so long as it is engaged by said teeth, and electrical stop motion means operatively connected with said to and fro movable guide arm and operated by excessive movement of said arm, to stop the mechanism.

26. Strand feed-controlling mechanism for textile or other machines comprising, in combination, a set of rotary members having intermeshing teeth constituting their strand feeding surfaces and which entirely control the feed of said strand so long as it is engaged by said intermeshing teeth, at least one of said members being driven; one of said members being supported for pendulum-like movement toward and from another of said set; a strand-receiving guide arm supported for movement to and fro consequent upon comparatively slight variations in strand tension for effecting through such pendulum-like movement (without unmeshing said teeth) a change in the depth of mesh of said teeth, whereby the strand is constantly fed at a uniform tension so long as it is engaged by said teeth, and electrical stop motion means operatively connected with said to and fro movable guide arm and operated by excessive movement of said arm, to stop the mechanism; and an element having a cam surface, which element is operatively connected with said guide arm and movable therewith and acting to actuate said electrical stop motion means upon excessive movement of said arm.

27. Strand feed-controlling mechanism for textile or other machines comprising, in combination, a set of rotary members having intermeshing teeth constituting their strand feeding surfaces and which entirely control the feed of said strand so long as it is engaged by said intermeshing teeth, at least one of said members being driven; one of said members being supported for pendulum-like movement toward and from another of said set; an element having a cam surface, said element having an attached strand-receiving guide arm mounted for movement consequent upon comparatively slight variations in strand-tension for effecting through such pendulum-like movement (without unmeshing said teeth) a change in the depth of mesh of said teeth, whereby the strand is constantly fed at a uniform tension so long as it is engaged by said teeth, and stop motion means; and connections to operate said stop motion means upon excessive movement of the said cam surface.

28. Strand feed-controlling mechanism for textile or other machines comprising, in combination, a pair of intermeshing gears, one of which is mounted for pendulum-like movement toward and from the pivot of the other, and which gears are adapted to feed the strand between them; a to and fro movable strand receiving guide arm mounted for such movement consequent upon comparatively slight variations in strand tension so as to vary through said pendulum-like movements the depth of mesh of the teeth of said gears whereby, without unmeshing said teeth, the strand is constantly fed at a uniform tension so long as it is engaged by said teeth; and stop motion means operatively associated with said guide arm to stop the mechanism upon excessive movement of said guide arm.

29. Strand feed-controlling mechanism for textile or other machines comprising, in combination, a set of rotary, toothed, interengaging members for feeding the strand between them, at least one of said members being driven; a strand-receiving guide arm supported for movement to and fro consequent upon comparatively slight variations in strand tension; an element

having a cam surface, said element being operatively connected with said guide arm and moved by strand-tension movements of said guide arm; and operative connections between said cam surface of said element and one of said rotary, toothed members for effecting a change in the interengaging relation of said rotary members consequent upon movement of said cam surface, so as to compensate for the said variations in strand-tension; and means to withdraw the strand from between the said rotary members in the event of strand breakage.

30. Strand feed-controlling mechanism for textile or other machines comprising, in combination, a set of rotary, toothed, interengaging members for feeding the strand between them, at least one of said members being driven; a strand-receiving guide arm supported for movement to and fro in entirely free and unrestrained response to comparatively slight, frequent, inevitable changes in the stress or tension of the strand, and operatively positioned with relation to said members to correct for such stress or tension changes by varying the meshing relation of the teeth of said members, and also withdrawing the strand from between said members upon cessation of machine-demand and the consequent entire ceasing of yarn stress upon said guide arm.

31. Strand feed-controlling mechanism for textile or other machines comprising, in combination, a set of rotary, toothed, interengaging members for feeding the strand between them, at least one of said members being driven; a strand-receiving guide arm supported for movement to and fro in entirely free and unrestrained response to comparatively slight, frequent, inevitable changes in the stress or tension of the strand, and operatively positioned with relation to said members to correct for such stress or tension changes by varying the meshing relation of the teeth of said members, and also withdrawing the strand laterally from between said members upon cessation of machine demand and the consequent ceasing of yarn stress upon said guide arm.

32. Strand feed-controlling mechanism for textile or other machines comprising, in combination, a set of rotary, toothed, interengaging members for feeding the strand between them, at least one of said members being driven; a strand-receiving guide arm supported for movement to and fro consequent upon comparatively slight variations in strand tension; and means active upon strand breakage to withdraw the strand from between said rotary members, said means including a pivoted guide and cam means to act upon and move the same in the event of strand breakage or other discontinuance.

