

Aug. 20, 1929.

H. D. ROBINSON

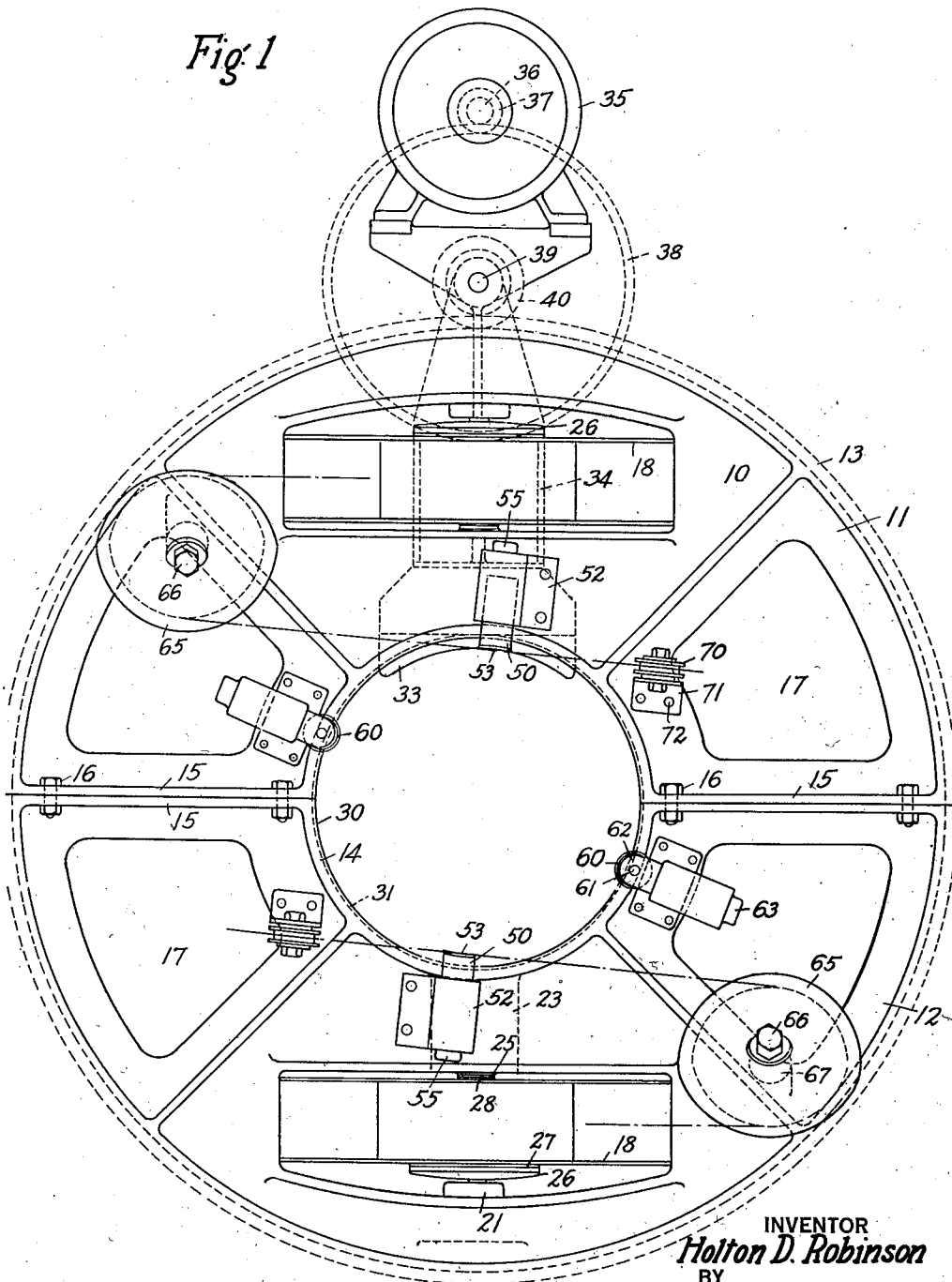
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CABLE WRAPPING MACHINE

