

Feb. 7, 1933.

H. HILL

1,896,084

STRANDING MACHINE

Filed Feb. 19, 1932

4 Sheets-Sheet 1

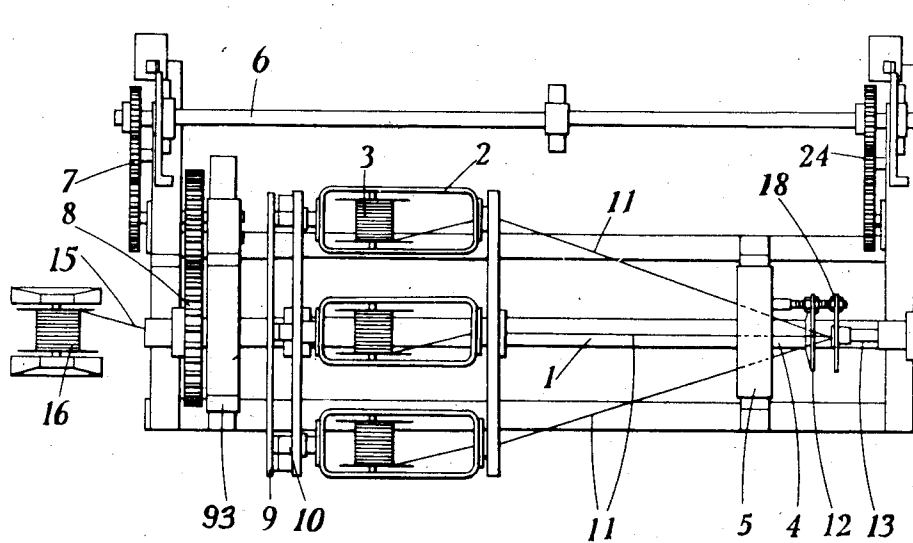
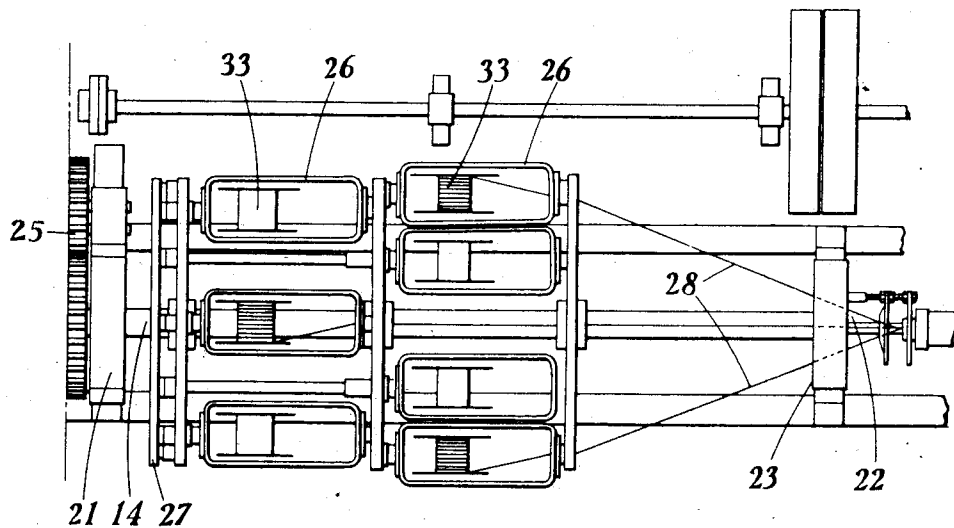


Fig. 1.



