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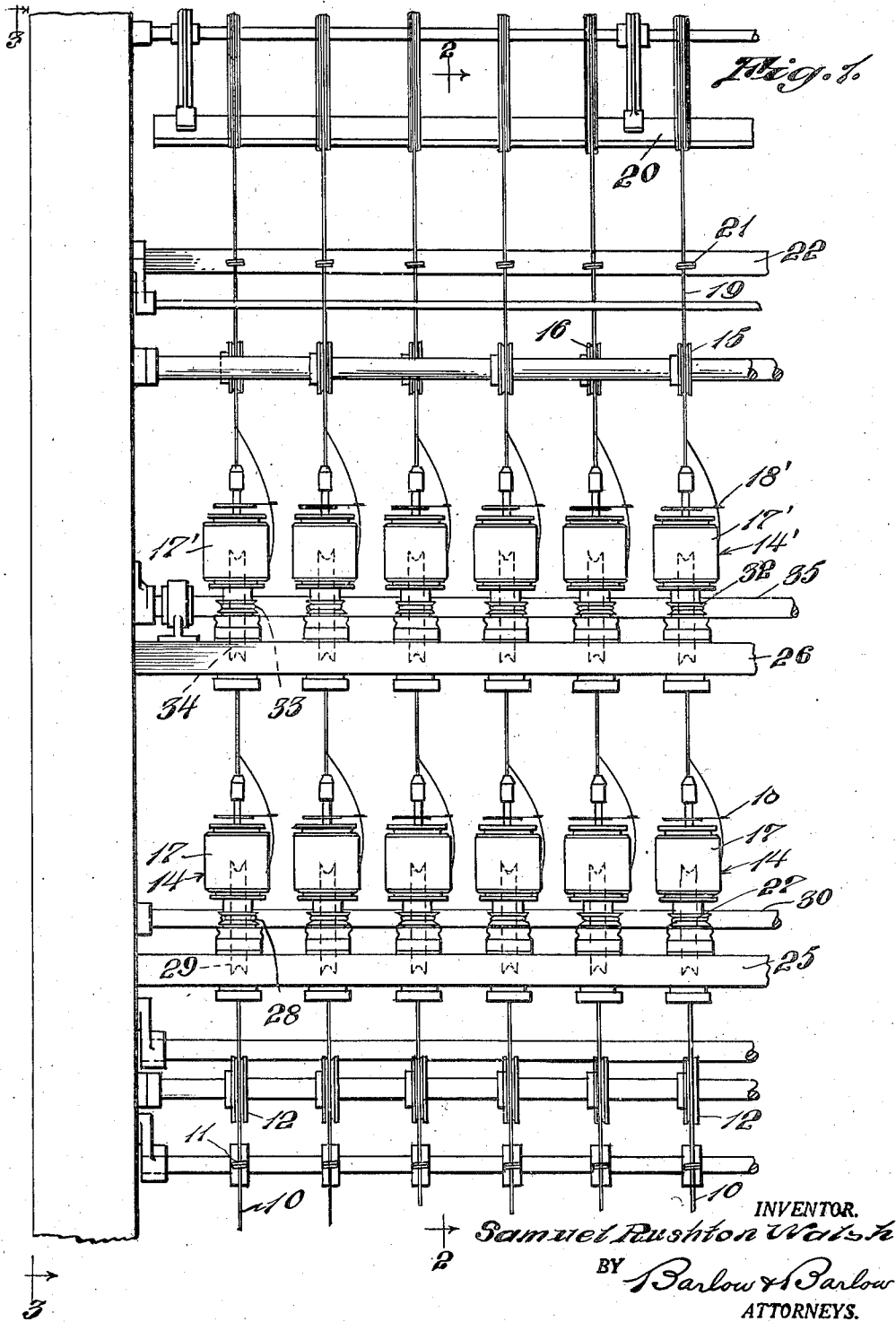
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STRAND COVERING APPARATUS

Filed Nov. 1, 1939

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STRAND COVERING APPARATUS

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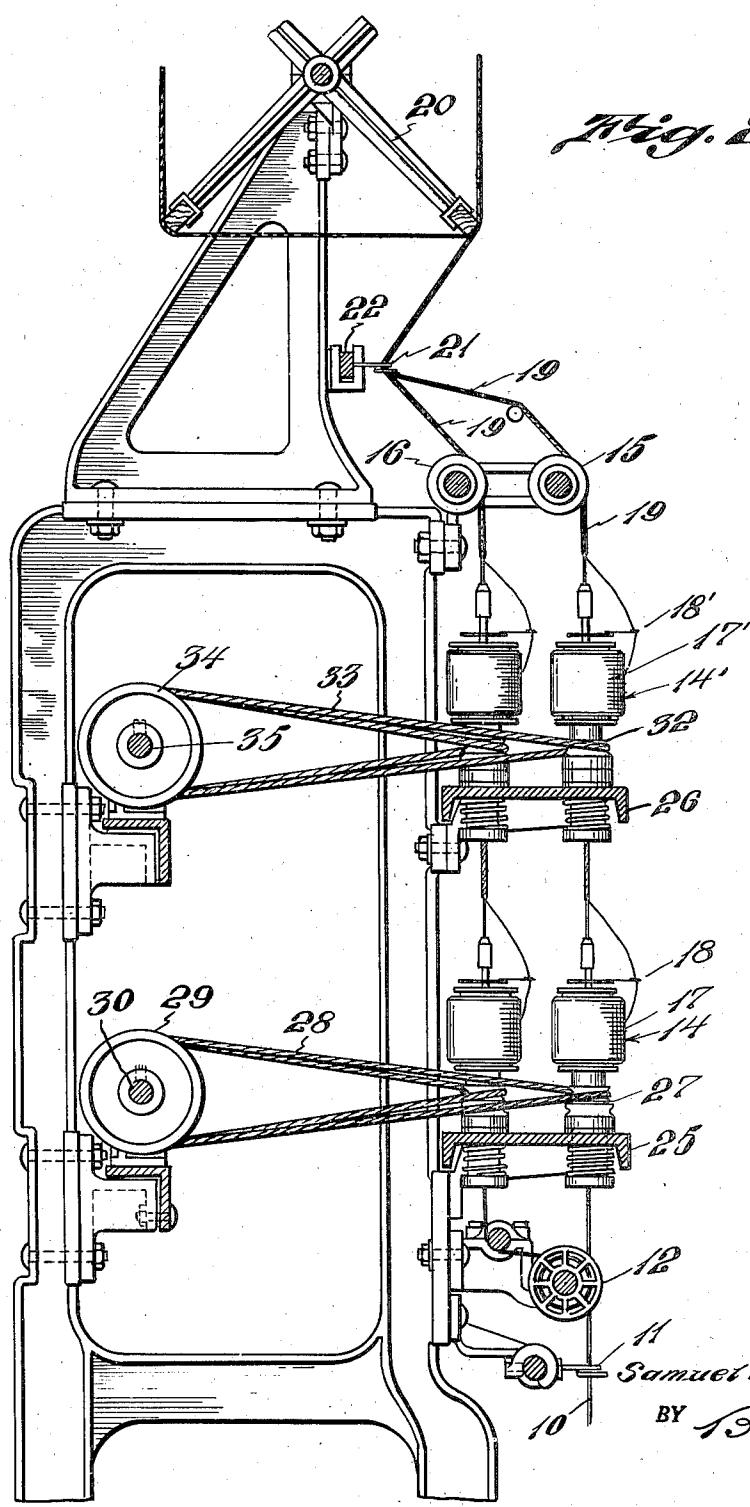