Filed June 4, 1927

6 Sheets-Sheet 1

Fig 1



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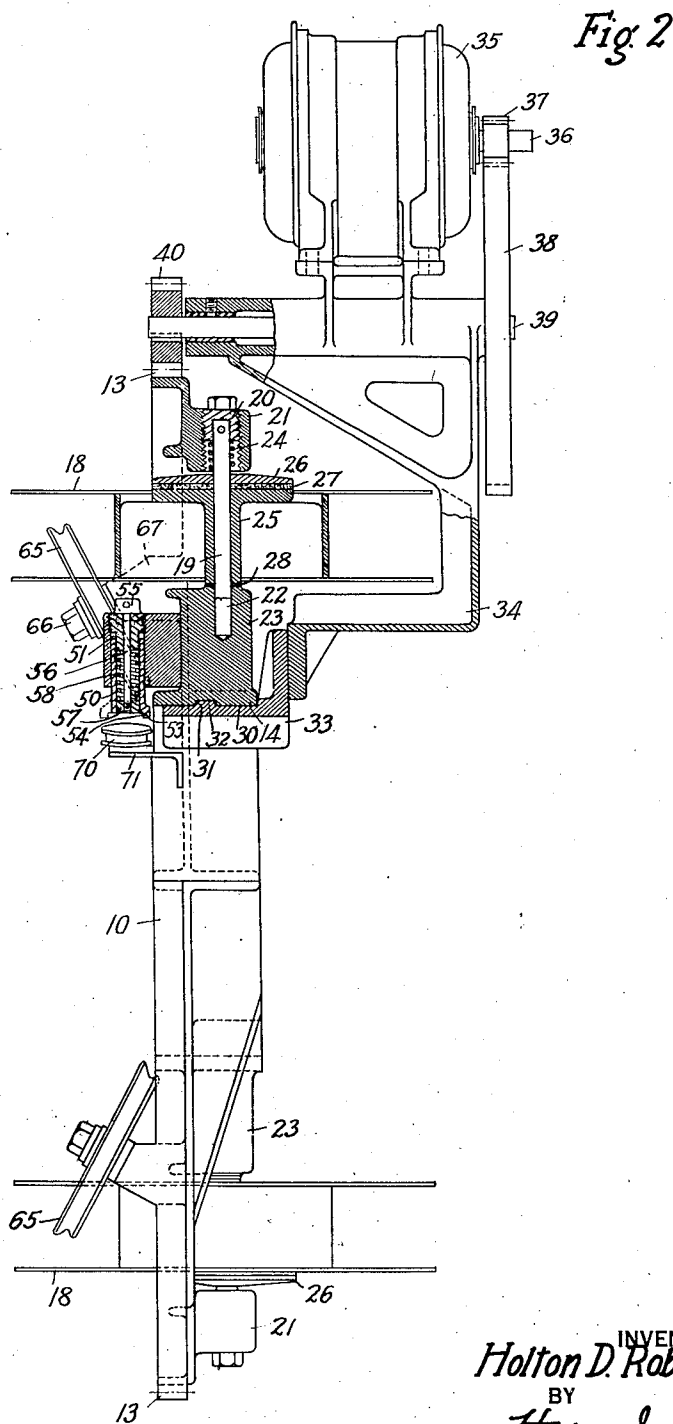
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CABLE WRAPPING MACHINE

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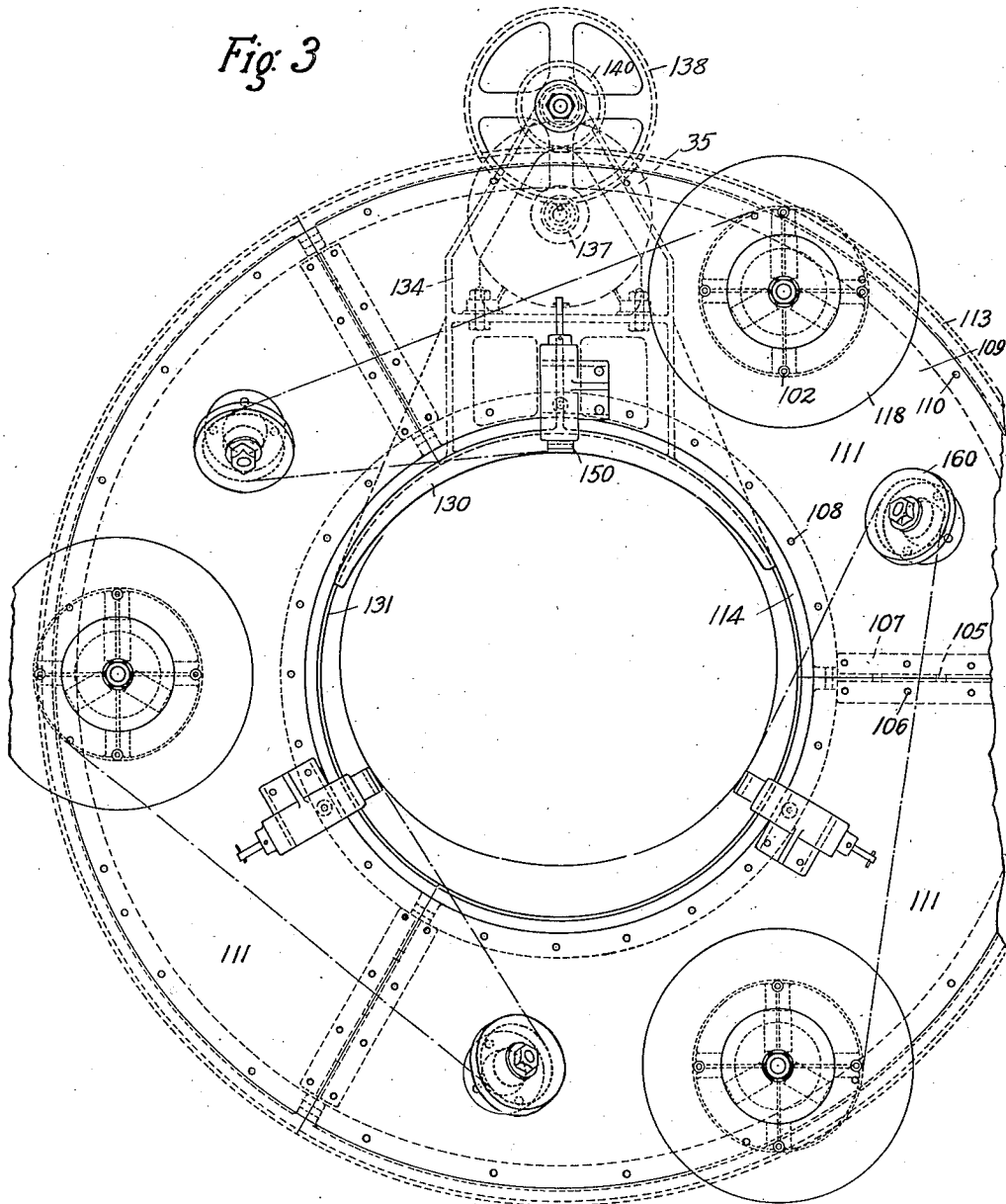
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CABLE WRAPPING MACHINE