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4 Sheets-Sheet 2

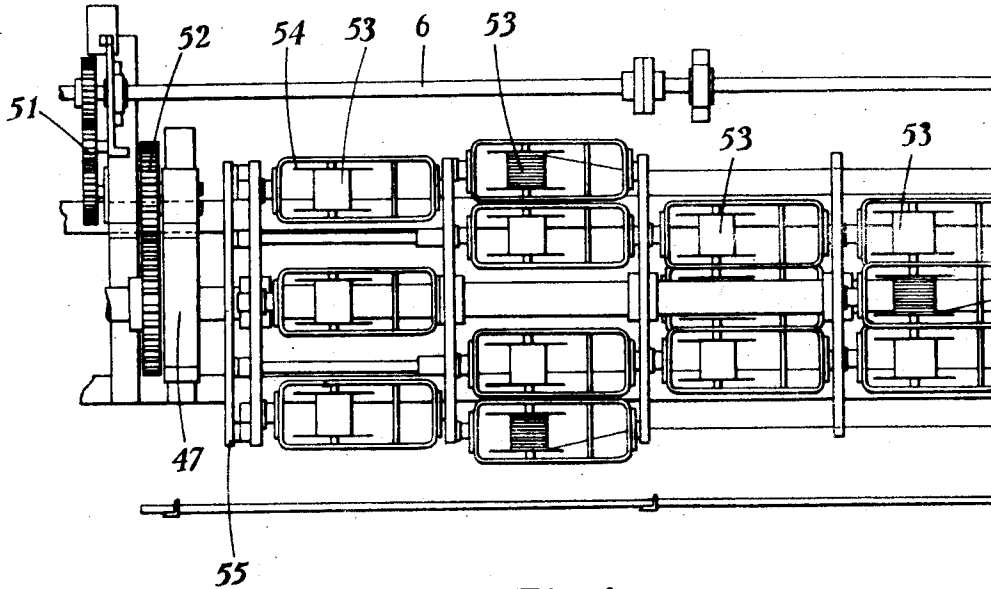
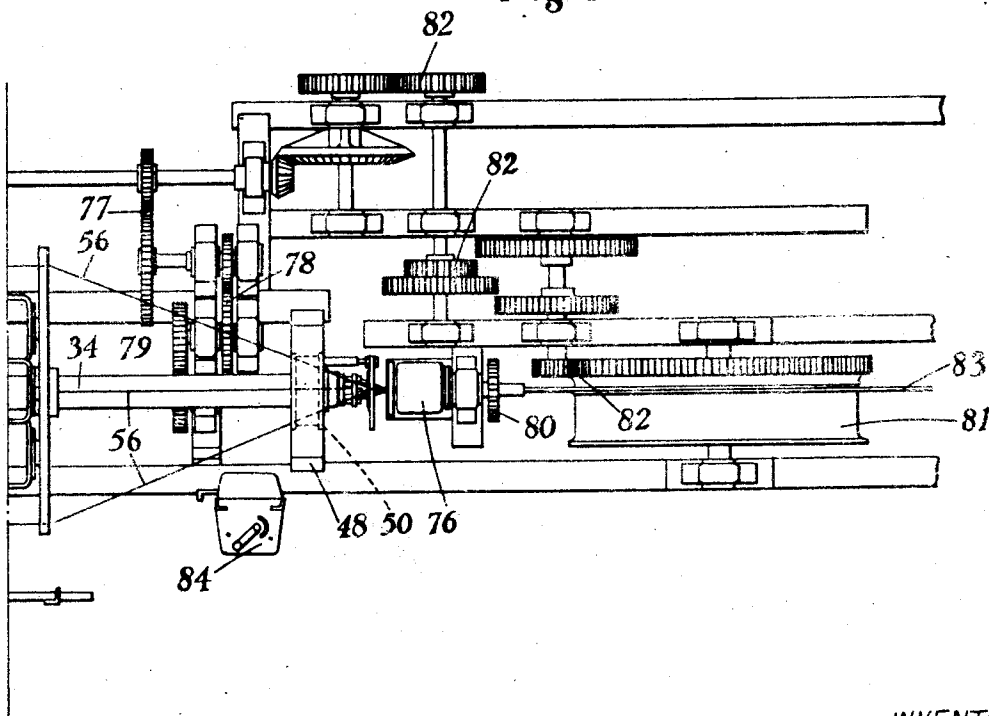


Fig 1 cont.



