March 23, 1954 L. SHULVER ET AL 2,672,722

SERVING MACHINE

Filed Oct. 18, 1949

5 Sheets-Sheet 1

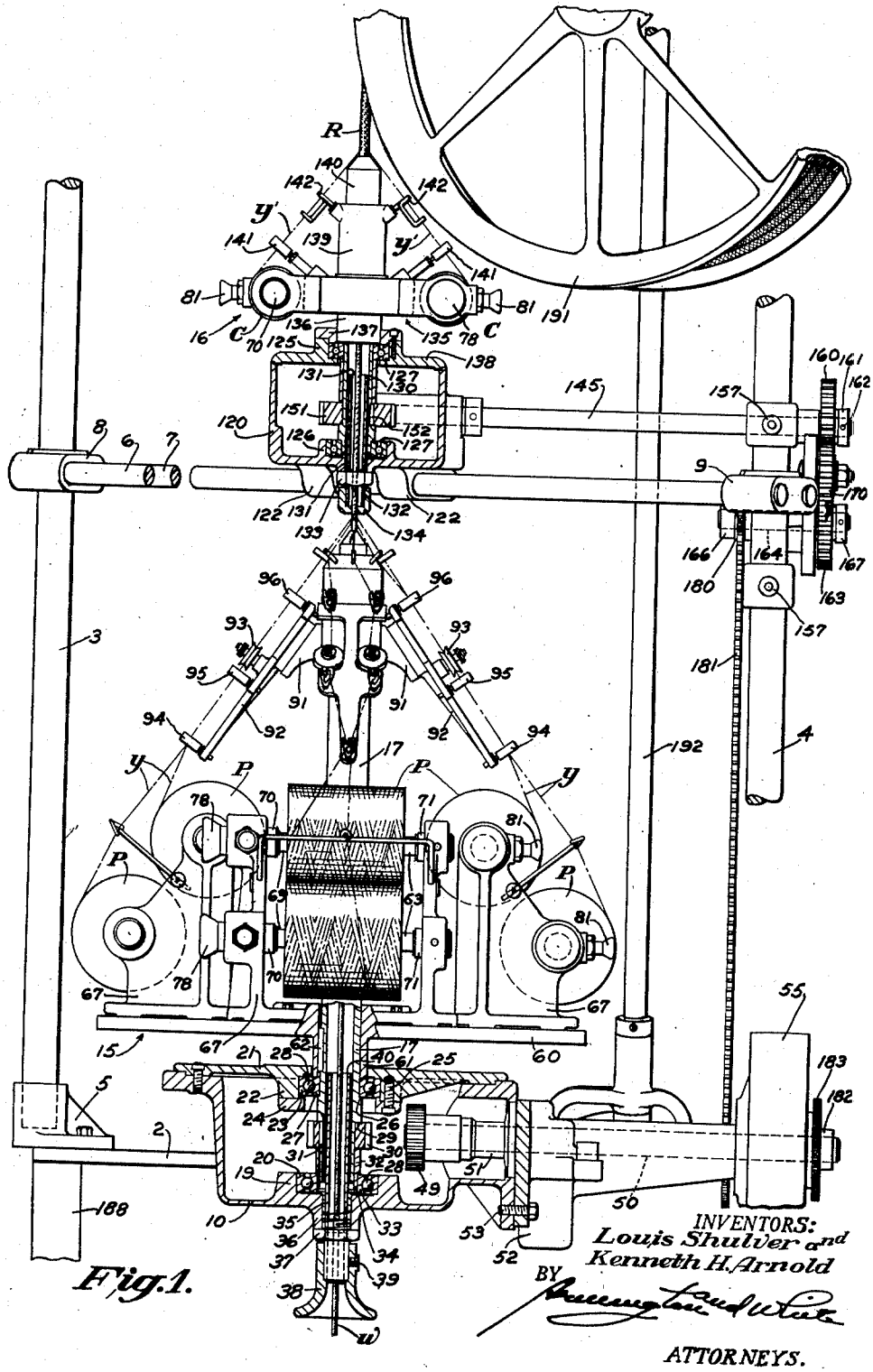


Fig. 1.

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5 Sheets-Sheet 2

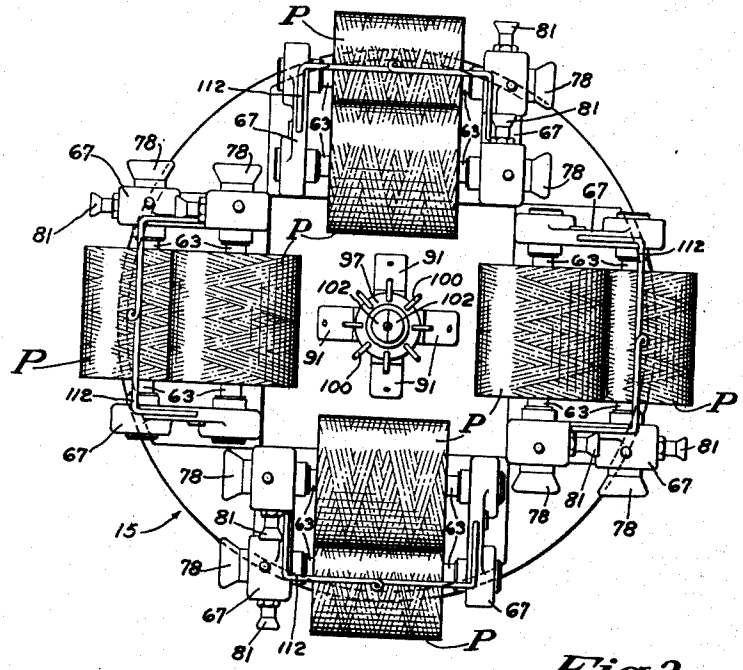


Fig. 2.