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*Fig. 3*



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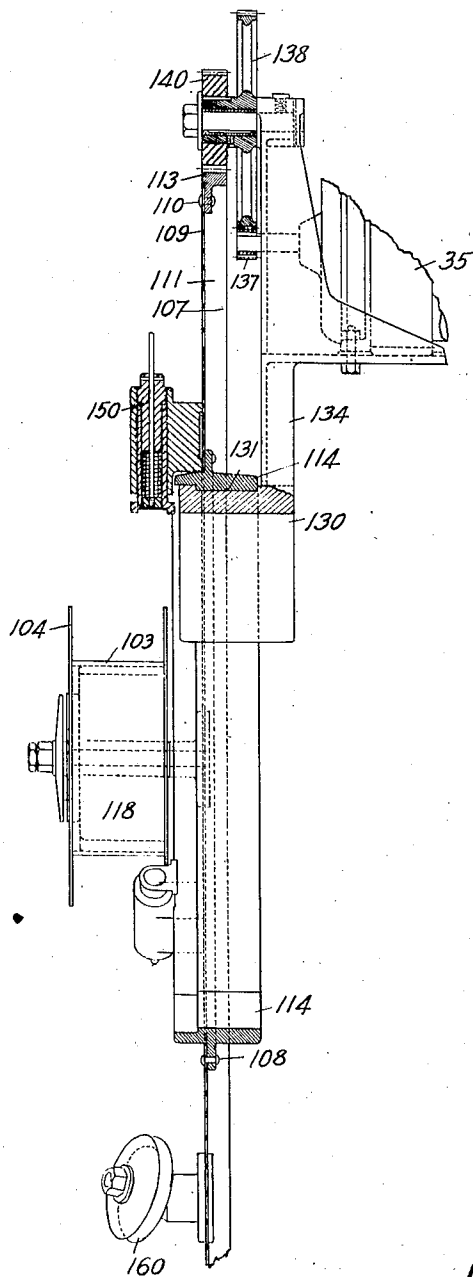
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CABLE WRAPPING MACHINE

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6 Sheets-Sheet 4

Fig 4



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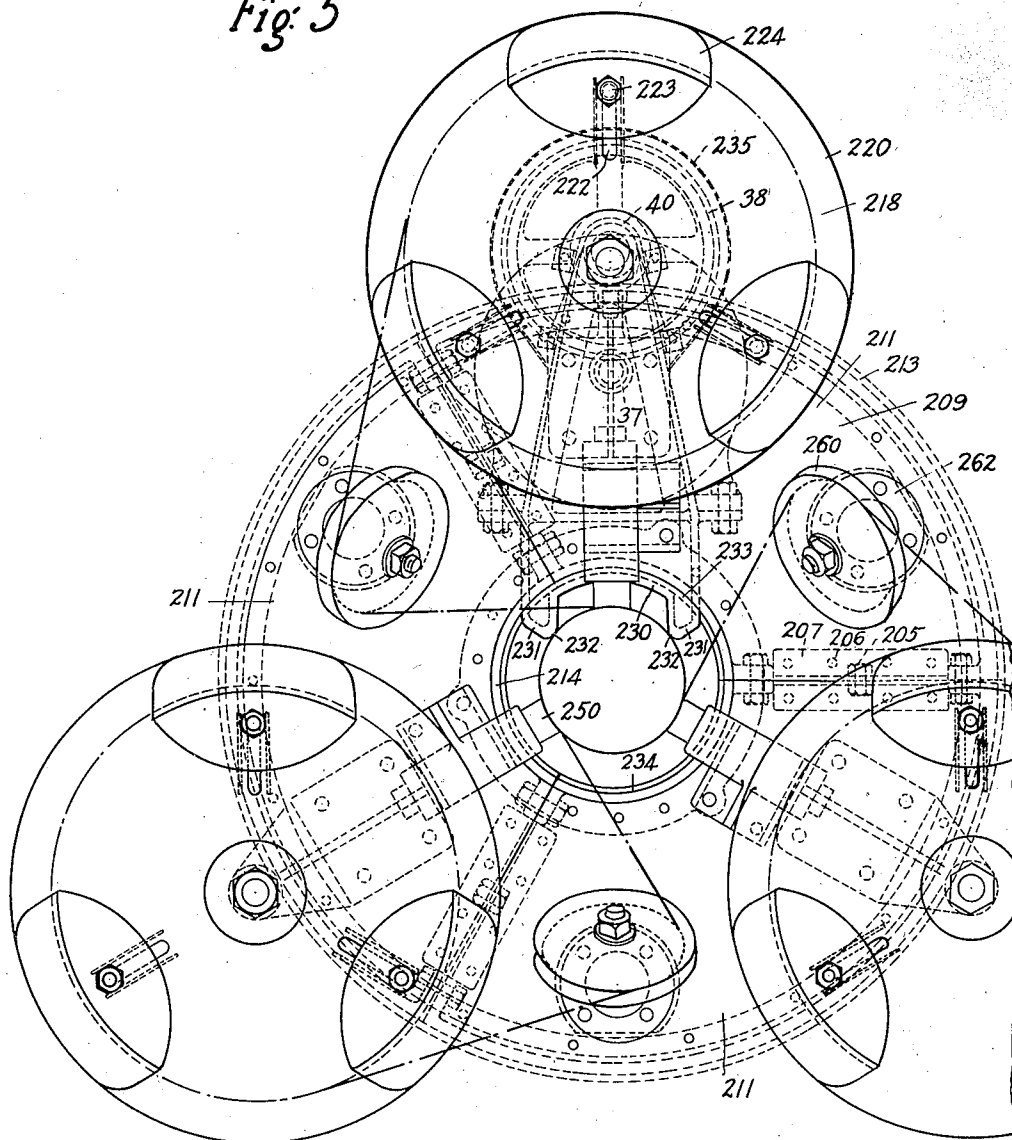
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# CABLE WRAPPING MACHINE