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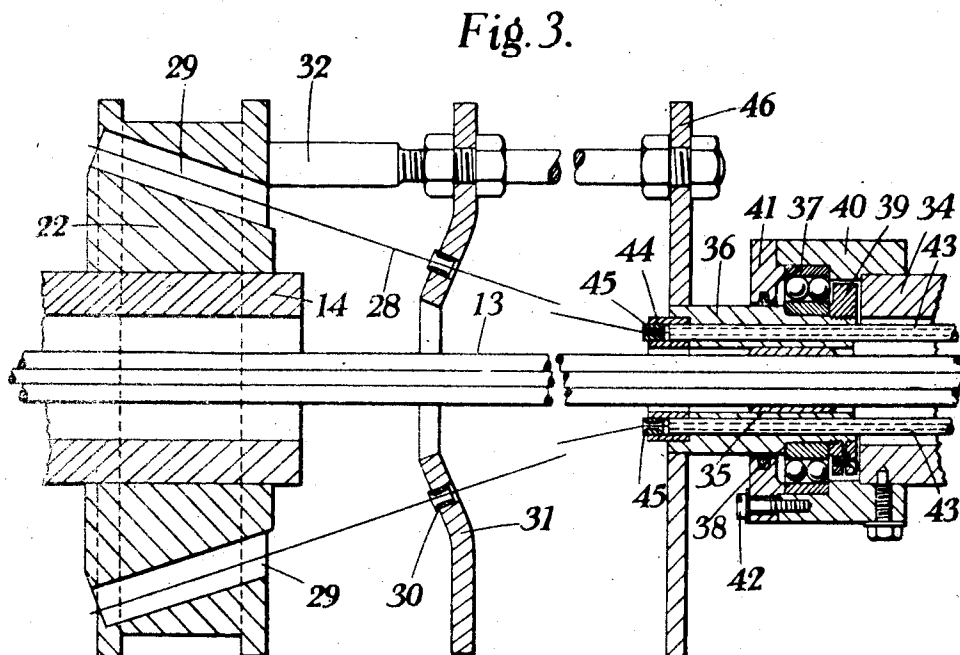
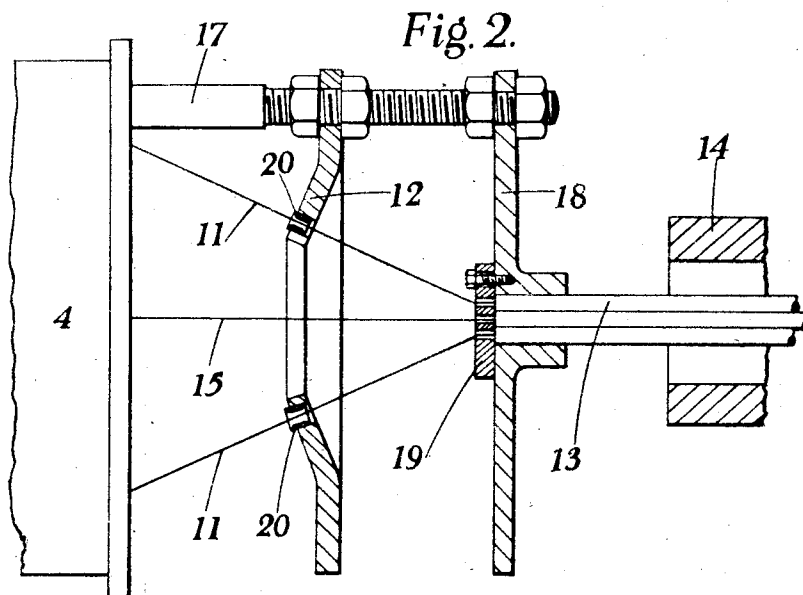
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Fig. 4.