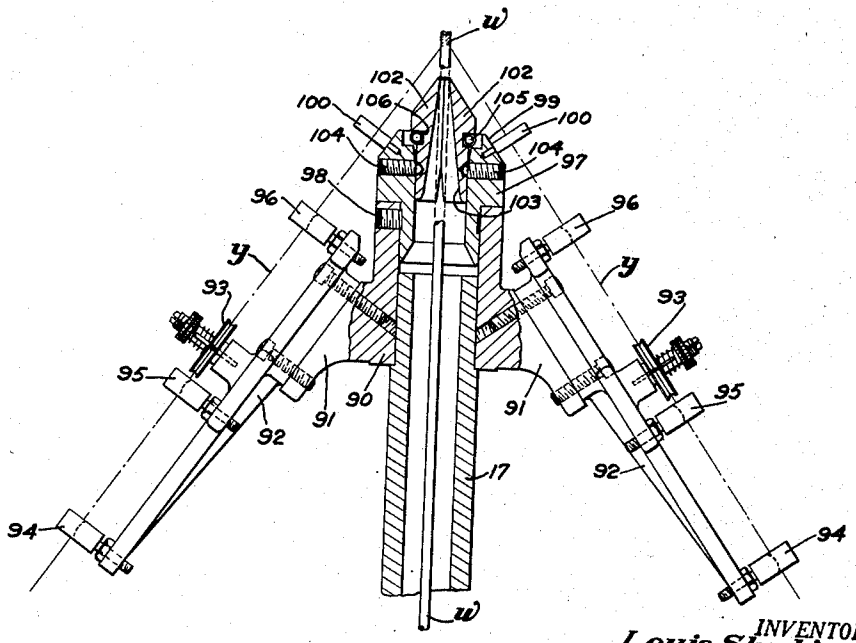


Fig. 3.

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5 Sheets-Sheet 3

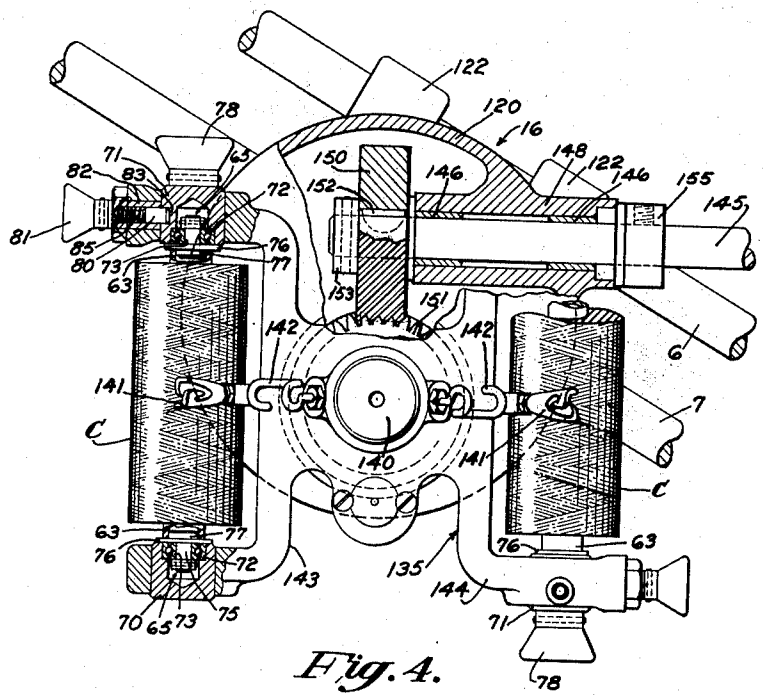


Fig. 4.

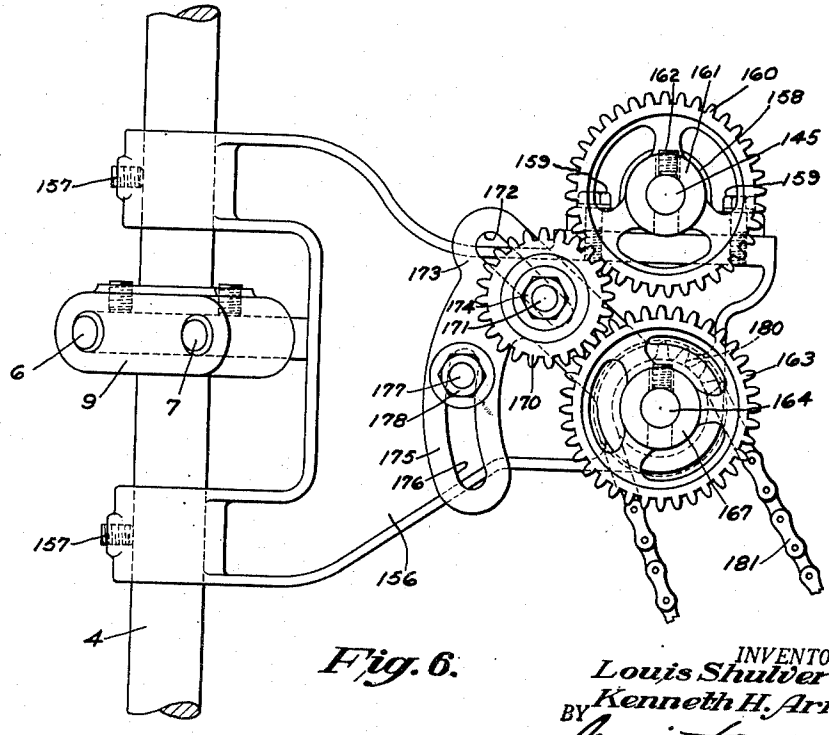


Fig. 6.

