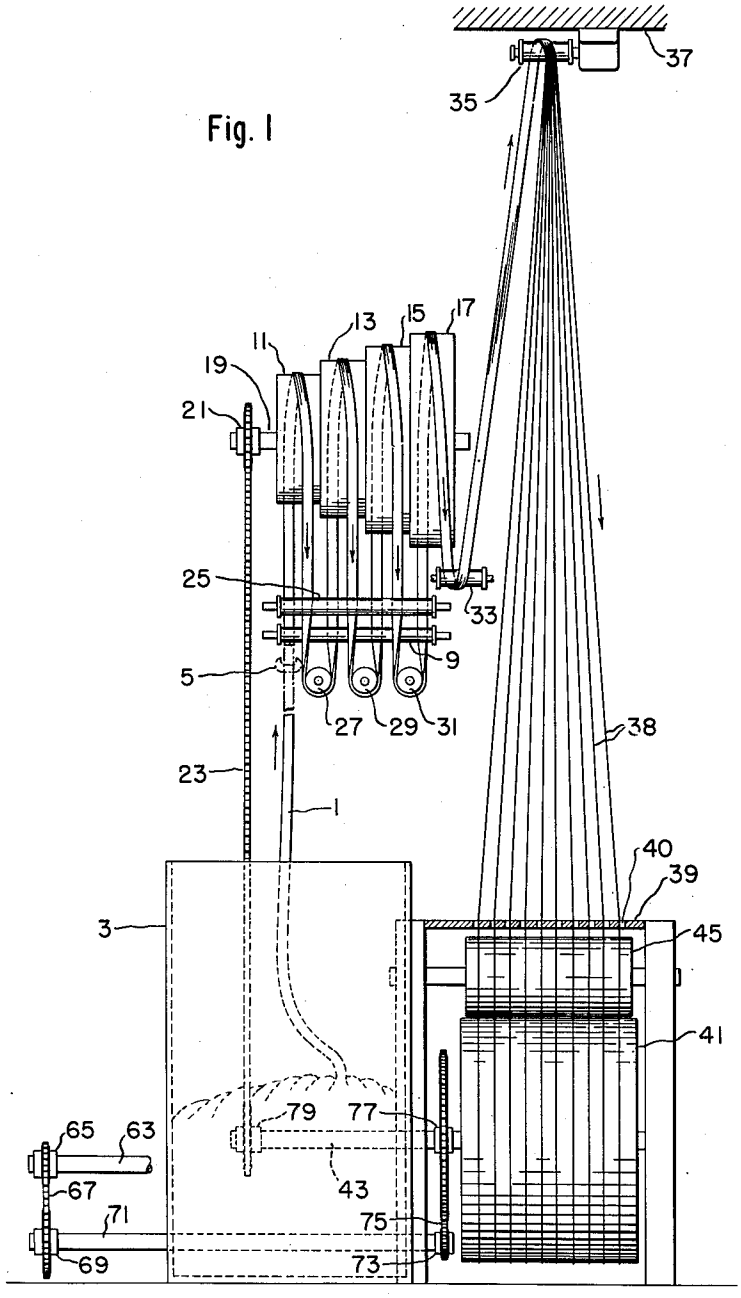
Feb. 15, 1949. O. F. NEIDEL 2,462,043

TENSION DEVICE FOR RUBBER COVERING MACHINES

Filed April 23, 1946 2 Sheets-Sheet 1

Fig. 1



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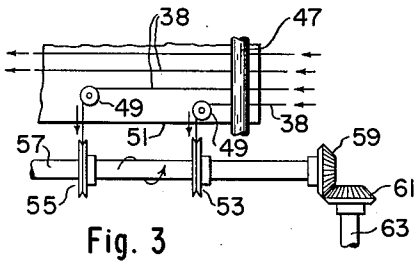


Fig. 3

Fig. 2

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TENSION DEVICE FOR RUBBER COVERING MACHINES

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This invention relates to the covering of elastic filaments with yarn or other desired covering material, and in particular to the feeding of the bare rubber or other elastic strands to the covering machine proper.