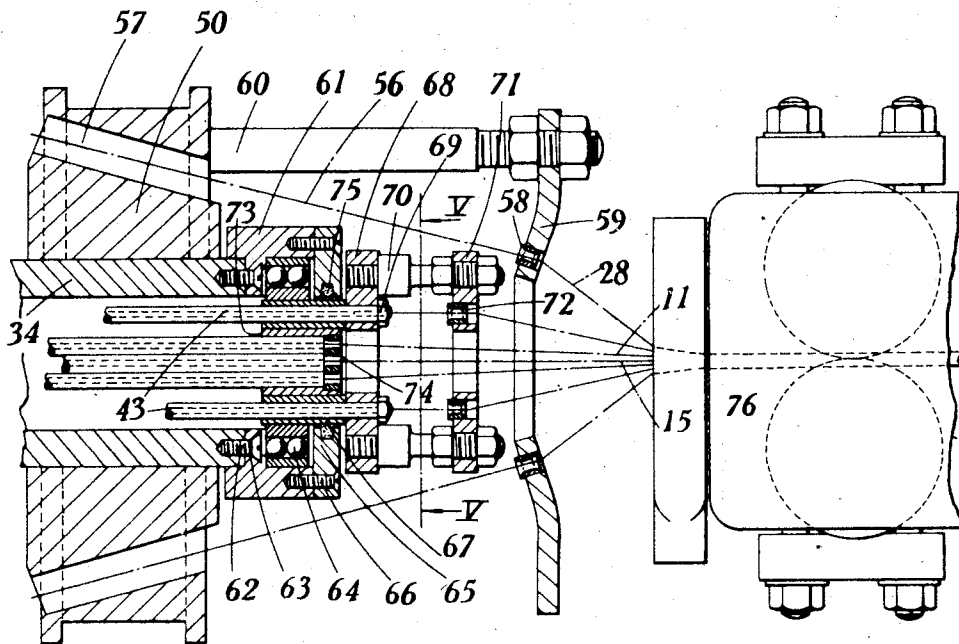
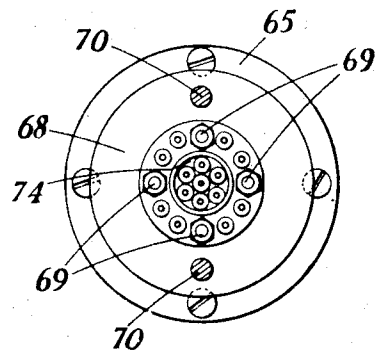


Fig. 5.



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STRANDING MACHINE

Application filed February 19, 1932, Serial No. 594,058, and in Great Britain March 27, 1931.

This invention relates to machines for stranding together a number of wires to form a wire rope or an electric cable (hereinafter referred to as a "cable") which may or may not be of circular form.

There are two main types of stranding machines, one of which is usually termed a "tubular or high-speed type" machine and the other a "cage type" machine. It is with a machine of the latter type that this invention is concerned. A machine of this type usually comprises a number of axially aligned sections each consisting of a rotatable structure—usually termed a "cage"—adapted to carry a number of wire-containing bobbins, a closing die, and a guide plate or other suitable arrangements for guiding the wires from their bobbins into the closing die. By reason of the rotation of the cage and guide plate, the wires are stranded together or about a wire or about that part of the stranded cable produced by the preceding section and within the closing die. From this die the stranded wires are adapted to be drawn-off as stranded by a tensional force applied to them, usually by means of a draw-off capstan situated in front of the die of the final section. The part of the cable formed in any one of the sections preceding the final section of the machine is drawn forward to the die of the succeeding section through the hollow mandrel of the cage of that succeeding section. The cross-sectional form of the cable manufactured in such a machine may be circular or other shape dependent upon the shape of the closing die or dies and in the non-circular case, may or may not be of pre-spiralled form dependent upon whether the die or dies of the stranding machine are rotated about the axis of the machine as the cable is manufactured or whether it or they is or are maintained stationary. A machine of this type which comprises two or more sections usually necessitates supervision by as many operators as there are closing dies in the machine.

In some cases of the manufacture of non-circular shaped cables comprising a core formed of a group of wires stranded together with a long lay and a single outer layer of

wires stranded upon this core with a relatively short lay, it has been the practice to effect these two stranding operations simultaneously in one stranding machine and within one closing die.

I have found that it is possible to produce in a single stranding machine, in one stranding operation and with the employment of only one closing die, a cable comprising a multiplicity of layers, some comprising large numbers of wires stranded upon the preceding layer or upon the core as the case may be.