33. Strand feed-controlling mechanism for textile or other machines comprising, in combination, a set of rotary, toothed, interengaging members for feeding the strand between them, at least one of said members being driven; a strand-receiving guide arm supported for movement to and fro consequent upon comparatively slight variations in strand tension; and means active upon strand breakage or other discontinuance to withdraw the strand from between said rotary members, said means including a cam member connected to said guide arm for movement therewith and a second cam carried by said cam member; and an operating connection between said second cam and said rotary gears and acting to withdraw the strand from between said rotary members.

34. Strand feed-controlling mechanism for textile or other machines comprising, in combination, a set of rotary, toothed, interengaging members for feeding the strand between them, at least one of said members being driven; a strand-receiving guide arm supported for movement to and fro consequent upon comparatively slight variations in strand tension; means active upon strand breakage or other discontinuance to withdraw the strand laterally from between said rotary members; and a shield for the laterally withdrawn strand.

35. Strand feed-controlling mechanism for textile or other machines comprising, in combination, a set of rotary members having intermeshing teeth constituting their strand feeding surfaces and which entirely control the feed of said strand so long as it is engaged by said intermeshing teeth, at least one of said members being driven; a strand-receiving guide arm supported for movement to and fro consequent upon comparatively slight variations in strand tension for effecting (without unmeshing said teeth) a change in the depth of mesh of said teeth, whereby the strand is constantly fed at a uniform tension so long as it is engaged by said teeth, and co-acting means operatively connected with said guide arm and moved by strand-tension movements of said guide arm; and operative connections between said co-acting means and one of said rotary, toothed members for effecting (without unmeshing said teeth) a change in the depth of mesh of the teeth of said rotary members consequent upon movement of said co-acting means, so as to compensate for the said variations in strand tension said operative connections between the said co-acting means and one of the rotary toothed members including means to support such rotary toothed member for pendulum movement with respect to another toothed member of said set to change the depth of mesh of the teeth.

36. Strand feed-controlling mechanism comprising in combination, a set of rotary, toothed, interengaging members for feeding the strand between them, at least one of said members being driven; a strand receiving guide arm or part supported for movement toward or from end faces of said members; and governed wholly by, and responding freely and unrestrainedly to, all slight changes in the stress of the strand, and also to withdraw the strand from between said rotary members upon entire cessation of strand stress.

37. Strand feed-controlling mechanism comprising in combination, a set of rotary, toothed, interengaging members for feeding the strand between them, at least one of said members being driven, a strand-receiving guide arm supported for movement to and fro consequent upon and making unrestrained response to all variations in strand tension; and another movable strand-receiving guide arm supported adjacent to said rotary members and entirely controlled by such movements of said guide arms so as to present a non-feeding strand at ends of the teeth of said members as delivered by feeding stress of such strands and there to enter such strand between the teeth, so that it may be fed by said teeth.

38. Strand feed-controlling mechanism comprising in combination, a set of rotary, toothed, interengaging members for feeding the strand between them, at least one of said members

being driven, a strand-receiving guide arm supported for movement to and fro consequent upon and making unrestrained response to all variations in strand tension, including frequent, slight tension changes; and another movable strand-receiving guide arm supported adjacent to said rotary toothed members and entirely controlled by such tension controlled movements of said guide arm so as to withdraw a strand from between the teeth of said members by movement in a direction lengthwise of intermeshing teeth of said members.

39. Strand feed-controlling mechanism comprising in combination, a set of rotary, toothed, interengaging members for feeding the strand between them, at least one of said members being driven, a strand-receiving guide arm supported for movement to and fro consequent upon and making unrestrained response to all variations in strand tension, including frequent, slight tension changes; and another movable strand-receiving guide arm supported adjacent to said rotary toothed members and entirely controlled by such strand tension movements of said first mentioned guide arm so as to insert a strand between and to withdraw said strand from between the teeth of said members by movement in a direction lengthwise of intermeshing teeth of said members.

40. Strand feed-controlling mechanism for textile or other machines comprising in combination, a set of rotary, toothed, interengaging members for feeding a strand or strands between them, at least one of said members being driven, a strand-receiving guide arm so operatively related to said feeding members and so supported for movement to and fro consequent upon, and making in operation unrestrained response to, all variations in strand tension as to correct for such variations in strand tension by correspondingly varying the toothed relation of said members, and cooperating means entirely controlled by movements of said guide arm for withdrawing such a feeding strand from between said rotary members upon cessation in strand tension, thereby discontinuing the feed of such withdrawn strand.

41. Strand feed-controlling mechanism for textile or other machines comprising in combination, a set of rotary, toothed, interengaging members for feeding a plurality of strands between them, at least one of said members being driven, a plurality of strand-receiving guide arms operatively related to said feeding members and supported for movement to and fro consequent upon, and making in operation unrestrained response to, all variations in strand tension of strands pertaining to said guide arms respectively, and cooperating means entirely controlled by movement of said guide arms respectively for withdrawing the respective feeding strand from between the corresponding rotary members upon cessation in strand tension of the corresponding strand, thereby discontinuing the feed of such withdrawn strand.