Fig. 2.

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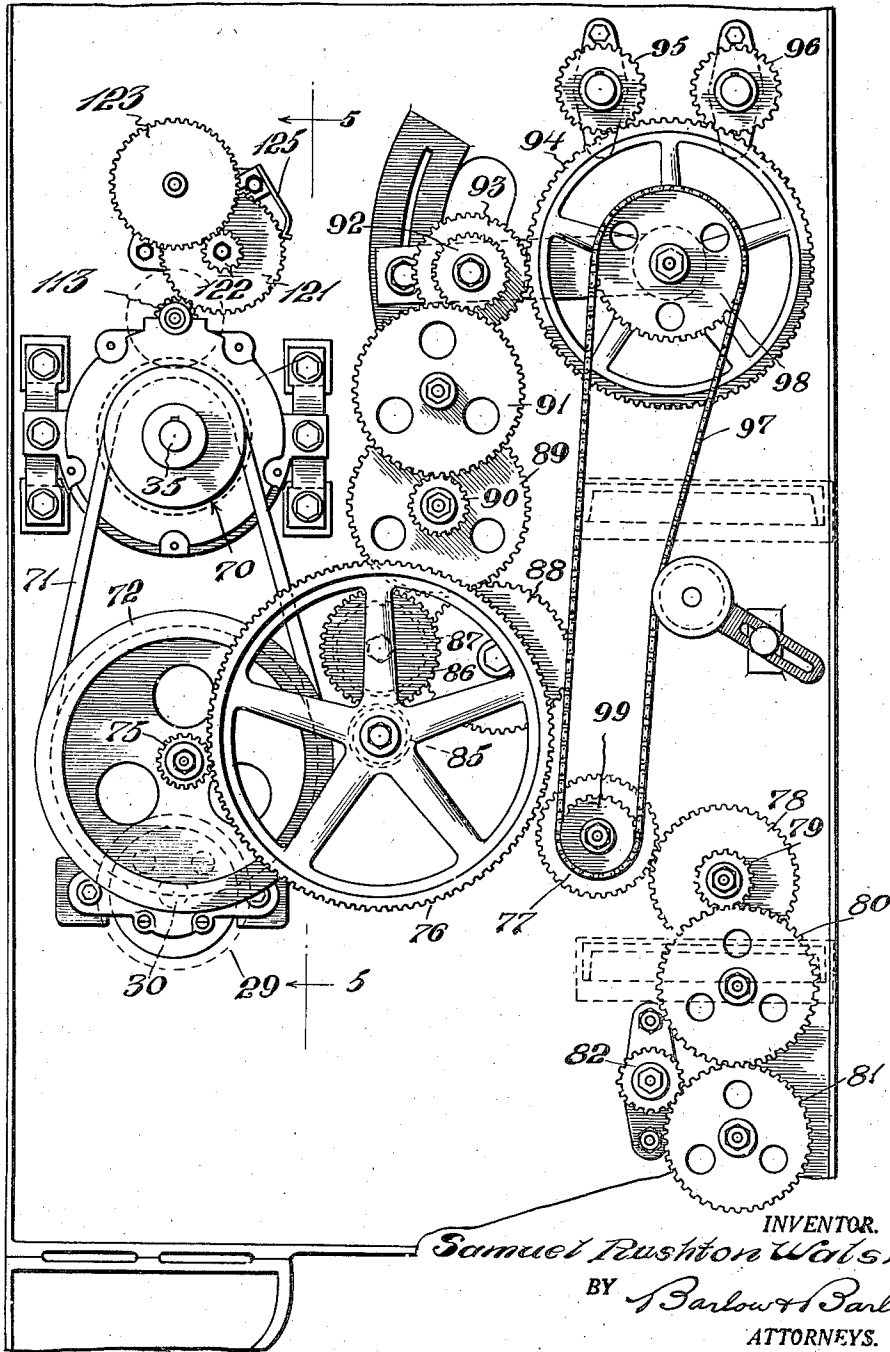
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Fig. 3.