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*Fig: 5*



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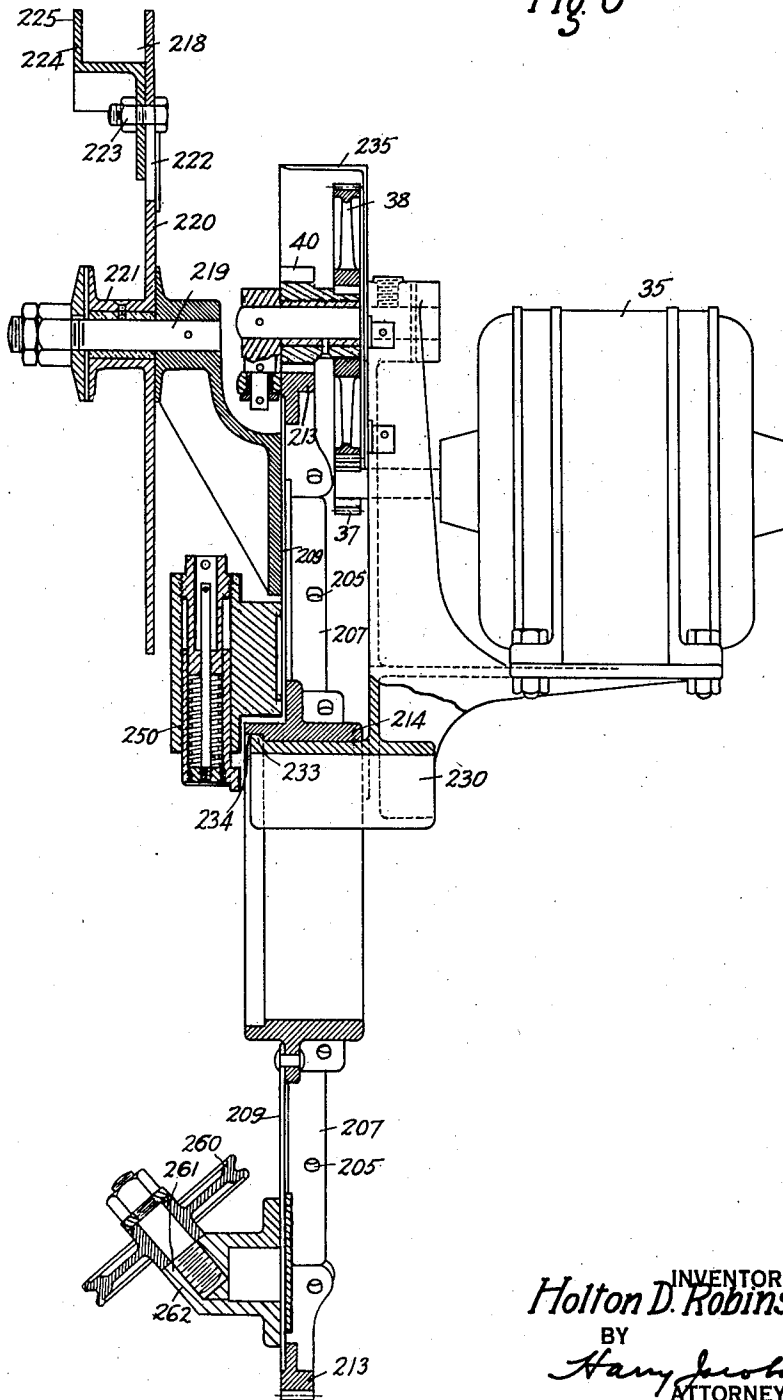
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CABLE WRAPPING MACHINE

1,725,540

Filed June 4, 1927

6 Sheets-Sheet 6

Fig 6



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1,725,540

# UNITED STATES PATENT OFFICE.

HOLTON D. ROBINSON, OF NEW YORK, N. Y.

## CABLE-WRAPPING MACHINE.

Application filed June 4, 1927. Serial No. 196,522.

This invention relates to machines for wrapping wire about the cables of suspension bridges and is an improvement of the machine illustrated and described in my previous patent for cable wrapping machines, dated February 28, 1911, No. 985,763. In my previous machine, I found it advisable to use a trolley or track arranged above the cable for supporting and guiding the driving mechanism. In carrying out my present invention, I have provided mechanism wherein the track may be entirely dispensed with. Instead of the track or trolley, I support the machine by means of a segmental saddle adapted to rest on the unwound portion of the cable and to be moved by the crowding action of the wire last wound, lengthwise of the cable, without rotating thereabout. I have further provided a centering mechanism which automatically adjusts itself to the varying diameters of the cable, and have so designed my improved machine that it may be readily taken apart and reversed for the purpose of completing the winding to a point in close proximity to the suspender band. Various other improvements have been provided such as an adjustable and collapsible reel for the rapid mounting of a coil of wire and an arrangement of the frame whereby reversal of the machine may be readily effected.