42. Strand feed-controlling mechanism for textile or other machines, comprising in combination, a set of gears having intermeshing teeth constituting strand-feeding surfaces and which entirely control the feed of a strand or strands so long as the same is engaged by said intermeshing teeth, a plurality of strand-receiving guide arms supported for movement consequent upon comparatively slight variations in strand-tension for effecting, without unmeshing said teeth, a change in the depth of mesh thereof, so that the strand or strands is or are constantly fed at a uniform tension while engaged by said teeth, whereby said mechanism feeds the strand or strands completely independent of any unevenness of tension in the strand or strands delivered from the original source of supply of said strand or strands, and cooperating means for interrupting at intervals the feed of one or more of said strands between said gears by withdrawing said strand or strands from between said gears.

43. Mechanism for feeding a strand to textile machinery so as to control the tension thereof completely independent of the condition of tension of the strand as it issues from the original source of supply and having means to determine the feeding or non-feeding of the strand to such textile machinery, comprising a set of gears having intermeshing teeth constituting strand-feeding surfaces, a strand-receiving guide arm supported for movement consequent upon comparatively slight variations in strand-tension for effecting, without unmeshing said teeth, a change in the depth of mesh thereof, so that the strand is constantly fed at a uniform tension while engaged by said teeth, and cooperating means for withdrawing said strand from between such intermeshing teeth, thereby interrupting the feed of said strand to the said textile machinery.

44. Strand feed-controlling mechanism for textile or other machines, comprising in combination, a set of rotary members having intermeshing teeth constituting their strand feeding surfaces, which entirely control the feed of the strand or strands so long as engaged by said intermeshing teeth, at least one of said rotary members being driven, one of said rotary members having pendulum-like supporting means mounted to respond entirely freely and unrestrainedly to the stress of the strand or strands, whereby the rotary member carried by such supporting means may be swung with a pendulum-like motion toward and from the axis of another rotary member of said set, in accurate, free and unrestrained response to the stress of the strand or strands.

45. Strand feed-controlling mechanism for textile or other machines, comprising in combination, a set of rotary members having intermeshing teeth constituting their strand feeding surfaces, which entirely control the feed of the strand or strands so long as engaged by said intermeshing teeth, at least one of said rotary members being driven, a lever whereon one of said rotary members is supported, the pivot of said lever being substantially over the said rotary member supported thereon, whereby the said rotary member and the said lever are swingable in a pendulum-like motion toward and from the axis of another rotary member of said set, said lever being free to act in unrestrained response to the stress of the feeding strand.

46. Strand feed-controlling mechanism for textile or other machines, comprising in combination, a set of rotary members having intermeshing teeth constituting their strand feeding surfaces, which entirely control the feed of the strand or strands so long as engaged by said intermeshing teeth, at least one of said rotary members being driven, a lever whereon a non-driven member of said set is supported, said lever having a pivotal mounting substantially vertically over said non-driven member, so that the latter may swing with a pendulum-like motion

toward and from the axis of another rotary member of said set, said lever being free to act in unrestrained response to the stress of the feeding strand.

47. Strand feed-controlling mechanism for textile or other machines, comprising in combination, a set of gears having intermeshing teeth constituting strand-feeding surfaces and which entirely control the feed of a strand or strands so long as the same is engaged by said intermeshing teeth, a plurality of strand-receiving guide arms supported for movement consequent upon comparatively slight variations in strand-tension for effecting, without unmeshing said teeth, a change in the depth of mesh thereof, so that the strand or strands is or are constantly fed at a uniform tension while engaged by said teeth, whereby said mechanism feeds the strand or strands completely independent of any unevenness of tension in the strand or strands delivered from the original source of supply of said strand or strands, at least one of said gears having pendulum-like supporting means mounted to respond entirely freely and unrestrainedly to the stress of the strand or strands, whereby the rotary member carried by such supporting means may be swung with a pendulum-like motion toward and from the axis of another rotary member of said set, in accurate, free and unrestrained response to the stress of the strand or strands.

48. Strand feed-controlling mechanism for textile or other machines, comprising, in combination, a set of rotary members having strand-feeding surfaces which control the feed of said strand so long as it is engaged by the surfaces of said rotary members, at least one of said rotary members being driven, a lever whereon one of said rotary members is supported, the pivot of said lever being substantially over the said rotary member supported thereon, whereby the said rotary member and the said lever are swingable in a pendulum-like motion toward and from the axis of another rotary member of said set, said lever being free to act in unrestrained response to the stress of the feeding strand.