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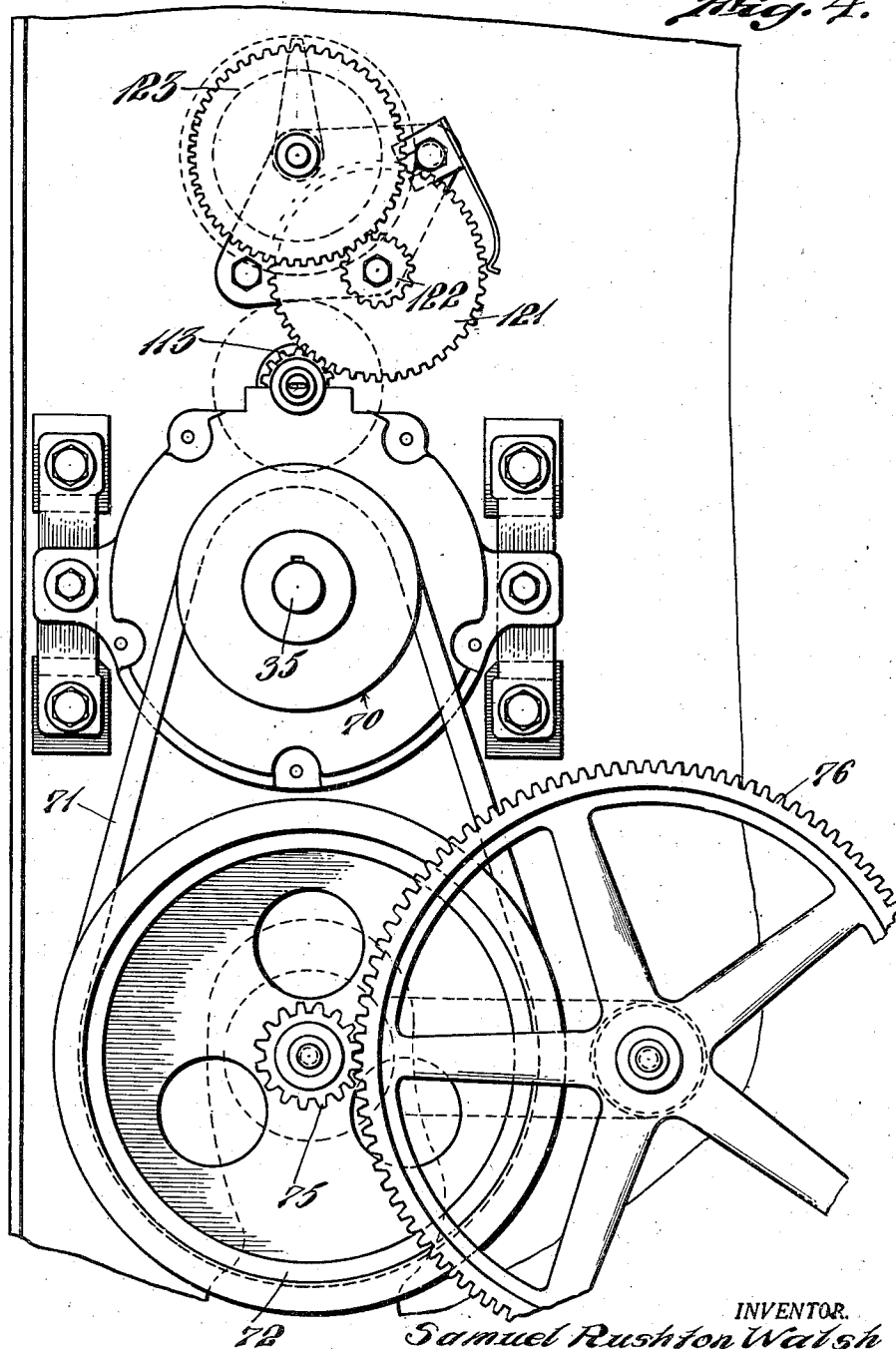
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Fig. 4.



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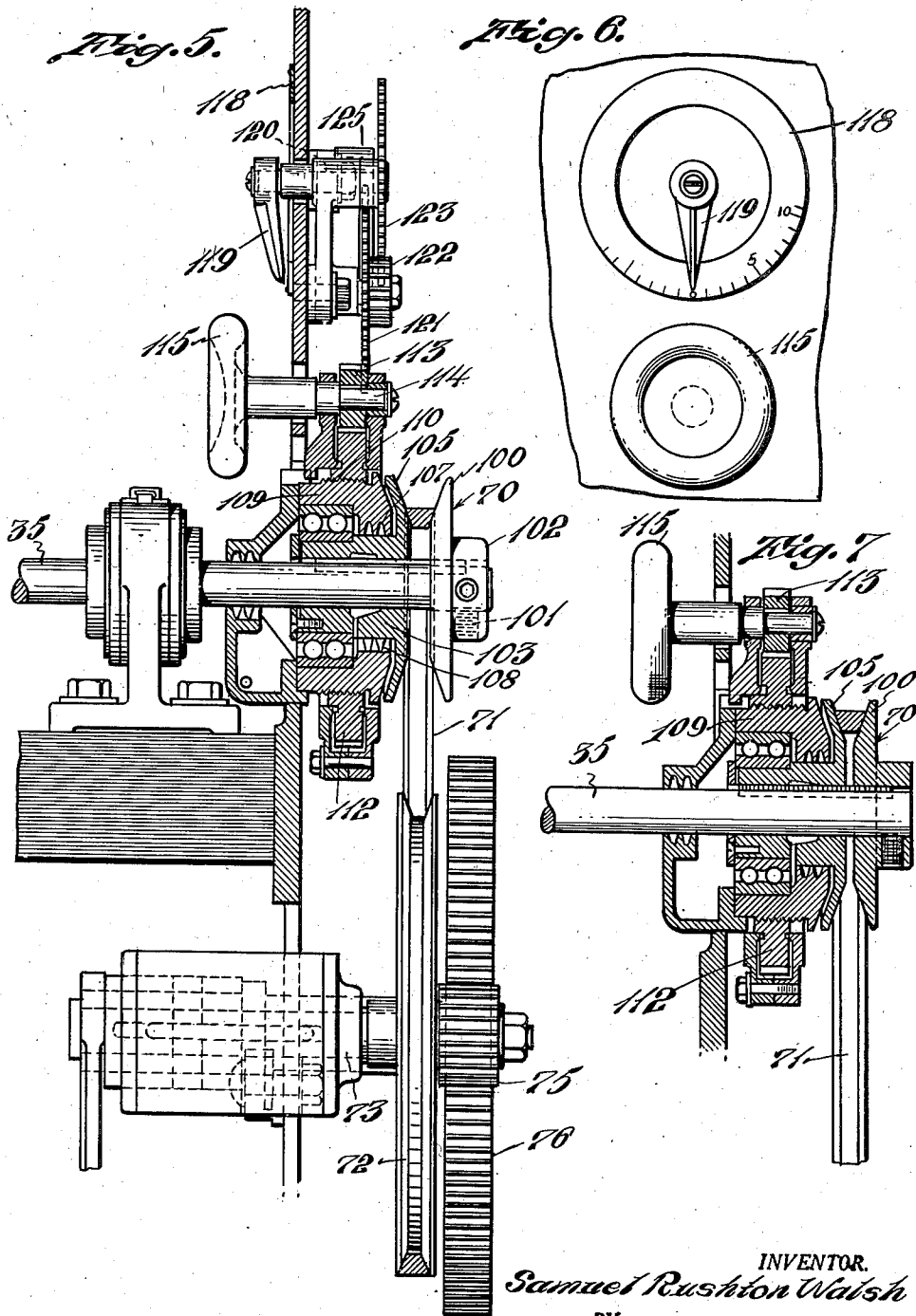
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STRAND COVERING APPARATUS