The conventional method of supplying the strands of rubber or other elastic material to the covering machine involves the preliminary winding of the strands onto a beam or a plurality of spools from which the strands are fed to the feed rolls of the covering machine in which the wrappings or coverings of yarn are applied. This practice involves a number of drawbacks, in addition to the trouble and cost of this beaming or spooling step itself, in that unequal degrees of tension are unavoidably imparted to the respective strands in the beaming or spooling and in the unwinding from such beams or spools, and also the strands of rubber or other elastic material acquire a permanent set, i. e., a permanent elongation left in the strands after they have remained in a stretched condition on the beam or spools for any length of time, this permanent set increasing with the length of time the elastic material is left on the beam or spools, and reducing the elasticity comprising the essential characteristic wanted in the fabric made from the covered elastic strands. It is very difficult to wind and unwind the elastic strands upon and from successive beams or sets of spools with exactly the same degree of tension. These variables introduce an unavoidable and relatively wide variation in the extensibility and contractive strength of the finished elastic yarn as it comes from the covering machine, which variation occurs not only as between the individual yarns from the same beam or set of spools, but also as between those from a given beam or set of spools and a preceding or following beam or set of spools, and even at indefinite points throughout the length of any given strand. When covered elastic yarns have such varying characteristics are utilized in the making of a fabric, the fabric or the garment made therefrom will be of inferior quality because of the presence of puckers caused by elastic yarns which are either too loose or too tight. Thus, inequalities in the tension of the elastic strands fed to the covering machine comprise a constant source of trouble and loss under existing practice.

It is the object of the present invention to minimize or eliminate these drawbacks, and to this end the invention eliminates the step of beaming or spooling the elastic strands entirely, by providing a novel method and apparatus for

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taking the rubber strands from a loose coil or pile lying on the floor or in any suitable container such as a barrel or truck, feeding these strands forward as a chain, separating them into individual ends, and delivering them individually to the respective feed rolls of the covering spindles in the covering machine, with a minimum or negligible degree of tension which in any event will be only what is needed to straighten out kinks and any loose ends that may appear in the chain and to spread them apart so as to separate them laterally from each other. In addition to thus eliminating both the beaming or spooling operation and avoiding stretch and permanent set previous to arrival at the covering machine, it is an object of the invention to deliver the elastic strands to the covering machine all at the same tension.

To these ends, I have devised the method and apparatus shown and described in the accompanying drawings and description, characteristically comprising means of bringing the elastic strands to the covering operation in a chain and completely relaxed, thus eliminating the beaming or spooling operation with its additional drawback of imposing permanent set and unequal tensions, and then feeding the rubbers all at equal but low tension to the feed rolls, so that the desired critical tension which determines the working characteristics of the covered strands and the fabric made therefrom can be inserted in known and accurately controlled and uniform degree between the feed rolls and the take-up rolls of the covering machine itself.

An illustrative embodiment of the invention is shown in the accompanying drawings, in which

Fig. 1 is a side elevation, and Fig. 2 is an end elevation, of the improved feeding device, and Fig. 3 is a plan view showing how the feed roll shaft of the covering machine drives the feeding devices.

In the embodiment of the invention method illustrated, the rubber or other elastic strands are disposed in a chain 1 or bundle, lying parallel and in completely relaxed condition and numbering on the order of 160 ends, in usual practice. This chain is packed, folded, or laid loosely into a can or other container 3 from which it is drawn upward without any tension through guide eyes 5, 7, under a guide roll 9, and thence over a series of pulleys 11, 13, 15 and 17 which have progressively greater surface speed, this increased speed being attained in the present instance by making the pulleys 11—17 as step pulleys of progressively increased diameter and