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SERVING MACHINE

Filed Oct. 18, 1949

5 Sheets-Sheet 4

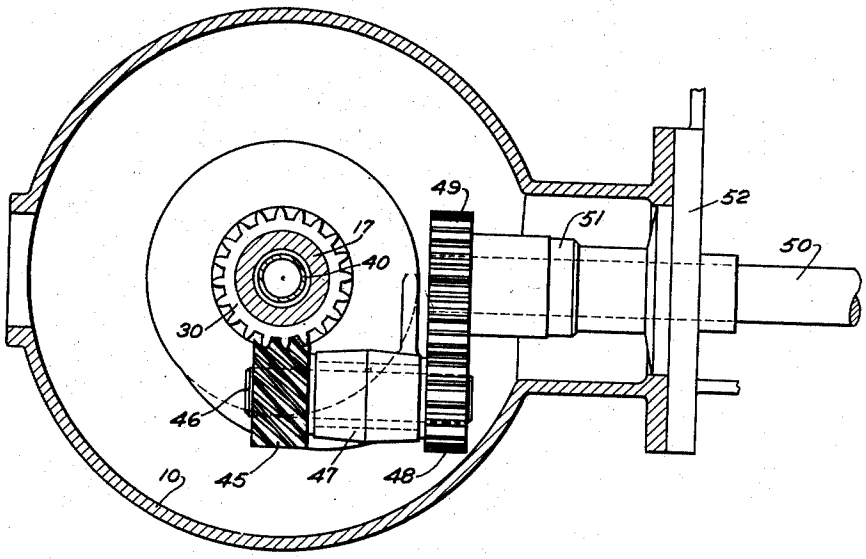


Fig. 5.

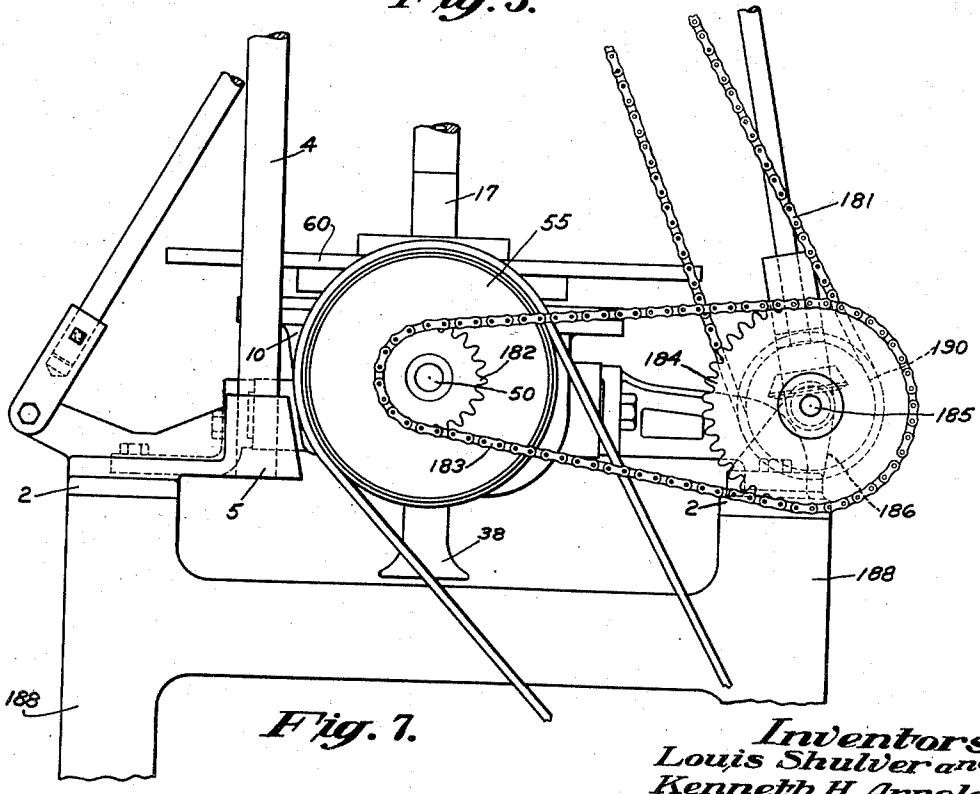


Fig. 7.

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L. SHULVER ET AL

SERVING MACHINE

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5 Sheets-Sheet 5

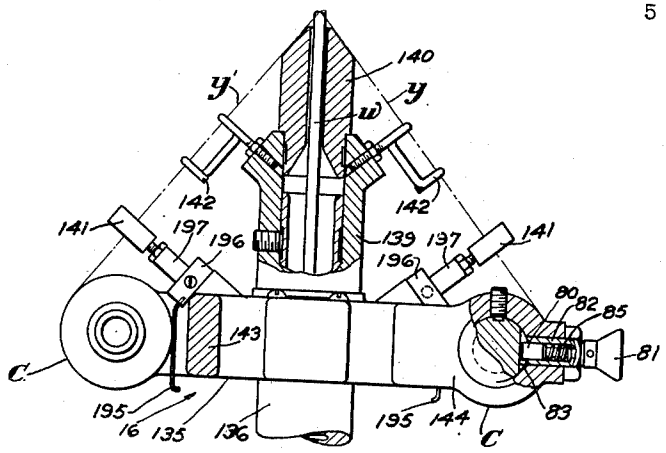


Fig. 8.