The various objects of my invention will be clear from the description which follows, and from the drawings, in which,

Fig. 1 is a front view of a simple form of my improved machine, which is adapted to wind two wires simultaneously about a cable.

Fig. 2 is a side view of the same, the upper half of the figure being shown partly in section.

Fig. 3 is a front view of another form of my machine adapted to wind three wires simultaneously.

Fig. 4 is a side view and partial section similar to Fig. 2 of the form shown in Fig. 3.

Fig. 5 is a front view of another modification of my improved machine adapted to wind three wires about a cable, showing a modified arrangement of the parts, and

Fig. 6 is a vertical section and partial side elevation thereof.

In carrying out my invention, I prefer to provide a suitable annular frame and gear combined consisting of two or more similar

sections bolted together in such a manner that the sections may be readily detached from each other for arrangement about a cable and for their removal therefrom. The frame gear is made preferably as narrow as possible from front to back for the purpose of allowing the winding to be continued to a point as close as possible to the cable bands, which are usually bolted in place to the unwound cable before the winding or wrapping operation is commenced. At their outer peripheries, the various sections of the frame gear are provided with suitable gear teeth so that said gear may be continuously rotated by the driving mechanism provided for that purpose. Rotatable wire-carrying reels on the frame gear carry the wires around the cable when the gear is rotated. A suitable relatively stationary saddle is provided on which the frame is supported and guided in its rotative movement, said saddle being adapted to rest on the unwrapped portion of the cable, and being moved along the cable by the advancing action of the wires on the machine, the last turns to be wound tending to crowd the machine backwardly away from the wire as fully described in my previous patent above mentioned.

In the accompanying drawings, I have illustrated three practical embodiments of my invention. These embodiments differ in the number of wires which they are adapted to wind simultaneously and therefore in the number of reels and pulleys provided in the machine, in the shape and construction of the frame; in the proportions and arrangements of the parts, and other details. It will be understood that I do not intend to be limited to any particular arrangement or to any specific proportions of the parts other than as is claimed, since it will be obvious that many changes may be made without departing from the spirit and scope of this invention and falling within the range of equivalents afforded by the appended claims.

In the modification illustrated in Figs. 1 and 2, the frame 10 is shown as formed of a pair of similar sections 11 and 12. Each of said sections is provided with suitable teeth as 13 on the outer periphery thereof, the inner periphery or hub 14 being of semi-circular form and having a radius greater than that of the cable to be wrapped. Suitable flanges as 15 are provided by means of which the sections may be removably bolted

together as by means of the bolts 16. To reduce the weight of the frame sections, openings as 17 may be provided therein. The reel 18 is shown mounted with the axis thereof substantially perpendicular to the axis of the machine. For adjusting and varying the resistance to rotation of said reel, I have provided an adjustable bearing therefor, comprising the pin 19 which is secured to the adjustable plug 20, which in turn is in threaded engagement with the rim projection 21 of the frame section. The pin 19 enters an opening 22 in the hub bearing 23 of the frame section, and is removably held in place by the screw plug 20 against the action of the spring 24 in the recess of the rim projection 21. Said pin 19 passes through the hub 25 of the reel and into the opening 22 whereby the reel is free to rotate thereabout. The pressure of the spring 24 on the metal friction disc 26 and on the leather washers 27 and 28, arranged respectively on opposite sides of the hub 25, serves to prevent the wire from being drawn too rapidly off the reel by resisting and retarding the rotation of said reel.

On the inner cylindrical face 30 of the hub 14, I prefer to provide an annular groove 31 into which is fitted the tongue 32 of the saddle 33. During the operation of the machine, said saddle is adapted to rest on the upper part of an unwrapped part of the cable. It is suitably curved, preferably in an arc of greater radius than that of the cable to contact with the cable without injury thereto and supports the motor frame 34, which is suitably secured to the saddle. The motor 35 on the frame 34 is driven through a suitable source of power, such as electric current. On the end of the motor shaft 36 is the drive pinion 37, meshing with the intermediate gear 38 fixed to one end of the shaft 39. Said shaft is revolvably mounted on the frame 34 and carries at its other end the intermediate gear 40 which engages the gear teeth 13 of the frame gear sections 11 and 12, and causes said sections to rotate together with the devices secured thereto as a unit about the saddle 33 when current is supplied to the motor.

The combined centering support and wire sleeve guide 50 is mounted yieldingly in the opening 51 of a suitable bracket as 52 secured to the frame gear at such a point that the support and guide is arranged immediately in advance of the last wrapped portion of the cable. The projection 53 of the guide 50 is formed with an interior corner 54, which controls the placement of the wire drawn from the reel, and which guides the wire into position as it is wound about the cable. Since the cable is not perfectly circular in cross-section, and since the cross-section may vary at different parts of the cable, it becomes advisable to provide a yield-

ing mounting for the guide 50 not only for the purpose of wrapping the wire tightly about the cable, but also for providing supporting means for the frame gear which is operative for all usual shapes of the cable sections and for the unequal diameters of each section.

Said guide, while adapted to wind the wire under the desired tension, at the same time, should be able to automatically adjust itself radially of the cable to function efficiently for the purposes just mentioned. Toward this end, I provide the screw plug 55 in adjustable threaded engagement with the outer end of the opening 51 and pinned to the rod 56, which is arranged preferably coaxially with said plug. The rod 56 is secured to the lower plug 57 which closes the opening of the guide, a compression spring 58 being interposed between said screw plug 55 and the lower plug 57 for normally and yieldingly maintaining the guide 50 in its innermost position. Adjustment of this position of the guide may be effected by the rotation of the screw plug 55 in either direction.