A stranding machine, in accordance with the present invention includes a group of three or more axially aligned rotatable cages, all or all but one of which have a hollow mandrel and each of which contains an appropriate number of wire-containing bobbins, and a corresponding number of rotating guide plates, located in front of the final cage of the group, and serving to guide the component wires into a single closing die arrangement immediately in front of them.

In carrying out my invention, the center wire or core, if any, of the cable to be manufactured is drawn forward from the rear end of the machine axially through the hollow mandrel of each cage to the closing die at the front end. The wires from each cage, with the exception of the last cage, are guided into and pass through the hollow mandrel of each succeeding cage and through a guide plate, rotating at the same speed as the cage from which the wires are drawn-off, to the closing die; the wires from the last cage pass directly to and through a guide plate, rotating at the same speed as the cage, to the closing die. During their passage through one or more of the hollow mandrels, the wires from each cage are positioned by one or more guide plates rotating at the speed of the cage from which the wires are being drawn-off. The guide plates situated between the front end of the last cage and the closing die will usually be rotating at different speeds and not necessarily in the same direction. If no center wire or core is employed it is not necessary that the mandrel of the first cage should be hollow.

In order that the invention may be more

fully understood, an example of a stranding machine, constructed in accordance with the invention, comprising a group of three axially aligned rotatable cages and having a single closing die will be described with reference to the accompanying drawings, wherein:—

Figure 1 is a diagrammatic plan of a three section stranding machine with a single rotatable closing die.

Figure 2 is a sectional elevation of a part of the machine shown in Figure 1 and illustrates the way in which the wires from the first section are guided into the hollow mandrel of the second section.

Figure 3 is a sectional elevation of a second part of the machine shown in Figure 1 and illustrates the way in which the wires from the first and second sections are guided into and through the hollow mandrel of the third section.

Figure 4 is a sectional elevation of a third part of the machine illustrated in Figure 1 and shows the manner in which the wires from the first, second and third sections are guided into the single closing die, and

Figure 5 is a sectional elevation taken on the line V—V in Figure 4.

Referring now to the drawings and more particularly to Figure 1, the machine as shown is set up for the manufacture of a thirty-seven wire strand of non-circular section and of the type known as pre-spiralled. The first section comprises a rotatable cage of the usual type mounted on a hollow mandrel 1 and carrying six cradles 2 in each of which is mounted a bobbin 3. The mandrel 1 is supported at its rear end in a bearing 93 and the runner head 4 is supported in a bearing 5 at the front end. This cage is driven from the lay shaft 6 by gearings 7 and 8. Back rotation is imparted to the bobbin cradles 2 in the usual way by means of the disc weight 9 coupled to the cage by cranks 10, in order to prevent twisting of the wires 11. These wires are withdrawn from the bobbins 3 and guided through the runner head 4 and through the metal bushings 20 in a guide plate 12 into the battery of tubes 13 which pass through the hollow mandrel 14 of the second section. The center wire 15 of the strand is withdrawn from a bobbin 16 mounted at the rear of the first section and passes through the hollow mandrel 1 and guide plate 12 into the central tube of the battery 13. This will be seen more clearly in Figure 2. The guide plate 12 is positioned in front of the runner head 4 by bolts 17, only one of which is shown, and the battery of tubes 13 consists of a center tube to carry the center wire 15 and of six other tubes disposed about this center tube. The tubes are secured at each end and preferably also intermediate their ends in any convenient manner, for example, by binding with spring

steel wire and subsequently spot welding. At their rear ends the tubes are inserted in the flange 18 and are welded to it. This flange is positioned in front of the guide plate 12 and carried by the bolts 17 so that the rear end of the battery of tubes 13 is effectively supported and constrained to rotate at the same speed as the rear cage. Bolted to the flange 18 is a hard metal guide plate 19 through holes in which the wires are guided into the mouths of the tubes.