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STRAND COVERING APPARATUS

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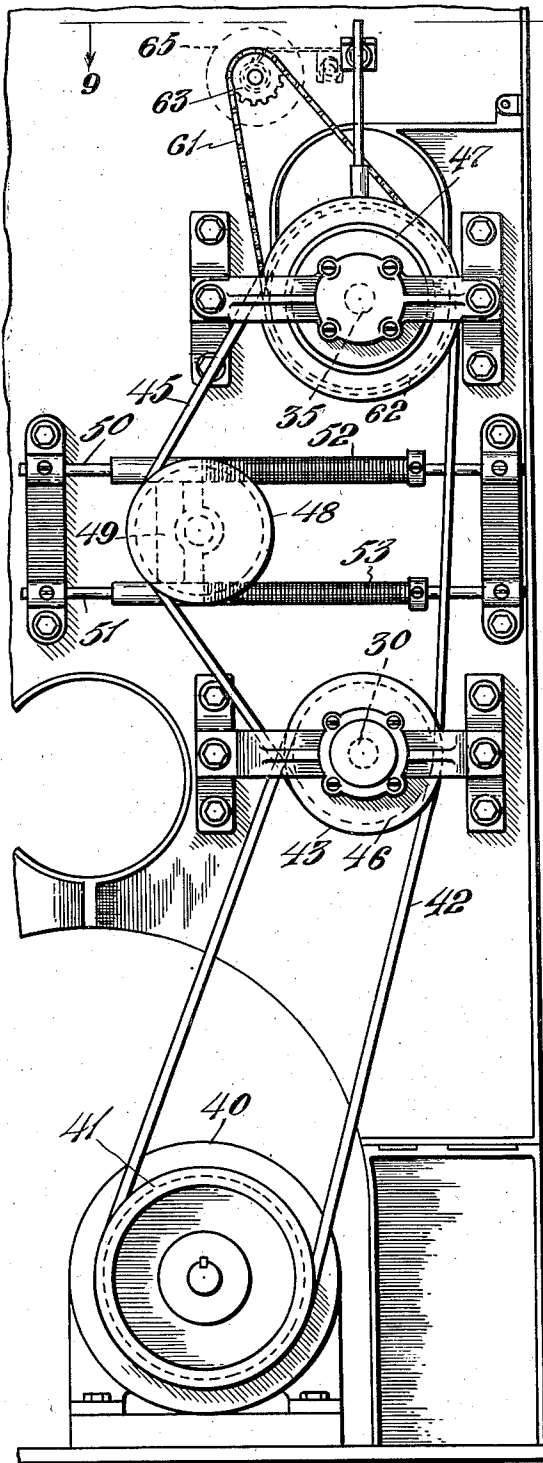


Fig. 8.

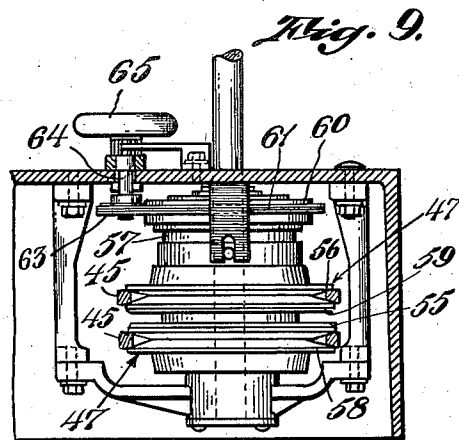


Fig. 9.

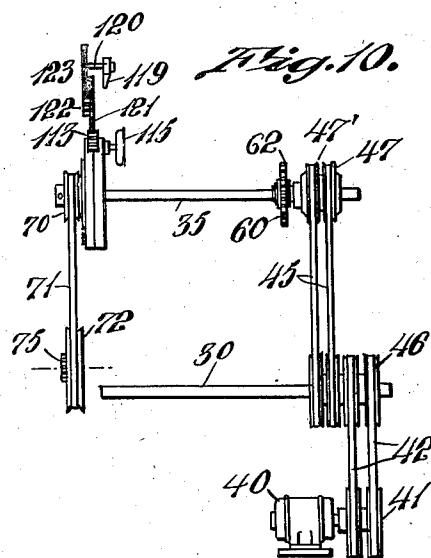


Fig. 10.

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2,224,110

STRAND COVERING APPARATUS

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Application November 1, 1939, Serial No. 302,391

5 Claims. (Cl. 57—16)

This invention relates to a strand covering apparatus and more particularly to a machine for individually covering a plurality of elastic strands, under tension, with helically applied wrappings of covering material one over the other; and has for one of its objects the controlling of the elongation of each of the elastic strands in order to maintain substantially uniform and constant pre-determined elongation of the stretched portion of the same during its advancing movement as the covering material is applied thereon.