When, as in the modification now being described, only two wires are wound about the cable simultaneously, it is sometimes advisable to provide yielding means for engaging the cable and aiding the combined wire guide and support to center the machine. This is particularly so when the cable is irregular in cross-section as is usually the case. I have provided such means in the guide rollers 60, which engage the cable, and form, together with the guides 50 and the saddle 33, widely separated points of support for the frame gear 10 during the rotation of said frame. Each guide roller 60 is pivoted as at 61 to the yieldable sleeve 62, which is mounted similarly to the wire sleeve guide 50 and therefore need not be shown nor described, in detail. The screw plug 63 serves to adjust the roller 60 in the same manner that the similar plug 55 adjusts the sleeve guide 50, a spring similar to the spring 58 being provided whereby the roller may adjust itself automatically to the non-circular cross-sectional shapes of the cable during the wrapping operation. It will be understood that the said rollers and the mountings and brackets therefor may be entirely omitted as in the modifications shown in Figs. 3 to 6 inclusive, if desired.

Referring again to Figs. 1 and 2, the path of the wire from the reel 18 to its final position about the cable is indicated by the dash and dot lines of Fig. 1. It will be noted that the direction of movement of the wire is changed by the grooved pulley 65, arranged in angular relation both to the reel 18 and to the guides 50. Said pulley is suitably mounted, as by means of the bolt 66 for rotative movement, on the angular arranged bearing 67 projecting from the frame gear

section. The wire is led from the reel 18 about the outer part of the pulley toward the lower part thereof, and is taken from the inner part of the pulley toward the guide 50, then through the corner 54 of the guide and around the cable. Rotation of the frame gear in a counter clockwise direction as viewed in Fig. 1, causes the guide 50 to advance in a circular path along the wire stretched between said guide and the pulley, and bends said wire along the cable close up to the previous turn of wire. The reel from which the wire is drawn is thereby rotated against the resistance of the retarding means therefor, so that the wire is constantly tensioned between the reel and the guide, and as the turns of wire are constantly wound closely together, they exert a thrust upon the guides 50 in a direction away from the turns so that the entire machine together with the saddle 30 and the driving mechanism carried thereby is forced away from the turns along the unwrapped part of the cable.

As the work progresses, the machine climbs the inclined cable until the saddle 33 reaches a point close to the suspender bands, when further advance of the machine along the cable is prevented by said bands. In order to wrap the remaining portion of the cable between the point where the work is stopped and the end of the cable band, it becomes advisable to reverse the machine so that the guides become arranged on that side of the machine nearer the cable band. For this purpose the bolts 16 are removed from the frame sections 11 and 12, whereby the said sections may be faced in the opposite direction to their normal position in the machine and then said sections are rebolted by the bolts, 16, the saddle at that time resting on the wrapped portion of the cable.

To facilitate this operation of reversing the machine, it is sometimes advisable to remove the reels 18 from the frame sections and the wires from the pulleys 65 for preventing tangling or kinking of the wires. After the machine has been reversed the wire is led from the reel 18 about the grooved pulley 65 and then about the auxiliary pulley 70 before it is passed through the corner 54 of the wire guide, whereby the direction of feeding the wire to the cable is also reversed. The auxiliary pulley 70 is of such diameter and is so arranged that the wire from the pulley 65 is brought between the pulley 70 and the frame gear 11 and then about the pulley, into alignment with the new position of the corner 54 of the wire guide. At the same time the sleeve or wire guide 50 is rotated through an angle of about 180° to bring the corner 54 thereof away from the face of the machine, and as near as possible to the cable band as shown by the dotted lines of Fig. 2. By this re-

versal of the machine and of the direction of feeding the wire, the wire is led in the same direction as before reversing so that the wrapping may proceed in the same direction from the point where it was discontinued. The motor 35 being reversed as compared to its original direction of rotation, the winding may be continued in the same way up to the cable band, that is, until the guide 50, which has been arranged at the forward part of the machine, is stopped by the cable band. In the reversed operation, the machine is pulled forwardly by the advancing force of the turns of wire instead of being pushed backwardly from the work as in the direct wrapping operation. The auxiliary pulley 70 is used only during the reversed winding operation of the machine for maintaining the direction of feeding the wire, and is revolubly mounted on the bracket 71 secured by suitable means as by the bolts or rivets 72 to the frame gear sections 11 and 12. A similar auxiliary reversing pulley may be used in connection with the modifications shown in Figs. 3 to 6 if desired to maintain the proper direction of the wire feed.

Referring now to the modification shown in Figs 3 and 4, the machine shown therein is adapted to wind three wires instead of two and the frame gear is accordingly made of three similar sections 111, suitably secured together. The gear 113 is here shown as formed on separate sectional rim or ring secured to the sectional web 109 as by means of suitable rivets or bolts 110. The sectional hub 114 of the machine is also made preferably of a separate piece in each of the sections 111 and is similarly secured to the web 109 as by means of the bolts or rivets 108. For securing the various sections 111 together I prefer to use the angles 107 each having one leg secured to one edge of the web 109 as by the rivets 106 and to each other by means of suitable removable bolts 105.

Each of the sections 111 carries a reel 118, a pulley 160 and a wire guide 150, having the same functions and substantially the same construction as the corresponding reel, pulley and guide of the modification of my improved machine previously described in connection with Figs. 1 and 2.