hence of increased circumference, while fixing them all on a common shaft 19 driven by a sprocket 21 fixed thereon and chain 23. As is obvious, these pulleys may be all of the same size, or of any preferred different sizes, and mounted to revolve at different speeds, with the progressively increased surface speed of the successive pulleys attained through the use of different gear ratios for the driving of each pulley. The chain 1 of rubber strands is drawn up and over the smallest pulley 11 by frictional contact with the circumference thereof, thence leaves the surface of pulley 11 to be engaged by a guide roll 25 and to make a half turn around another guide roll 27, after which it is drawn upward outside of guide roll 9 and over the second step pulley 13 by frictional engagement with the circumference thereof, under guide roll 29, over step pulley 15, under guide roll 31, and over step pulley 17, by frictional engagement with the circumference of pulleys 15 and 17, just as before.

In this manner the rubber strands composing the chain 1 are alternately pressed against the surfaces of the several pulleys and guide rolls, and then released from such pressure throughout substantial extents of their length, and throughout this process the chain as a whole is given a very slight degree of stretching, just sufficient in degree to straighten out the kinks in the individual strands. The lateral pressure against the surfaces of the successive guide rolls and driving pulleys with intervening release from such pressure, coupled with the slight increase in tension on the strands, serves to work out the kinks and overlaps in the individual strands and to permit relative longitudinal movement of intermediate tight or loose portions of each individual strand, and thus to equalize the tension in the strands and arrange them in truly parallel relation.

The chain 1 of strands in leaving the largest pulley 17 passes around a guide roll 33, and thence travels up to and over a guide roll 35 supported from the ceiling 37, and then descends to and through a reed 39 containing the necessary number of dents or guide-eyes 40 to separate the elements of the chain 1 into individual strands or groups 38 of two or three strands, the guide roll 35 being as far remote as convenient from the reed, to enable the spreading of the strands to be effected as gradually as possible. The term "reed" is used generically herein, to define any known or suitable device for splitting the chain into individual strands or groups of a small number of strands, so as thereafter to run in spaced and substantially parallel relation. After passing through the reed 39, the laterally separated individual strands or groups of strands make a ¾ turn around a drum 41 fixed on a driven shaft 43, and the strands then pass between drum 41 and a gravitating press roll 45 so that all the strands are fed forward at an identical rate. The surface speed of drum 41 is preferably identical with that of the largest step pulley 17, and thus no tension is added thereby to the strands after leaving guide roll 35. Press roll 45 prevents any recoil of strands breaking when the tension is applied at the feed rolls which might foul the reed or step pulley.

From the top surface of press roll 45 the strands are led in parallel and spaced-apart relation first obliquely downward and under a horizontal guide roll 47 and then in a horizontal sheet along and parallel to the base of the covering machine at a slight distance above the floor. Starting at the margin of this sheet that is adjacent the covering machine, the innermost strand 38 is led in a right angle turn around a pulley 49 rotating freely and mounted on a support 51 running along the foot of the machine the strand then passing to the usual feed roll 53 of the first spindle or covering unit of the covering machine, which latter may be of any preferred known type, and therefore need not be illustrated herein; the second strand 38 from the inward edge of the sheet is led around a corresponding pulley 49 in a right angle turn to the feed roll 55 of the second spindle or unit, and so on in similar fashion down the entire length of the covering machine until each strand has been delivered to the feed wheel of a spindle or covering unit.

The feed rolls 53, 55, are positively driven through being fixed on a shaft 57 of the covering machine which shaft is driven as customary at the desired rate of speed less than that of the shaft carrying the take-up rolls (not shown) that is deemed necessary to impart to all the strands the predetermined tension needed to give them the desired stretch characteristics after they shall have been covered and woven or knitted into fabric. From the end of this shaft 57 is taken the drive for the feeding device of the invention, this being accomplished by bevel gear 59 fixed on the end of shaft 57 and bevel gear 61 on shaft 63 which through a train of reducing gear comprising sprocket 65, chain 67, sprocket 69, shaft 71, sprocket 73, and chain 75 drives a large sprocket 77 fixed on shaft 43 on which the drum 41 is fixed. As previously noted, shaft 43 drives the shaft 19 on which step pulleys 11 to 17 are fixed, by means of a sprocket 79 fixed on the end of shaft 43 and chain 23 driving sprocket 21 on shaft 19.