Another object of the invention is the variable speed driving of the strand advancing means, whereby a control of the speed of advancing movement and elongation of the elastic strands to be covered through the wrapping means will be obtained for maintaining a substantially constant pre-determined elongation of the stretched portions of the elastic strands as the covering material is applied thereon.

Another object of the invention is the variable speed driving of one group of several sets of vertically aligned hollow covering devices, whereby the finished covered elastic yarn or thread will be produced with the wrapped coverings in a balanced condition.

Another object of the invention is to provide variable means for maintaining a substantially constant and uniform predetermined elongation of the elastic strands at all times during application of the covering material from the time the package of covering material is full until it is depleted.

With these and other objects in view, the invention consists of certain novel features of construction, as will be more fully described and particularly pointed out in the appended claims.

In the accompanying drawings:

Fig. 1 is a fragmentary front elevational view of a portion of a strand covering machine embodying my invention;

Fig. 2 is a vertical sectional view taken substantially on the line 2—2 of Fig. 1;

Fig. 3 is an end view of the machine shown in Fig. 1 taken substantially on the line 3—3, and showing the variable elongation control mechanism in operating position;

Fig. 4 is an enlarged detailed view of the variable elongation control mechanism shown in Fig. 3;

Fig. 5 is an enlarged sectional view taken on the line 5—5 of Fig. 3, with the adjustable sheave pulley being shown in a widely separated position;

Fig. 6 is a front view of the manual control for adjusting the variable elongation control mechanism;

Fig. 7 is a fragmentary sectional view of a portion of the mechanism shown in Fig. 5, but with the adjustable sheave pulley being shown in a different position;

Fig. 8 is an end view of the foot end of the strand covering machine showing the variable speed transmission mechanism for driving and controlling the speed of one set of spindles;

Fig. 9 is a horizontal sectional view taken on the line 9—9 of Fig. 8; and

Fig. 10 is a diagrammatic view of the drive arrangement of the machine and illustrating the cooperating relationship between the variable means for driving the upper group of spindles of the machine and the variable means for driving the strand advancing wheels for effecting control of the feeding and elongation of the elastic core strand.

Elastic yarns or thread, such as are used in the manufacture of woven or knitted elastic fabrics for either the warp or the filling threads, or both, to provide the elasticity desired in the finished article, have usually consisted of a core of rubber having two superimposed layers or wrappings of the covering material, such as a textile substance, which is wrapped helically on the core. In the manufacture of such covered yarns or threads, the outer wrapping of the covering material is applied to the core in the opposite direction to that of the inner covering layer in order to balance the twist of the inner wrappings so that there is neither a right-hand nor a left-hand twist in the final product. Hence, the finished covered product will be in equilibrium when retracted and at rest after removal from the covering machine, and it will remain straight without kinking, whereby any twisting tendency of the outer layer of covering material will act to oppose and neutralize the action of opposite twist of the inner covering layer, after the applied tension on the rubber core to stretch the same during the covering operation, is removed from the rubber core, and it is permitted to retract and be restored to a stable condition.

In weaving elastic fabrics it is customary to employ a shuttle having an adjustable tension eye which is set to a predetermined elongation of covered elastic yarn. It is found that if use of elastic yarns of a variable elongation is attempted with such shuttles, the result is the formation of blisters and imperfections in the cloth. The same detrimental results are pro-

duced in knitted fabrics employing elastic yarns of un-uniform elongation. It is therefore essential that the manufacture of the elastic yarns be carried out in such a manner as to maintain a uniform pre-determined elongation of the elastic core strand as the covering material is being applied thereto, whereby a balanced finished yarn will be produced when the tension is relieved.

The machines for making covered elastic yarns or thread have heretofore comprised upper and lower sets of rotatable wrapping devices having vertically aligned hollow spindles through which the portions of the rubber core strands to be covered are advanced vertically during the covering operation while being maintained in a stretched condition by the tensioning members. In such prior machines, there is maintained a constant speed ratio between the relative speeds of rotation of the spindles of the upper and lower decks in order to produce a finished covered, balanced, elastic yarn. However, if the yarn balance changes during the covering operation, or different weights of covering material are employed for the outer wrapping than are used for the inner wrapping, it is necessary to change the relative speeds of the spindles of one of the decks in which instance such a change has required the changing of the drive pulleys of the machine, thus necessitating shutting down the machine each time that such an adjustment is made, with the consequent loss in production, especially where there are a considerable number of machine involved. Also, a large number of pulleys of different sizes were required for each machine to provide the small adjustments required.

It is found, however, in the operation of the prior constructions of covering machines, that it is difficult to maintain a uniform elongation and uniform yarn balance in the finished covered elastic yarn product, due to the fact that the strand covering material being delivered from the upper yarn package exerts a drag on the upwardly advancing elastic core strand to impart additional stretch thereto, whereby the finishing covered elastic yarn, when tension is relieved, will have its outer wrapping of covering material wrapped in bunches. It has been found that this objectionable condition is due to the length of covering material being wrapped not being of a constant length, since the package of the covering material decreases in diameter during the covering operation, so that there is less material removed from the outer convolutions of the package when it is half empty than there was at the start when the package was full, as the package revolves at constant speed. Consequently, at the beginning of the covering operation when a full package of covering material carried by the wrapping device there is normally a ballooning tendency of the yarn or strand of covering material being delivered from the supply package which action enables the covering material to be freely wound about the moving elastic core strand without appreciably affecting its upward movement. As the covering operation progresses, the diameter of the package of covering material accordingly decreases as the yarn is withdrawn so that the successive lengths of the covering material being delivered therefrom become shorter and are tensioned by the action of the rotary flyer to exert a pull upon the core as it is being wrapped to oppose its normal advancing movement and increase its elongation above that required to be maintained as a minimum.