49. Strand feed-controlling mechanism for textile or other machines, comprising in combination, a set of gears having intermeshing teeth constituting strand-feeding surfaces and which entirely control the feed of a strand or strands so long as the same is engaged by said intermeshing teeth, a plurality of strand-receiving guide arms supported for movement consequent upon comparatively slight variations in strand-tension for effecting, without unmeshing said teeth, a change in the depth of mesh thereof, so that the strand or strands is or are constantly fed at a uniform tension while engaged by said teeth, whereby said mechanism feeds the strand or strands completely independent of any unevenness of tension in the strand or strands delivered from the original source of supply of said strand or strands, at least one of said gears having pendulum-like supporting means mounted to respond entirely freely and unrestrainedly to the stress of the strand or strands, whereby the rotary member carried by such supporting means may be swung with a pendulum-like motion toward and from the axis of another rotary member of said set, in accurate, free and unrestrained response to the stress of the strand or strands, and cooperating means for interrupting the feed of the strand or strands between said gears by withdrawing said strand or strands from between said gears.

50. Strand feed-controlling mechanism for textile or other machines, comprising in combination, a set of rotary members having intermeshing teeth constituting their strand feeding surfaces and which entirely control the feed of the strand or strands so long as engaged by said intermeshing teeth, at least one of said rotary members being driven, a lever whereon one of said rotary members is supported for pendulum-like movement toward and from the axis of another rotary member of said set, the said lever having an arm extending above the pivotal point thereof, and strand guiding means delicately responsive to the stress of the feeding strand or strands and positioned to act upon said lever arm above said pivot, thereby controlling the pendulum motion of said lever.

51. Strand feed-controlling mechanism for textile and other machines, comprising in combination, a set of rotary members having intermeshing teeth constituting their strand feeding surfaces and which entirely control the feed of the strand or strands so long as engaged by said intermeshing teeth, at least one of said rotary members being driven, a lever whereon one of said rotary members is supported for pendulum movement toward and from the axis of another rotary member of said set, the pivot for said lever being substantially directly over the toothed rotary member carried thereby.

52. Strand feed-controlling mechanism for textile or other machines comprising in combination, a set of rotary members having engageable strand-feeding surfaces for feeding a strand between them when so engaged, at least one of said members being driven, a strand-receiving guide arm operatively related to said feeding members and movable to and fro wholly consequent upon, and therefore making in operation unrestrained response to all variations in strand tension, and by such movements correcting for such variations in strand tension by correspondingly varying the relation of the strand-feeding surfaces of said members, and means cooperating with and entirely controlled by movement of said guide arm for withdrawing such a feeding strand from between said rotary members upon cessation in strand tension thereof, thereby discontinuing the feed of such withdrawn strand.

53. Strand feed-controlling mechanism for textile or other machines comprising in combination, a set of rotary members having engageable strand-feeding surfaces for feeding a strand between them when so engaged, at least one of said members being driven, a strand-receiving guide arm operatively related to said feeding members and movable to and fro wholly consequent upon, and therefore making in operation unrestrained response to all variations in strand tension, and by such movements correcting for such variations in strand tension by correspondingly varying the relation of the strand-feeding surfaces of said members, and another strand-receiving guide arm supported adjacent to said rotary members and cooperatively related to said first mentioned strand-receiving guide arm and moved thereby to present a strand at ends of said members and thereafter to enter such strand between said members so that it may be fed by said members.

54. Strand feed-controlling mechanism for textile or other machines comprising in combination, a set of rotary members having engageable strand-feeding surfaces for feeding a strand between them when so engaged, at least one of

said members being driven, a strand-receiving guide arm operatively related to said feeding members and movable to and fro wholly consequent upon, and therefore making in operation unrestrained response to all variations in strand tension, and by such movements correcting for such variations in strand tension by correspondingly varying the relation of the strand-feeding surfaces of said members, and another strand-receiving guide arm supported adjacent to said rotary members and cooperatively related to said first mentioned strand-receiving guide arm and moved thereby to withdraw a strand from between said rotary members by movement in a direction widthwise said members.

55. Strand feed-controlling mechanism for textile or other machines comprising in combination, a set of rotary members having engageable strand-feeding surfaces for feeding a strand between them when so engaged, at least one of said members being driven, a strand-receiving guide arm operatively related to said feeding members and movable to and fro wholly consequent upon, and therefore making in operation unrestrained response to all variations in strand tension, and by such movements correcting for such variations in strand tension by correspondingly varying the relation of the strand-feeding surfaces of said members, and another strand-receiving guide arm supported adjacent to said rotary members and cooperatively related to said first mentioned strand-receiving guide arm and moved thereby to move such latter guide arm to and fro to insert a strand between, and to withdraw such strand from between, the feeding surfaces of said members by movement in a direction widthwise said members.

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