Thus the feeding device is always driven in exact predetermined relation to the feed rolls 53, 55, of the covering machine, preferably with the surface speed of drum 41 substantially equalling the surface speed of the working surface of feed rolls 53, 55. Because all the drive gearing of the feeding device is positive and fixed in its ratio to the speed of the feed roll shaft 57 of the covering machine, the tension cannot vary from beginning to end of an individual strand or as between one strand and another in the same chain, and also as between the strands of a preceding and a following chain, other factors being equal. Nor is it possible for the attendant running the covering machine to vary the rate of feed or the tension of the strands as delivered to the feed rolls, as is frequently resorted to in prior structures when maladjustments in the covering machine prevent the attainment of the desired characteristics in the covered yarns. If, however, it is desired to insert any substantial degree of tension uniformly throughout all the strands of the sheet fed to the feed rolls, a simple gear change at the bevel gears 59, 61, or at any other desired point in the train will effect this in equally fixed and meddle-proof manner. But with the device operated in the preferred manner so as to bring all the elastic strands to the feed rolls with a uniform and substantially negligible degree of tension sufficient merely to get and keep them apart and running straight and without undue sagging on their respective courses, and with this minimum tension equal throughout all the strands of a chain and from one chain to the next, all the tension that is of any significant degree is inserted between the feed rolls and the take-up rolls where it can be accurately controlled and be made of the exact predetermined degree de-

sired, and uniform throughout each strand and as between one strand and another thus enabling the production of a warp made of covered elastic strands in which all ends are of the same tension, and which when interwoven with weft or interknitted results in a perfect elastic fabric devoid of tight or loose elastic elements which would pucker the fabric and depreciate its value.

Since the method and apparatus of the invention eliminate the step of beaming or spooling the elastic strands preliminary to the covering operation, there is no limit to the yardage of the strands forming the chain; whereas the capacity of the beams or spools used in prior practice sets a very definite limit on the length of the elastic strands which can be covered at a single operation.

While I have illustrated and described a certain form in which the invention may be embodied, I am aware that many modifications may be made therein by any person skilled in the art, without departing from the scope of the invention as expressed in the claims. Therefore, I do not wish to be limited to the particular form shown, or to the details of construction thereof, but

What I do claim is:

1. Feeding apparatus for elastic strands having in combination means feeding a plurality of strands in parallel and contiguous relation at progressively increased speed, with the individual strands in non-adherent and thus relatively movable condition such as will permit the straightening out of kinks and overlaps and permit longitudinal movement equalizing the tension in individual strands, and means thereafter separating the strands and feeding them forward in spaced and substantially parallel relation.

2. Feeding apparatus for elastic strands having in combination a plurality of rotating surfaces feeding the strands in chain form at successively increased speed, and in relatively movable relation such as will permit the straightening out of kinks and overlaps and permit longitudinal movement equalizing the tension in individual strands, and guide means thereafter separating the individual strands of the chain into spaced and substantially parallel relation.

3. Feeding apparatus for elastic strands having in combination a plurality of driving surfaces frictionally engaging and feeding the strands in chain form at successively increased speed, and in relatively movable relation such as will permit the straightening out of kinks and overlaps and permit longitudinal movement equalizing the tension in individual strands, and a reed separating the individual strands of the chain apart from each other after leaving the driving surfaces.

4. Feeding apparatus for elastic strands having in combination a plurality of pulleys feeding the strands in chain form at successively increased speed, and in relatively movable relation such as will permit the straightening out of kinks and overlaps and permit longitudinal movement equalizing the tension in individual strands, a reed separating the individual strands of the chain apart from each other after leaving the pulleys, and means propelling the strands through the reed.