As above stated, in the operation of such rubber covering machines, it is desirable that a minimum variation of elongation of the rubber core strand or thread be maintained and that such elongation be held substantially constant and within certain predetermined limits. The prior practice employed in the use of the previous constructions of rubber covering machines has been to employ separate change gears at the head end of the machine which are changed by the operator at periodic intervals during the covering operation after the package of covering material has reached a certain size, usually every two hours, from the time the package has decreased to a certain diameter until it has been emptied. This method of elongation control is objectionable, since it requires shutting down each of the machines each time that these change gears are changed. However, if the gears of the proper number of teeth are not inserted at the proper time that the supply of covering material has been depleted to a point as to cause appreciable drag on the core strand, then the aforementioned detrimental effect is observed in the covering of the finished covered rubber core or thread when the tension is relieved. Furthermore, the job of changing gears is very dirty and distasteful to the operator.

The present invention is therefore directed to means for overcoming the aforementioned disadvantages of these previous strand-covering machines and comprises variable means for driving one group of covering spindles while the speed of rotation of the other group of covering spindles is maintained constant, whereby control of the yarn balance is obtained, and also the use of variable means for stretching and advancing the elastic core strand during the covering operation, whereby its elongation is maintained substantially constant and uniform; and in the embodiments shown in the accompanying drawings the adjustment of each of these variable transmissions is effected manually for obtaining the desired driving speeds of one set of covering spindles and the elongation of the core strand being covered; and the following is a more detailed description of the present embodiment of this invention, illustrating the preferred means by which these advantageous results may be accomplished:

With reference to the drawings, one embodiment of the invention is shown and comprises a covering machine for applying covering material helically in oppositely wrapped layers to elastic core-strands or threads 10 for incorporation into elastic fabric, the elastic strands 10 being of rubber and drawn from suitable supply sources (not shown) through guide eyes 11 by the feed wheels 12, and then pulled in a stretched condition vertically upwardly through the bores of lower and upper decks of vertically aligned hollow spindles generally designated 14 and 14' by the draw-off wheels 15 and 16 as the covering material in strand form on the packages 17 and 17' is withdrawn therefrom by the rotary flyers 18 and 18' and wound thereby in successively applied helical layers on the elastic rubber core-strands or threads 10. On this machine, the lower deck of winding spindles 14 normally run at a faster speed and in the opposite direction to the rotation of the upper deck of covering spindles 14'. The draw-off wheels 15 and 16 rotate at a faster speed than the feed wheels 12 so that the portion of the rubber core-strand or thread 10 extending between these wheels is stretched

to a pre-determined extent during its progressive movement upwardly through the hollow spindles 14 and 14' respectively as the spiral wrappings of the covering material are applied thereto.

5 The finished covered elastic strand designated 19, with its inner and outer spiral wrappings of the covering material, is delivered from the draw-off wheels 15 and 16 to a take-up reel 20 or other means which in the course of its reeling operation pulls the covered core 19 through the usual guide eyes 21 mounted upon a horizontally reciprocable bar 22 that is traversed by the core-advancing mechanism hereinafter to be described, for distributing the covered core 19 uniformly along the take-up reel 20.

10 If desired, the weighted presser roller and grooved wheel members of the Feeding and tensioning mechanism for strand wrapping machines, described and claimed in the copending application of John Perry, Serial No. 276,782, filed June 1, 1939, now Patent No. 2,211,434, granted Aug. 13, 1940, may be substituted for either the draw-off wheels 15 and 16, or the feed wheel 12, or both.

20 The upper and lower decks of covering spindles 14 and 14' respectively each consist of two longitudinal rows of spindles, the bores of the front and rear rows of spindles on the lower deck being vertically aligned with respect to the bores of the corresponding rows of spindles on the upper deck. The covering spindles 14 and 14' are of similar construction, and each is mounted in a resilient manner upon the rails 25 and 26 respectively, extending longitudinally of the machine. The lower spindles are driven by means of whorls 27 which are fixed on the spindles and driven by belts 28 rotated by the driving pulleys 29 secured to the longitudinally extending driving shaft 30. To drive the upper sets of winding spindles 14', the whorls 32 are provided fast on the spindle and driven by belts 33 which are rotated by the driving pulleys 34 secured to the longitudinally disposed upper drive shaft 35, the upper covering spindles 14' being rotated in a direction opposite to and at a slower speed than that of the lower spindles 14. Consequently, the spindles of one deck wrap one layer of covering material with a right-hand twist about the elastic core strand, and the spindles of the other deck apply the second layer of the covering material with a left-hand twist, and vice versa, the twists of the two superimposed windings neutralizing each other to prevent the curling effect and balance one another.

55 Means are provided for driving the covering spindles on one deck at a constant speed, and variable means are provided for driving the spindles of the other deck at variable speeds. In the embodiment shown in the drawings, the constant speed driving means comprises an electric motor 40 having a driving pulley 41 which transmits power by means of a plurality of V-belts 42 to the driven pulley 43 which is fixedly secured to an extended end portion of the longitudinal shaft 30 for driving the same to rotate the driving pulleys 20 and in turn, the lower covering spindles 14 driven therefrom.

70 The variable means for driving the spindles 14' of the upper deck at different selected speeds as required during the covering operation may consist of one or more V-belts 45 extending between the V-grooved pulleys 46 fixed on the outer end portion of the upper longitudinal drive shaft 30 adjacent the pulley 43, and the adjustment sheaves 47 and 47' of a variable speed

transmission for transmitting power from the V-pulleys to the adjustable sheaves 47 for driving the shaft 35 and the drive pulleys 34 to rotate the upper sets of covering spindles 14' at different speeds regulatable by the operator during the course of the covering operation. One or more idler V-pulleys 48, which are freely rotatable on a bracket 49 slidably mounted on cross rods 50 and 51, for shifting movement bodily in a direction to the left of Fig. 8 by the pressure of the springs 52 and 53 carried by the rods 50 and 51, serves to maintain the V-belts 45 taut.