The reel 118 is provided with a removable outer plate 104 secured to the drum 103 by means of suitable screws 102. For renewing the supply of wire on the reels, it is therefore unnecessary to remove the reel for replacement with a loaded reel, but the plate 104 may be removed instead, and a new coil of wire slipped over the drum 103, after which the plate 104 and the screws 102 may be replaced and the winding operation continued. In the normal direction of wrapping, the wire is drawn from the reel 118 about the pulley 160 and thence to the guide,

150, which bends and wraps the wire about the cable on the rotation of the frame gear.

The saddle 130 rests normally on the unwrapped portion of the cable, and is provided with annular groove for the reception of the tongue 131 of the hub 114. The motor frame 134 carries the motor 35 and drives the frame gear through the intermeshing gears 137, 138 and 140.

For winding the last part of the cable, adjacent to the cable band, the machine is reversed and the wire fed in the opposite direction relatively to the reel and pulley, but in the same direction relatively to the cable.

For this operation, the bolts 105, joining the angles 107 of one of the sections 111 to the adjacent sections, are removed. The section may then be removed from the remainder of the machine leaving a space

through which the saddle 130 and the driving mechanism carried thereby may be withdrawn. The saddle is then rested on the wrapped portion of the cable in reversed position, that is, turned through a horizontal

angle of 180°. The frame sections are also withdrawn from the cable and reinserted thereabout in reversed position. The reels

may be removed from the sections before reversal if desired to prevent entanglement

of the unwrapped wires as hereinbefore described. After the removed section 111 has

been replaced and rebolted in the machine, the wires are led from the reels 118 about the adjacent pulley 160 of the same section,

whereby the direction of feed of the wire relatively to the cable is maintained.

In the modification of my improved machine shown in Figs. 5 and 6, the sectional gear rim or ring 213 is similar to the ring

113 and hub 214 is similar to the hub 114, the plate or web 209 connecting said gear ring and said hub in the same manner as the plate 109 serves its function. The frame

gear segments 211 are removably secured together by means of the angles 207 which are

secured to said segments by means of the bolts or rivets 206 and which are removably

secured to each other by the bolts 205. The grooved pulleys 260 are arranged on the inclined bearing 261 of the bracket 262 in substantially the same manner as are the pulleys

160 on their brackets, but said pulleys 260 are preferably spaced equally from the reels

218. By so arranging the pulleys 260 it becomes possible to run the machine in the reverse position without changing the angular

relation of the wire to the reel 218, the pulley 260, and the wire guide 250. Said wire guide is preferably arranged along the

radius of the machine passing through the center of the reel, for this purpose. The saddle 230 is preferably segmental in form, having

spaced projections 231 thereon provided with cylindrical surfaces as 232 of little

radius adapted to rest along elements thereof

on the cable and serving to distribute the weight of the machine on the cable and to more readily maintain the balance of the machine. In the form of the saddle 230 just

referred to, a projection 233 is provided from the outer surface of the saddle, adapted to enter the groove 234 of the hub 214, for maintaining the said hub in position on the saddle during the rotation of the machine. The

frame gear 213 is rotated by the motor 35 through the intermeshing gears 37, 38 and 40 of suitable proportions in the same manner as described in connection with Figs. 1 and 2. A gear cover 235 may be provided for said gears if desired.

Referring particularly to Fig. 6, I have shown a modified form of reel 218 which need not be dismantled from the shaft 219 therefor when the supply of wire is to be renewed, and in which no part need be removed. In this modification, the reel consists of a plate 220 formed with a hub 221 and provided with radial slots as 222 in which the bolts 223 may be manipulated. A series of wire holders 224, are adjustably secured to the plate 220 by said bolts 223. When the coil of wire held between the flange 225 of the holder 224 and the plate 220 is exhausted, the bolts 223 are loosened whereupon the holders 224 may be moved inwardly radially a sufficient distance to allow the passage thereover of a new coil of wire, after which the holders are moved outwardly into contact with the inner periphery of the coil and the bolts 223 again tightened to maintain the parts in adjusted position. It will be seen that by the use of this form of reel, I am enabled to adjust the reel to feed coils differing appreciably in the inner and outer diameters.

To reverse the machine in order to wrap that portion of the cable near the cable bands, the bolts 205, of one of the sections 211 are removed and the machine reversed in the same manner as described in connection with the previously described modifications. The wire is then led from the reels 218 to those pulleys 260 which are on the same respective sections after which the wire is led to that guide 250 arranged nearest to the reel.

It will be seen that I have provided a machine which is capable of supporting and advancing itself along the cable as the wrapping operation proceeds without the necessity for, nor the use of, extraneous supporting mechanism. It will further be seen that I have provided a cable wrapping machine capable of comparatively rapid and efficient reversal for wrapping that part of the cable nearest the cable bands, which part heretofore had to be wrapped manually.

I do not intend to be understood as limiting myself to the specific construction or proportions of the parts shown and de-

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scribed as it will be obvious that various changes therein may be made without departing from the spirit and scope of this invention.

5 I claim:

1. In a machine for wrapping suspension bridge cables in situ, a revoluble member having a substantially central opening therein, wire-carrying reels on said member, means on said member for guiding wire from said reels around a cable on the rotation of said member, and a non-rotatable segmental saddle adapted to rest on, and to be advanced along the cable by the action of the wires wound about said cable, said saddle being inserted into the opening of and revolubly supporting said member thereabout, and a motor means supported by said saddle for driving said member.

2. In a machine for wrapping suspension bridge cables in situ, a sectional revoluble frame gear, means for rotating said gear, a wire reel and a wire guide on each section of said gear, a hub on said gear, and means adapted to rest on the cable for engaging and revolubly supporting said hub, said means comprising a segmental saddle having one face terminating near one face of the hub, and said saddle projecting beyond the other face of said hub for providing a support for the gear rotating means.