5. Feeding apparatus for elastic strands having in combination a plurality of pulleys feeding the strands in chain form at successively increased speed, and in relatively movable relation such as will permit the straightening out of kinks and overlaps and permit longitudinal movement equalizing the tension in individual strands, a reed thereafter spreading the individual strands or small groups thereof apart into laterally spaced relation with each other, and a roll drawing the strands through the reed and feeding them forward in spaced and substantially parallel relation.

6. Apparatus for feeding elastic strands to the feed rolls of a strand covering machine having in combination a plurality of pulleys feeding the strands in chain form at successively increased speed, a reed spreading the strands of the chain apart into laterally spaced relation to each other, a roll drawing the strands through the reed and feeding them forward in laterally spaced relation, and guide means maintaining the strands in spaced and substantially parallel relation and delivering them to the respective feed rolls of the covering machine.

7. Apparatus for feeding elastic strands to the feed rolls of a strand covering machine having in combination a plurality of pulleys feeding the strands in chain form at successively increased speed, a reed spreading the strands of the chain apart into laterally spaced relation to each other, a roll drawing the strands through the reed and feeding them forward in laterally spaced relation, guide means maintaining the strands in spaced and substantially parallel relation and delivering them to the respective feed rolls of the covering machine, and means driving the pulleys and roll in fixed speed relation to the feed rolls of the strand covering machine.

8. Apparatus for feeding elastic strands to the feed rolls of a strand covering machine having in combination means supporting a chain of elastic strands in relaxed relation, means feeding forward these strands while progressively stretching them to a fixed predetermined extent, means thereafter spreading the individual strands or small groups thereof apart into laterally spaced relation with each other, and means delivering the strands without further stretching to the feed rolls of the covering machine.

9. Feeding apparatus for elastic strands having in combination step pulleys around which the elastic strands in chain form travel progressively from the smallest to the largest pulley, rolls around which the chain of strands makes a reverse bend in passing from one pulley to the next, a reed spreading the individual strands or small groups thereof apart into laterally spaced relation with each other, and a roll drawing the strands through the reed and feeding them forward in spaced and substantially parallel relation.

10. Feeding apparatus for elastic strands having in combination step pulleys around which the elastic strands in chain form travel progressively from the smallest to the largest pulley, rolls around which the chain of strands makes a reverse bend in passing from one pulley to the next, surfaces engaging the chain between the step pulleys and the rolls, a reed spreading the individual strands or small groups thereof apart into laterally spaced relation with each other, and a roll drawing the strands through the reed and feeding them forward in spaced and substantially parallel relation.

11. The method of feeding elastic strands to the feed rolls of a strand covering machine which includes the steps of taking the strands in a chain and in relaxed condition and propelling them at progressively increased speed, then separating the strands from each other, and running the individual strands to the several feed rolls of the covering machine.

12. The method of feeding elastic strands to the feed rolls of a strand covering machine which includes the steps of arranging the elastic strands in a chain in relaxed condition, bending the chain around various traveling surfaces which carry it forward while stretching it only to the extent needed to straighten out kinks and work out loose ends, and then delivering the individual strands to the respective feed rolls of the covering machine without any material additional tensioning.

13. The method of feeding elastic strands to the feed rolls of a strand covering machine which includes the steps of arranging the strands in relaxed condition in a chain, feeding the chain at progressively increased speed throughout an interval in its length while bending and working the chain to straighten out kinks and overlaps, and thereafter feeding the strands to the feed rolls of the covering machine at substantially the terminal speed acquired during said interval of length.

14. The method of feeding elastic strands to the feed rolls of a strand covering machine which includes the steps of arranging the strands in relaxed condition in a chain, feeding the chain at progressively increased speed throughout an interval in its length while bending and working the chain to straighten out kinks and overlaps, and thereafter feeding the strands to the feed rolls of the covering machine at substantially the terminal speed acquired during said interval of length while separating the individual strands from each other.

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