15 The specific construction of the variable speed power transmission mechanism "per se" for rotating the covering spindles forms no part of the claimed subject matter of the present invention. One suitable mechanism which may be employed is that disclosed in Patent No. 1,662,511 of March 3, 1928, and only sufficient description is given herein of its structure as will be necessary to a full understanding of the novel patentable subject matter of the present invention. As shown in Fig. 9, the variable speed transmission comprises a pair of shiftable halves 25 55 and 56 of the sheave 47, and 47', each of which shiftable members being carried by an adjustable sleeve 57 suitably mounted for movement toward and from the fixed halves 58 and 59 of the sheaves 47 and 47' respectively, upon rotation of a rotatable nut 60 internally threaded to provide screw-threaded connection with an exteriorly screw-threaded part of the sleeve 57 and rotated thereon by means of a sprocket chain 61 in a desired direction by means of 35 sprocket teeth 62 projecting from the exterior of the nut. The sprocket chain 61 extends between the sprocket teeth 62 on the nut and a sprocket wheel 63 fast on one end of a stub shaft 64 journaled in the frame of the machine and carrying a hand wheel 65 at the other end of the shaft 64, whereby rotation of the hand wheel 65 will serve to axially move the shiftable halves 55 and 56 of the sheaves 47 and 47' toward or away from the fixed halves 58 and 59 of the sheaves 47 and 47' to vary the effective diameter of the same into different selected positions for changing the speed of the upper drive shaft 35.

50 Variable means are also provided for controlling the elongation or stretch of the elastic rubber core strand whereby it can be varied and adjusted to a predetermined extent as it is pulled through the covering spindles 14 and 14' during the covering operation. This variable control of the elongation consists of a variable speed drive which is positively driven from one of the longitudinal drive shafts that drives a set of covering spindles 14 and 14' respectively, and there is provided suitable gearing for connecting this variable speed drive to the feed wheels 12 and to the draw-off wheels 15 and 16 for driving these wheels at variable speeds of rotation, the arrangement being such that any adjustment of the variable speed drive will result 65 in simultaneously varying the speeds of rotation of the feed wheels and the draw-off wheels, and yet will always maintain a constant predetermined speed ratio or differential speed between the speeds of these wheels relative to each other. 70 As illustrated in Figs. 3, 4, 5 and 7, the variable speed drive for the elongation and feeding mechanism is shown as consisting of an adjustable sheave generally designated 70 connected by means of a V-belt 71 which extends between 75

the sheave 70 and the pulley 72 to be driven fixed to a stud shaft 73 suitably journaled in the frame of the machine where rotation of the driving pulley 70 will transmit power through the V-belt 71 and pulley 72 to rotate the pinion gear 75 carried by the outwardly extending end portion of the stub shaft 73 meshing with gear 76 which through the gear train consisting of gears 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95 and 96 rotate the upper draw-off wheels 15 and 16 in unison. The lower feed wheels 12 are rotated in unison with and at a slower speed of rotation than the speed of the upper draw-off wheels 15 and 16, and the driving arrangement consists of a lower gear train made up of gears 77, 78, 79, 80, 81 and 82 to which power is transmitted from the upper gear train by means of a chain 97 extending between and connecting the gears 98 and 99, the gear 98 being fixed to the same shaft as the gear 94 and rotated therewith, and the gear 99 being operatively connected to the gear 77 for driving the same and the lower gear train.

The adjustable sheave 70 of the variable speed drive mechanism is made in two parts, one of which is movable axially relative toward and from the other, and is shown in Figs. 5 and 7 as consisting of a flange 100 of frusto-conical formation forming one wall of the sheave and fixed to the end of the drive shaft 35 in any suitable manner, such as by means of set screws 101 threadingly carried by the hub 102 of the flange. A sleeve 103 slidably mounted for axial movement along the shaft 35 carries a frusto-conical flange 105 forming the movable side wall of the V-grooved adjustable sheave pulley 70. A series of circular flanges 107 projecting radially outwardly from the exterior cylindrical surface of the sleeve 103 have interfitting engagement within correspondingly shaped recesses formed internally of the bore of the end wall 108 of a sleeve-like nut 109 whereby axial adjustment of the same will be effected by means of external screw threads 110 carried thereby and having threading engagement within correspondingly shaped screw threads formed internally of a rotatable gear-like nut 112 upon rotation of the nut by the pinion gear 113 fixed to a shaft 114 when the same is actuated by the hand wheel 115. Hence, the manual turning of the hand wheel 115 by the operator will either advance or withdraw the movable side wall 105 of the driving pulley 70 so as to vary the effective diameter of the same and thereby simultaneously change the speeds of rotation of the feed wheels 12 and the draw-off wheels 15 and 16 respectively, in the same ratio whereby a control of the rate of feeding and the elongation of the elastic rubber core strand or thread during the covering operation may be obtained within pre-determined desired limits.

A dial 118 and a pointer 119 mounted on a shaft 120 and connected to the pinion 113 by means of a suitable train of gears 121, 122 and 123 serve to indicate on an arbitrary scale on the dial 118 the elongation or the extent of each increment of change of adjustment of the driving pulley 70. This adjustment of elongation is made manually by the operator periodically during the covering operation without stopping the machine and as the package of covering material reaches a certain size during withdrawal of the covering material.

From the foregoing description of the invention, it will be observed that a novel form of apparatus for covering elastic strand material has

been provided including variable means for maintaining uniform balance of the covering material as it is applied to the elastic core strands, and also separate variable means for controlling the rate of feeding and the elongation of the elastic core strand whenever necessary due to the type of yarn used for the covering materials and the number of ends of the same employed for maintaining the elongation substantially constant and within a minimum pre-determined value. It will also be observed that the present invention provides for the manual adjustment of each of these variable transmissions whereby the control may be performed by the operator of the machine, whenever desired, and with considerable accuracy by reason of the micrometer gear ratio of the parts of these mechanisms.

While the foregoing description relates to the illustrated embodiment of the invention in which variable means are employed for the driving of the covering spindles of the upper deck at variable speeds for control of the "balance" of the applied layers of covering material on the elastic core strands, it will be apparent that obvious modifications may be made of my invention in a form different from that which I have employed and illustrated without departing from the spirit and scope of the invention, such as the use of variable means for driving the covering spindles of the lower deck at variable speeds, and it is to be understood that such applications of the invention are to be considered as included by the above specification and in the following claims appended hereto.