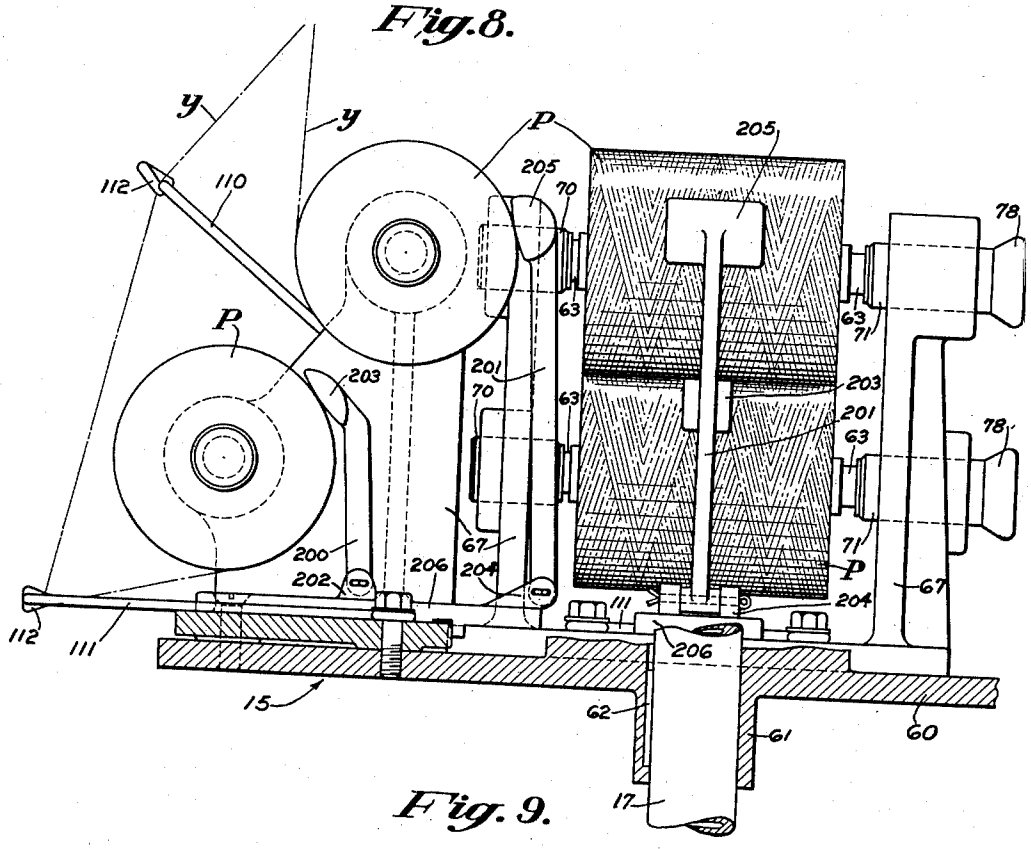


Fig. 9.

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Patented Mar. 23, 1954

2,672,722

UNITED STATES PATENT OFFICE

2,672,722

SERVING MACHINE

Louis Shulver, Central Falls, and Kenneth H. Arnold, Pawtucket, R. I., assignors to Wardwell Braiding Machine Company, Central Falls, R. I., a corporation of Maine

Application October 18, 1949, Serial No. 121,988

4 Claims. (Cl. 57—15)

1

This invention relates to an improved serving machine for serving or wrapping multiple strands of yarn or other attenuated material around a core such as an electrical conductor.

One object of the invention is to provide a machine of the type indicated adapted for high-speed operation to rapidly apply the strand material as a covering for wire, cables or other cores.

Another object is to provide a machine of the type indicated in which multiple supply packages of strand material are revolved around the wire to wrap the strands thereon and so arranged that the wire need not be cut to replenish the strand-supply whereby the machine will cover maximum lengths of the wire or conductor continuously.

Another object is to provide a machine of the type indicated having a main head carrying a plurality of strand-supplies and rotatable in one direction to closely wrap the strands around the core and a second oppositely rotatable head arranged thereabove and carrying other supplies of strand material for applying a binder over the first-laid wraps to tie them in place.

Another object is to provide change-gearing in the machine for driving the upper head and adjusting its speed of rotation independently of that of the main head so as to regulate the spacing of the coils of binder strands.

Another object is to provide a machine of the type indicated embodying tension means for controlling the feed of the strands from their supplies to insure a uniformly tight wrap of the strand material around the core.

Another object is to provide means for feeding the wire from a supply reel through the machine and delivering it therefrom to wind on another reel while traversing it lengthwise of the barrel of the latter to insure a uniform disposition of the layers of winding.

Further objects of the improvement are set forth in the following specification which describes a preferred embodiment of the invention, by way of example, as illustrated by the accompanying drawings. In the drawings:

Fig. 1 is a front elevational view of the machine shown with the housings for the driving gears of the two heads in section to illustrate the arrangement of the drive;

Fig. 2 is a top plan view of the main or lower head shown as carrying eight supply cops or packages of strand material mounted in truncated pyramidal arrangement on rotary mandrels held in ball-bearings;

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Fig. 3 is an enlarged side view of the conically-disposed brackets which support the guiding and tension devices for the strands, with its mounting on the axial spindle shown partly in section;

Fig. 4 is an enlarged top plan view of the upper head of the machine illustrated as carrying two strand supplies for the binder wraps and part-sectional to show the driving means therefor;

Fig. 5 is an enlarged plan view of the gearing for driving the main head;

Fig. 6 is an enlarged elevational view of the change-gear driving mechanism for the upper head of the machine shown with its mounting;

Fig. 7 is an enlarged end view of the chain or belt driving connections between the main shaft of the machine and the drive for the upper head;

Fig. 8 is a part-sectional elevational view of the upper head showing the braking means for the packages carried thereby; and

Fig. 9 is a view of the centrifugally-operated braking means for controlling the rotation of the supply packages on the main head of the machine.

Heretofore, in machines for serving strand material onto elongate cores it has been the usual practice to mount several reserve packages of yarn or similar strand material above the serving head with the core, such as a wire or the like, passing through the hollow centers of the packages. The strand material is drawn off from one package arranged below, wrapped about the core by guiding means in the form of a flier and as each delivering package is exhausted the machine is stopped and another package lowered onto the head enclosing the core so as not to cut the wire. This arrangement limits the number of packages that can be placed in reserve, usually not more than two, and necessarily reduces the amount of yarn that can be applied to a given length of wire. When the reserve supply packages of yarn are exhausted it is necessary to cut the wire and apply a new series of packages to the machine with the wire passed through their interiors. This greatly reduces the length of wire that can be covered without cutting it and is a serious disadvantage since it is desirable to serve the wire continuously in long lengths to avoid multiple splices in the conductor.

To overcome this deficiency in previously-used servers the present invention contemplates a novel and ingenious construction of the machine whereby the strand-supply packages may be carried in groups arranged concentrically surrounding the wire or other core feeding through the

machine. Through this arrangement a large number of strand-supplies may be carried on a rotary head and long lengths of wire served without cutting it to don fresh supplies when those on the machine become exhausted.