3. In a machine for wrapping suspension bridge cables in situ, a frame gear, means on said gear for delivering and winding wire about the cable on the rotation of said gear, and a segmental saddle engaging part of the cable, adapted to be supported by and to be moved along the cable by the wire last wound thereon, for carrying said gear.

4. In a machine for wrapping suspension bridge cables in situ, a segmental saddle of less axial length than the circumference thereof, adapted to extend less than half way about the cable and to engage a comparatively small area of the cable top and adapted to be supported by and to be moved axially along the cable by the advancing action of the wire last wound about the cable, and wire delivering means supported by said saddle for rotation thereabout.

5. In a machine for wrapping suspension bridge cables in situ, a frame gear, a wire reel on said gear, an adjustable spring pressed wire guide for leading wire about the cable, said guide projecting inwardly of said gear sufficiently to engage the cable surface and a segmental saddle engaging said gear and projecting beyond said gear on one side only for supporting the gear.

6. In a machine for wrapping suspension bridge cables in situ, a series of frame gear sections, means for removably securing said sections together, a wire reel and a yieldable wire guide on each of said sections, said

guide having a projecting lip for guiding the wire tangentially of the cable, means on each guide for adjusting the guide, an angularly arranged pulley on each of said sections adapted to have the wire passed thereabout before said wire is led to said guide and a saddle projecting beyond the gear sections on one side only for supporting said sections.

7. In a machine for wrapping suspension bridge cables in situ, revoluble means adapted to be arranged about a cable for wrapping wire thereabout, and a relatively stationary segmental saddle of less length than its circumference adapted to rest directly on the top portion of the cable to engage a comparatively small area of the top of the cable, and for engaging and supporting said revoluble means.

8. In a machine for wrapping suspension bridge cables in situ, revoluble means adapted to be arranged about a cable for wrapping wire thereabout, a relatively stationary saddle of less length than its circumference adapted to rest directly on a comparatively small area on the top of the cable for engaging and supporting said revoluble means on the outer face thereof and a radially yieldable wire guiding and controlling plunger on said revoluble means having a lip adapted to be reversed about the axis of the plunger into diametrically opposite position on the reversal of the machine.

9. In a machine for wrapping suspension bridge cables in situ, revoluble means adapted to be arranged about a cable for wrapping wire thereabout, a relatively stationary segmental saddle adapted to rest directly on the cable for engaging and supporting said revoluble means, a radially yieldable wire guiding and controlling plunger on said revoluble means, said plunger terminating in a reversible lip, and means for driving said revoluble means secured to and movable with said saddle lengthwise of the cable.

10. In a machine for wrapping suspension bridge cables in situ, a relatively stationary saddle adapted to rest directly on the cable and to be advanced lengthwise of the cable, a revoluble frame gear, supported by said saddle and interengaging means on said saddle and gear for preventing relative axial movement while allowing relative rotary movement of said saddle and gear, a wire reel on said gear, an angularly disposed pulley on said gear for changing the direction of the wire led from said reel, and a spring-pressed adjustable wire guide on said gear, said guide having a projection forming a corner for receiving the wire from said pulley and for controlling the wire at a point at which the wire is substantially tangent to the cable.

11. In a machine for wrapping suspension bridge cables in situ, a sectional frame gear, teeth on the outer periphery of said gear,

a substantially cylindrical hub on said gear, having an annular depression on the inner face thereof, a wire reel on said gear, a radially yieldable wire guide and centering support on said gear having a radial projection thereon, an angularly disposed pulley on said gear interposed between said reel and said guide, a saddle of less circumference than that of said hub and of less length than its circumference and having an outer surface adapted to engage the inner surface of said hub, a projection on said saddle entering the depression of said hub, and a motor carried by said saddle for rotating said gears about said saddle.

12. In a machine for wrapping the cables of suspension bridges, a comparatively short segmental saddle adapted to rest on the cable and to allow the machine to wrap the cables up to a point close to the cable bands of the bridge, revoluble means carried solely by the saddle and adapted to be reversed with the saddle for wrapping wire about the cable closer to the cable bands than is possible in the normal position of the machine, and a motor supported only by the saddle for rotating the revoluble means.

13. In a machine for wrapping suspension bridge cables in situ, a saddle in the form of a section of a hollow cylinder subtending an angle of less than  $180^\circ$  and adapted to rest on the cable and to move only axially therealong, wire delivering means revoluble

about and directly supported by said saddle, and a motor supported only by said saddle for operating said wire delivering means.

14. In a machine for wrapping suspension bridge cables in situ, a saddle adapted to rest on the cable, a revoluble frame gear having an opening therein in part of which said saddle is inserted, said opening being free of the saddle through a circumferential angle of more than  $180^\circ$ , cooperating means on said gear and said saddle for allowing relative rotation thereof but presenting relative axial movement thereof, and means for leading wire around the cable carried by said frame gear on the face thereof.

15. In a machine for wrapping suspension bridge cables in situ and adapted to be reversed for winding wire close to an obstruction on the cable, revoluble means adapted to surround a cable for wrapping wire thereabout, and a yieldable wire guide having an inwardly extending projection forming a corner, arranged on said means for controlling the wire at a point at which said wire is substantially tangent to the cable and for centering said means, said guide being designed to be reversed through an angle of  $180^\circ$  into position to bring the corner further in advance of the machine in the reversed position of the machine than in the normal position thereof.

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