I claim:

1. In a strand wrapping machine, upper and lower hollow rotatable covering devices in substantially vertical alignment, upper and lower rotatable members for stretching portions of an elastic core strand to a pre-determined extent and progressively advancing the stretched portions thereof upwardly through a pair of upper and lower hollow covering devices as the helical wrappings of the covering material is applied successively on the elastic core strand, and a variable power transmission for rotating the upper and lower strand stretching and advancing members, and adjustable manually to various selected positions to vary the relative speeds of these members simultaneously with no alteration of their differential speed ratio which is maintained at a constant value, whereby a uniform pre-determined elongation of the elastic core strand is obtained.

2. The combination with a strand covering apparatus wherein a core strand to be covered with one or more successively applied helical wrappings of textile material is fed and stretched by upper and lower spaced rotary feeding members rotated at the same speed to maintain constant elongation of the core strand, of a variable speed drive for driving said feeding and stretching members comprising a shaft, a sheave flange fixedly secured on said shaft, a sheave flange carried by said shaft and slidable thereon in a direction toward and from said fixed sheave flange, said flanges being of generally frusto-conical formation having mutually facing conical surfaces defining an annular groove with outwardly diverging side walls for the reception of a V-belt, and means for moving said slidable sheave flange longitudinally of the shaft toward the fixed sheave flange into different axially adjusted positions to provide variable effective sheave diameters for engaging said V-belt, said means com-

prising a pair of concentric annular members co-axial with said shaft and carried by said slidable sheave flange, the inner annular member engaging and being movable bodily with said slidable sheave flange during its longitudinal adjusting movement and also being independently rotatable with respect thereto, and the outer annular member being restrained from movement longitudinally with respect to said shaft and having rotary screw-threaded connection with the inner annular member to produce speed-varying adjustment of said slidable sheave flange when the outer annular member is rotated.

3. The combination with a strand covering apparatus wherein a core strand to be covered with one or more successively applied helical wrappings of textile material is fed and stretched by upper and lower spaced rotary feeding members rotated at the same speed to maintain constant elongation of the core strand, of a variable speed drive for driving said feeding and stretching members comprising a shaft, a sheave flange fixedly secured on said shaft, a sheave flange carried by said shaft and slidable thereon in a direction toward and from said fixed sheave flange, said flanges being of generally frusto-conical formation having mutually facing conical surfaces defining an annular groove with outwardly diverging side walls for the reception of a V-belt, and means for moving said slidable sheave flange longitudinally of the shaft toward the fixed sheave flange into different axially adjusted positions to provide variable effective sheave diameters for engaging said V-belt, said means comprising a sleeve member and a ring gear concentric with each other and co-axial with said shaft, said sleeve being carried by said slidable sheave flange with one end in engagement therewith and movable bodily with such flange in all its adjusted positions, and also being independently rotatable of said slidable sheave flange, said ring gear being rotatably mounted on said sleeve member and having internal screw threads cooperating with external screw threads on the periphery of said sleeve to produce speed-varying adjustment of said slidable sheave flange when the ring gear is rotated.

4. The combination with a strand covering apparatus wherein a core strand to be covered with one or more successively applied helical wrappings of textile material is fed and stretched by upper and lower spaced rotary feeding members rotated at the same speed to maintain constant elongation of the core strand, of a variable speed drive for driving said feeding and stretching members comprising a shaft, a sheave flange fixedly secured on said shaft, a sheave flange carried by said shaft and slidable thereon in a direction toward and from said fixed sheave flange, said flanges being of generally frusto-conical formation having mutually facing conical surfaces defining an annular groove with outwardly diverging side walls for the reception of a V-belt, and means for moving said slidable sheave

flange longitudinally of the shaft toward the fixed sheave flange into different axially adjusted positions to provide variable effective sheave diameters for engaging said V-belt, said means comprising a sleeve member and a ring gear concentric with each other and co-axial with said shaft, said sleeve being carried by said slidable sheave flange with one end in engagement therewith and movable bodily with such flange in all its adjusted positions, and also being independently rotatable of said slidable sheave flange, said ring gear being rotatably mounted on said sleeve member and having internal screw threads cooperating with external screw threads on the periphery of said sleeve, and a manually operable gear in meshing engagement with said ring gear for rotating the same to produce speed-varying adjustment of said slidable sheave flange when the ring gear is rotated.

5. The combination with a strand covering apparatus wherein a core strand to be covered with one or more successively applied helical wrappings of textile material is fed and stretched by upper and lower spaced rotary feeding members rotated at the same speed to maintain constant elongation of the core strand, of a variable speed drive for driving said feeding and stretching members comprising a shaft, a sheave flange fixedly secured on said shaft, a sheave flange carried by said shaft and slidable thereon in a direction toward and from said fixed sheave flange, said flanges being of generally frusto-conical formation having mutually facing conical surfaces defining an annular groove with outwardly diverging side walls for the reception of a V-belt, and means for moving said slidable sheave flange longitudinally of the shaft toward the fixed sheave flange into different axially adjusted positions to provide variable effective sheave diameters for engaging said V-belt, said means comprising a sleeve member and a ring gear concentric with each other and co-axial with said shaft, said sleeve being carried by said slidable sheave flange with one end in engagement therewith and movable bodily with such flange in all its adjusted positions, and also being independently rotatable of said slidable sheave flange, said ring gear being rotatably mounted on said sleeve member and having internal screw threads cooperating with external screw threads on the periphery of said sleeve, and a manually operable gear in meshing engagement with said ring gear for rotating the same to produce speed-varying adjustment of said slidable sheave flange when the ring gear is rotated, and means including a movable pointer and a gear train operatively connected to the pointer and to said manually operable gear and actuated by rotation of the latter for indicating by said pointer on a scale the extent of speed-varying adjustment of said slidable sheave flange.

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