In general, the present machine comprises means for feeding a wire, cable or other core through the machine and a main head carrying groups of spools, cops or packages of strand material disposed circumferentially outside the core and preferably arranged in truncated pyramidal form so that a large number of the supplies may be revolved about the core. For some purposes a second auxiliary head is arranged above the main head to revolve a lesser number of supply packages around the core, two for example, to deliver their strands to the core and wrap them around the initial serving in reverse direction to apply a binder for holding the first-served strands securely in place. When supplied with two heads of the above arrangement the lower or main head is driven directly from power means to rotate at high speed and the upper auxiliary binder-head may be driven therefrom at a slower rate of speed, preferably variable through the means of change-gears to regulate the pitch or lead of the binder strand or strands as required. Tension means are provided for the several strands from each head so that the strands may be wrapped tightly about the core and in most instances braking means are employed to control the rotation of the spools or packages from which the strands are delivered. Stopping mechanism may also be applied to the machine for arresting its operation should one or more strands become broken and also to stop the machine when the supplies run out.

Referring to the accompanying drawings, the present machine may be mounted on a stand having legs supported from the floor or, in other cases, it may be mounted on a bench or the like. As herein shown two horizontal cross-members 2 are supported from the legs and rising therefrom are columnar standards 3 and 4 forming a skeleton framework. The standards 3 and 4 may be mounted in socketed brackets 5, only one of which is herein shown, bolted to two cross-members 2. A pair of rods 6 and 7 held in brackets 8 and 9 fastened to the columns 3 and 4 serve to brace the latter and also furnish a support for the upper head of the machine and its driving mechanism to be described later. Mounted between the cross-members of the framework and supported therefrom is a main housing 10 containing the gearing for driving the lower head, indicated generally by the reference character 15, while the upper head is designated 16.

The main head 15 is mounted on a hollow spindle 17 journaled in spaced ball-bearings in the housing 10, the housing serving as a reservoir for oil to lubricate the bearings and the gearing which drives the head. The housing 10 is formed at the bottom with a boss 19 counterbored to receive the outer race 20 for the lower ball-bearing and a cover 21 screwed onto the top of the housing is formed with a boss 22 counterbored to provide a seat for the outer race 23 of the upper ball-bearing, this latter race being held in place by a collar 24 fastened to the boss 22 by a screw 25.

The hollow spindle 17 is formed with a shouldered seat 26 for the inner race 27 of the upper ball-bearing and between the races are suitable balls 28. Beneath the upper bearing the spindle 17 is formed with a shouldered seat 29 for a helical gear 30 held rotatively therewith by a key 31. A sleeve 32 secured fast on the reduced portion of the spindle 17 holds the gear 30 against the shoulder of its seat 29 and its lower end is reduced in diameter to provide a seat for the inner race 33 of the lower ball-bearing with balls 28 between the races. A packing washer 34 underlies the lower ball-bearing for preventing escape of the lubricant from the bottom of the housing 10. A flanged sleeve 35 is inserted through the reduced lower end of the bore in the boss 19 extending down through a depending neck 36 on the under side of the housing 10. The periphery of the sleeve 35 is screw-threaded to receive a nut 37 set up against the end of the neck 36 to secure the sleeve in place.

Below the nut 37 the sleeve 35 is reduced in diameter to receive a hollow member 38 fastened thereto by a set-screw 39. The member 38 is flanged outwardly at its lower end in the manner of a trumpet to provide a re-entrant opening for receiving the core or wire *w* in threading it up through the tubular spindle 17, whence it emerges at the top to be served with the strand material. Within the lower end of the hollow spindle 17 is a quill-like tube 40 held fast in the sleeve 35 with its periphery spaced from the inner wall of the spindle to provide a clearance therebetween. The tube 40 is thus held against rotation and acts as a guide for the core or wire *w* to prevent it from being twisted or turned by frictional contact with the interior of the rotary spindle 17.

Referring to Fig. 5, the gear 30 on the spindle 17 is in mesh with a helical gear 45 fast on a stub-shaft 46 journaled in a stationary bearing 47 supported from the bottom wall of the housing 10. At the opposite end of the stub-shaft 46 is a spur-gear 48 meshing with a gear 49 fast on the end of a main drive-shaft 50 to which power is applied for rotating the lower head 15. The shaft 50 is journaled in a bearing 51 held in a bore in the side of the housing 10 and extends outwardly through bearings in an overhanging bracket 52 bolted to the housing at 53, see Fig. 1. The outer end of the shaft 50 carries a belt-pulley 55 which may be connected to the shaft by means of a clutch, not herein shown or described in detail, through which the drive of the machine may be controlled. The drive for the upper head 16 of the machine is taken from the main shaft 50 through an arrangement of sprockets, chains and gearing to be described later.

The main head 15 is constructed in the form of a circular disk 60 having a depending hub 61 surrounding the hollow spindle 17 and keyed thereto at 62. The supply packages P of yarn or other strand material are wound on paper tubes or cores mounted on tubular mandrels 63 supported at their ends by pintles 65 journaled in ball-bearings as shown in Fig. 4. This latter plan view shows the upper head 16 and its driving connections and the arrangement of the bearings for the packages is the same as on the lower head and therefore are described in connection with this view. Held in bores in the arms of each supporting bracket are hollow plugs 70 and 71 enclosing ball-races 72 for cooperation with races 73 on the pintles 65 with balls between the races. The pintles 65 have reduced spindles 75 provided with flanges 76 and forwardly-projecting heads 77 adapted for insertion into the ends of the hollow mandrels 63 on which the packages C are carried. The bear-

ings for each end of the mandrels 63 are of similar construction except that one plug 71 and its pintle 65 are manually retractible in the supporting arm in which they are mounted by means of a finger-knob 78 on the outer end of the plug. After one end of the package-supporting mandrel 63 has been placed on the head 77 of the fixedly-journaled pintle 65 the movable bearing plug 71 is withdrawn and the head 77 of its pintle inserted into the opposite end of the mandrel; a locking pin 80 carrying a finger-knob 81 being first released from engagement with the plug. The locking pin 80 is slidable axially through a bushing 82 in the end of the bracket arm and is normally forced inwardly to engage its end with a slot 83 in the bearing plug 71 by means of a helical spring 85 whereby to hold the plug locked with the mandrel 63 in engagement with the head 77 on the pintle. The spring 85 is coiled around a reduced portion of the pin 80 with one end bearing against a shoulder thereon and its opposite end held against the end of the bore in the bushing 82 in which the pin slides. The knob 81 is pinned to the reduced stem of the locking pin 80 to adapt it to be withdrawn manually to release its end from the slot 83 so that the plug 71 may be withdrawn by its knob 78 and the head 77 of the pintle 65 released from the end of the mandrel 63.

Referring again to Fig. 1, each of the eight packages P on the head 15 is mounted in the manner above explained on rotary pintles journalled in ball-bearings in the bosses on the upright stanchions of the brackets 67. Each pair of brackets 67 is arranged to support two cops or packages P of strand material, see Figs. 1 and 2, with their axes extending horizontally and staggered in inclined relationship, the whole forming a truncated pyramid to conserve space and provide for mounting a large number of packages on the head 15. The pairs of brackets 67 are arranged in spaced relation around the platform or disk 60 of the head 15 to support eight separate packages so that the strands therefrom will lead upwardly at an angle to the core or wire w as it emerges from the top of the hollow spindle 17 around which the head rotates.

The upper end of the spindle 17 is reduced in diameter to receive a cylindrical hub 90, see Fig. 3, which carries four radial arms 91 spaced equidistantly therearound and serving as a mounting for an equal number of angularly-positioned brackets 92. Referring particularly to Figs. 1 and 3, the brackets 92 support a series of spaced guides for directing the strands y from the lower head upwardly through tension-devices 93 to converge at the end of the spindle 17 and feed to the wire w to be wrapped therearound. At the lower end of each bracket 92 is a porcelain guide 94, spaced thereabove are a second guide 95 and third guide 96 with the tension-device 93 mounted between the last two mentioned guides. The tension-devices 93 may be of the usual disk-type as well known to those versed in the art to adapt the strands y to draw between the opposed faces of the disks which are pressed together by means of weights or springs, not herein shown in detail. Held in the upper end of the bore of the hub 90 is a cylindrical member 97 fastened in place by a set-screw 98 and formed with an upper beveled rim 99. The rim 99 is provided with a plurality of radially-projecting guide-pins 100 around which the strands lead to hold them separated until they merge in the wrapped covering on the core or wire w. Held in the bore of the member 97 is a hollow nose-piece comprising two cooperating segments 102 formed with interior tapered slots 103 and rockably mounted on the rounded ends of screws 104. A helical spring 105 surrounding the segments 102 is held in grooves 106, thereby tending to force the upper ends of the segments together to exert a yielding pressure against the wire w as it feeds therethrough.

As shown in Fig. 9, two wire bails 110 and 111 may be provided on the head 15 projecting forwardly from each bracket 67 and looped at the center to form guide-eyes 112 through which the strands y from the lower packages P lead to direct them upwardly and prevent them from rubbing against the related packages in the upper group.

The upper auxiliary head 16 is organized in substantially the same manner as that of the lower head 15. A gear-casing or housing 120 is mounted on the pair of horizontal rods 6 and 7, previously mentioned, which extend through apertured lugs 122 formed on its bottom, the rods being supported at their ends in the brackets 8 and 9 fastened to the upright columns or standards 3 and 4, see Fig. 1. Mounted in counterbores in bosses 125 and 126 at the top and bottom respectively of the housing 120 are ball-bearings 127 for a tubular shaft 130 through which the core or wire w feeds upwardly. A quill-like tube 131 spaced from the interior of the shaft 130 is held in a flanged sleeve 132 fitted to the bore in the bottom of the housing 120 with a nut 133 screwed onto its lower end. A cup-shaped collar 134 held on the reduced end of the sleeve 132 is provided with an axial aperture through which the wire feeds. Fast on the upper end of the shaft 130 is a spider 135, see Fig. 4, for supporting the cops or packages C of the upper head 16, not more than two of these being usually employed for the binder strands. The lower hub 136 of the spider 135 extends downwardly through an aperture in a plate 137 which overlies the upper ball-bearing 127 and closes the counterbore in a cover or closure 138 fitted across the top of the housing 120. Above the spider 135 is a hub 139 surmounted by a nose-piece 140 fitted to its bore, see Fig. 8, and formed with a restricted bore terminating in an orifice through which the wire w feeds after it has been served with the strands from the lower head 15. Porcelain guides 141 are mounted on the spider 135 with other guides 142 supported thereabove on the hub 139, these guides serving to direct the strands y' from the cops or packages C on the upper head 16 upwardly across the beveled end of the nose-piece 140.

It has been explained that the cops or packages C carried by the upper head 16 are mounted on rotary arbors or mandrels 63 supported on pintles 65 journaled in ball-bearings and shown in Fig. 4 as held in the arms 143 and 144 of the spider 135. The upper head 16 is driven in the opposite direction from that of the lower head 15 by means of helical gearing shown in the plan view, Fig. 4. A horizontal drive-shaft 145 is journaled in spaced bushings 146 held in a bearing 148 formed integral with the gear-housing 120. A gear 150 on the inner end of the shaft 145 meshes with a gear 151, see also Fig. 1, which is secured fast on the hollow shaft 130 by a key 152. A collar 153 holds the gear 150 in place on the end of the shaft 145 and a second collar 155 abuts the outer end of the bearing 148 to hold the shaft from axial movement in its bearing.

Referring to Figs. 1 and 6, a bifurcated bracket 156 secured fast on the standard or column 4 by

means of set-screws 157 projects outwardly therefrom to provide bearings for a gear-train shown in Fig. 6. The drive-shaft 145 for the upper head 16 is journaled at its outer end in a bearing 158 fastened to a seat on the bracket 156 by bolts 159. Keyed to the outer end of the shaft 145 abutting the end of the bearing 158 is a spur-gear 160 held in place by a collar 161 fastened by a set-screw 162. Below the gear 160 is a similar gear 163 mounted on the end of a stub-shaft 164 which is journaled in a bearing on the bracket 156 with collars 166 and 167, shown in Fig. 1, holding these parts in place. In mesh with the two gears 160 and 163 is a change-gear 170 mounted on a headed bolt 171 which is adjustable in a slot 172 formed in a swinging arm 173. The bolt 171 is fastened in adjustable position along the slot 172 by means of a nut 174 which can be released to change the position of the bolt for accommodating change-gears of varying diameters. As a further means for adjusting the position of the bolt 171 and gear 170 the arm 173 is pivotally mounted on the stub-shaft 164 to swing toward or away from the driving gear 160, a curved extension 175 of the arm 173 being formed with a slot 176 through which extends a stud 177 projecting from the bracket 156 with a nut 178 on its end for clamping the arm 173 in adjusted position. The stub-shaft 164 carries a sprocket-wheel 180 fast thereon, see Fig. 1, the teeth of which engage with a chain 181 driven from the main drive-shaft 50.

Referring to Fig. 7 the main drive-shaft 50 carries a sprocket 182 on its outer end connected by a chain 183 to a larger sprocket 184 fast on a stub-shaft 185. The shaft 185 is journaled in a bearing 186 supported at the rear of the main frame of the machine by the cross-member 2 extending between the legs 188. The shaft 185 also carries a smaller sprocket 190 with which the chain 181 engages to drive the upper sprocket 180 and gear-train, shown in Fig. 6, and thereby the shaft 145 which transmits rotation to the upper head 16. It has been explained that power is applied to the main drive-shaft 50 by means of the pulley 55 belted to a line-shaft or motor and through these last-described connections the two heads are rotated in opposite directions; the main head 15 being usually turned clockwise and the auxiliary head 16 counterclockwise, although the direction of each may be reversed by changing the arrangement of the gearing.

The core or wire w is drawn upwardly from the supply wound on a reel arranged below, fed through the hollow spindle 17 and as it emerges from the nose it is served with the strands y from the packages P on the main head 15. Thence the wire w passes through the upper head 16 and tubular shaft 130 to emerge from the nose-piece 140 where the first serving is bound in place by the strands y' from the upper supply packages C. A grooved wheel or capstan 191, shown fragmentarily in Fig. 1, receives the covered wire R which is coiled several times about its periphery and delivers it therefrom down to another take-up reel located at the side or rear of the machine. The capstan 191 is driven by a vertical shaft 192, see Fig. 1, suitably geared thereto and to the main drive-shaft 50, these connections not being herein shown. Suffice it to state that the arrangement of the last-mentioned wire feeding and delivering mechanisms of the machine is similar in most respects to that shown and described in United States Letters Patent No. 1,064,407, dated June 10, 1913, for Braiding Machine and therefore not described herein. Stopping mechanism for the heads of the machine may be employed, for example, of a form generally similar to that shown in United States Letters Patent No. 1,085,369, dated January 27, 1914, to be actuated by suitable drop-wires normally held suspended by the running strands.

In order to prevent the cops or packages of yarn from overrunning under the rapid draft of the strands therefrom it is preferable to employ braking means, for example, such as shown in Figs. 8 and 9. As illustrated in Fig. 8, flexible thin sheet-metal plates 195 held by collars 196, fast on studs 197 which support the thread-guides on the upper head 16, are arranged to bear yieldingly against the peripheries of the upper cops or packages C during the unwinding of the strands therefrom. For the packages P carried by the lower or main head 15 there are provided pivoted brake-arms 200 and 201. The shorter arms 200 are pivotally mounted in bearings 202 on a plate 206 on the lower head 15 and formed at their upper ends with enlargements 203 having convex forward faces which bear against the peripheries of the packages P. The longer arms 201 are pivoted at their lower ends in bearings 204, also mounted on the plates 206, and formed with enlargements 205 at their upper ends with convex faces for contact with the peripheries of the packages P in the upper group or tier. These brake-arms are provided for the eight packages carried on the main head 15 and are caused to swing outwardly about their pivots under centrifugal force acting on their weighted upper ends as the head is rotated at a rapid rate, thereby causing the enlargements on the arms to press against the surface of the winding on the several packages to resist the rotation of the latter and control the unwinding of the strand material therefrom. Usually, the strands y are wound in multiple on the packages P and in other instances spools of fine wire may be used to supply the wrapped covering. The construction and arrangement of the parts of the present improved serving machine having been described in detail its method of operation is explained briefly as follows:

The wire w or other core wound on a supply reel, not shown, is drawn off therefrom and threaded up through the hollow spindle 17 carrying the lower head 15, continued upwardly through the nose-piece at its end, threaded through the upper hollow spindle 130 to emerge from the upper nose-piece 140 and a few turns taken around the capstan 191. Thence the wire is delivered to a take-up reel as the machine starts to operate and the capstan feeds the wire through the machine. The shaft 50 driven by the pulley 55 drives through the gearing in the housing 10 to rotate the hollow spindle 17 and the head 15 carried thereby. Meanwhile the strands y are drawn off from the supply packages P and fastened to the wire w by giving them a few turns therearound or otherwise attaching them as with adhesive tape. As the machine operates with the main head 15 turning in one direction to revolve the supplies P around the wire w or other core the strands y will be wrapped tightly therearound as tension is applied thereto by the tension-devices 93 previously described. The wire w feeds up through the hollow spindle 130 of the upper head 16 which is rotated in the opposite direction from that of the main head 15 whereby the strands y' from the upper pack-

ages C are wrapped around the previously-served strands *y* to bind the latter in place and provide a close uniform covering for the core or wire *w* being served. The wire or other core may thus be served continuously in long lengths taken from a large supply reel and when it is required to replenish the supplies of strand material it is unnecessary to cut the wire. That is to say, the operation of the machine is stopped and without cutting the wire fresh packages, or in some cases spools, carrying the new supply of strand material are placed on the heads by removing the mandrels **63** on which the first supplies are supported and replacing them in the bearings after the fresh supplies have been applied thereto. It is a simple matter to remove and replace the mandrels **63** by withdrawing the lock-pins **80** to permit the plugs **70** to be retracted for releasing the pintles from the ends of the mandrels. Then when the fresh packages have been placed on the mandrels the plugs **71** are pushed into their bearings and the locking pins **80** caused to engage in their slots **83** so that the arbors or mandrels **63** will be securely held without chance of escape from their bearings to fly out from the heads during the rapid rotation of the latter. After the heads have been furnished with fresh supplies of strand material the machine may be started again to continue serving the covering on the core or conductor for the full length thereof. This is a most important result of the present improved construction of the machine in that for insulating electrical conductors it is undesirable to cut the wire in relatively short lengths as it then becomes necessary to splice the ends together and repair the insulation at the splices. Usually, electrical conductors served with yarn, glass-fiber or similar strand material require another covering of rubber, plastic, or in some cases, a braided jacket which may be treated to render it weather-proof.

It will be observed from the foregoing specification that the present invention provides an improved serving machine adapted for covering cores such as electrical conductors with closely-wrapped strands of various kinds of material, with binder strands laid over the first wrap if desired, and the complete covering rendered smoothly uniform and closely applied on continuous lengths of the core without necessitating cutting the lengths and splicing the ends together. While the invention is herein shown as embodied in a preferred form of construction, it is to be understood that modifications may be made in the structure and arrangement of the parts of the machine without departing from the spirit or scope of the invention as expressed in the accompanying claims. Therefore, without limiting ourselves in this respect, we claim:

1. In a serving machine, a hollow spindle, spaced bearings for supporting said spindle to rotate about a vertical axis, a main head mounted on said spindle to rotate therewith, means for supporting a plurality of strand-packages on said head with their axes extending horizontally and alternately at right-angles to each other around the vertical axis of the machine, means for guiding the strands from said packages to converge beyond the end of the spindle to be wrapped around a core feeding through the spindle, a second spindle arranged in alinement with and spaced above the first spindle, bearings for rotatably mounting the second spindle to rotate about a vertical axis, an auxiliary head mounted on the second spindle, strand-supplies carried by the auxiliary head with their axes extending horizontally, means to guide the strands from the supplies on the auxiliary head to converge at the end of the second spindle and be wrapped around the first-served strands on the core to bind the latter in place, gearing for driving the first-named spindle to rotate the main head, change-gearing for driving the second spindle to rotate the auxiliary head, and means connecting the gearing for the two heads to rotate them in opposite directions with a variable ratio of speed.

2. In a serving machine, a gear-housing, a hollow spindle journaled in bearings in said housing to rotate about a vertical axis, a head carried by said spindle to rotate about its axis, means for supporting a plurality of yarn-supplies on said head to revolve about the spindle, said yarn-supplies arranged in tiers with their axes disposed horizontally and extending alternately at right-angles to each other around the vertical axis of the machine, means for guiding the strands from said supplies to converge beyond the end of the spindle, a second housing, a hollow spindle journaled in bearings in said second housing for rotation about a vertical axis, an auxiliary head carried by the second spindle, means for supporting a plurality of strand-supplies on the auxiliary head with their axes disposed horizontally, means for feeding a core axially through both spindles, means for guiding the strands from the supplies on the auxiliary head to cause them to converge beyond the end of its spindle and be wrapped around the first-served strands to bind them in place, gearing in the housings for rotating the heads, and means for driving the gearing in both housings from a source of power.

3. In a serving machine, a hollow spindle, means for feeding a core axially through said hollow spindle, bearings for journaling said spindle to rotate about a vertical axis, a main head mounted on said spindle to rotate therewith, means for supporting a plurality of strand-packages on said main head, means to guide the strands from said strand-packages to converge at the upper end of the spindle, a drive-shaft, gearing connecting said drive-shaft to rotate the spindle and drive the main head, a second hollow spindle arranged above and in spaced relation to the first spindle, bearings for journaling the second spindle to rotate about a vertical axis in line with the axis of the first-named spindle, an auxiliary head mounted on said second spindle, a plurality of strand-packages carried by the auxiliary head, means to guide the strands from the strand-packages on the auxiliary head to converge at the end of the second spindle for wrapping them around the first-served strands on the core feeding through said second spindle to bind said first-served strands in place, gearing for driving the second spindle, and means to connect said gearing with the drive-shaft to rotate the auxiliary head in the opposite direction from that of the main head.

4. In a serving machine, a hollow spindle, bearings for supporting said spindle to rotate about a vertical axis, a main head mounted on said spindle to rotate therewith, a horizontal drive-shaft, gearing connecting said drive-shaft to rotate the spindle, means for supporting a plurality of strand-packages on said head, means for guiding the strands from said packages to converge beyond the end of the spindle for wrapping them around a core feeding through the

hollow spindle, a plurality of tension-devices for tensioning the strands leading from the several packages to the core beyond the upper end of the spindle, a second spindle arranged above and in spaced relation to the first spindle, bearings for mounting the second spindle to rotate about a vertical axis, an auxiliary head mounted on the second spindle for rotation therewith, a plurality of strand-packages carried by said auxiliary head, guiding means for leading the strands from the packages on the auxiliary head to converge at the upper end of the second spindle for wrapping them around the first-served strands on the core, change-gearing for driving the second spindle to rotate the auxiliary head, and means for connecting the drive-shaft to said change-gearing for the auxiliary head to rotate the auxiliary head in the opposite direction from that of the main head with a variable speed-ratio therebetween.

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