In the second section the cage is constructed of three discs mounted on the hollow mandrel 14 which is supported at its rear end in a bearing 21 while the runner head 22 on the front end of the mandrel is supported in a bearing 23. The cage is rotatably driven in a manner similar to that of the first section, that is to say, by the lay shaft 6 through gearing 24 and 25. Each compartment of the cage carries six bobbin cradles 26 which are given back rotation by the disc weight 27. The wires 28 from the twelve bobbins 33 pass through appropriate apertures 29 in the runner head 22 and through hard metal bushings 30 in the guide plate 31 positioned in front of the runner head by bolts 32, only one of which is shown, however. At the rear end of the hollow mandrel 34 of the third section the battery of tubes 13 which passes through this mandrel is rotatably supported, as shown in Figure 3, by a sleeve 35, threaded over and welded to the tubes 13, turning in a second sleeve 36 which is rotatably supported at the end of the mandrel 34 by a ball bearing 37. The inner part of the bearing is axially positioned on the sleeve 36 by being located between the step 38 and the screwed collar 39. The outer part is housed in a recess in a sleeve 40 secured on the end of the mandrel 34, axial movement being prevented by the ring 41 secured to the end of the sleeve 40 by set screws 42. The sleeve 36 is suitably drilled to receive twelve tubes 43 symmetrically arranged about and parallel to the axis of the machine. Each of these tubes 43 is secured to the sleeve 36 preferably by welding. At its rear end this sleeve 36 is appropriately recessed to receive a guide plate 44 which is drilled to receive at its front side the ends of the tubes 43 and its rear side hard metal bushings 45. Rotation is imparted to the sleeve 36 by the runner head 22 in a manner similar to which rotation is imparted to the tubes 13 by the runner head 4, the flange 46, integral with or secured to the sleeve 36, being connected with the runner head by bolts 32, only one of which is shown.

In the third section the rotating cage is built up of five discs carried on the hollow mandrel 34 supported at its rear end in a bearing 47 and at its front end in a bearing 48 in which the runner head 50 rotates. Rotation is imparted to the cage by the lay shaft 6 through gearing 51 and 52. Six

bobbins 53 are carried in cradles 54 in each of the two rear compartments of the cage while three bobbins are similarly carried in each of the two front compartments of the cage. Back rotation is imparted to each bobbin in the usual manner by the disc weight 55. The eighteen wires 56 withdrawn from the bobbins 53 are guided through apertures 57 in the runner head 50 and through hard metal bushings 58 carried in a guide plate 59 which is supported in front of the runner head 50 by bolts 60, so that it rotates at the same speed as the runner head. From the bushings 58, the wires 56 pass into the closing die together with the central wire 15, the six wires 11 from the first section and the twelve wires 28 from the second section. The way in which the front ends of the tubes forming the battery 13 and the tubes 43 are rotatably supported and the way in which the wires from these tubes are guided into the single closing die is clearly seen in Figure 4. A sleeve 61 is secured to the end of the hollow mandrel 34 by set screws 62 passing through the radially directed web 63. Within the sleeve 61 is housed a ball bearing 64 the end movement of which is limited by a plate 65 secured to the sleeve 61 by set screws 66. The front ends of the tubes 43 are threaded through holes in a sleeve 67 which is rotatably supported in the bearing 64. Between the front end of this sleeve 67 and the end of the tubes 43 is secured a disc 68, preferably by means of four nuts 69 screwing on to the projecting ends of four of the tubes 43. Stud 70 are fixed to the disc 68 and carry a second disc which forms a guide plate 71 carrying twelve bushings 72. It is apparent that this guide plate 71 through which the wires 28 pass on their way to the closing die rotates at the same speed as the runner head 22. On the front end of the battery of tubes 13 is secured a sleeve 73. The sleeve 67, bored to receive the sleeve 73, functions as a bearing supporting the front end of the battery of tubes 13 in a rotatable manner. A plate 74 having bushings 75 is secured in the recessed ends of the sleeve 73. Through these bushings the wires 11 from the first section of the machine pass on their way to the closing die arrangement 76.

The various guide plates at the front of the final cage may be positively driven each by its respective cage without providing for the complete segregation of individual wires. For instance, the nest of tubes 13 in the illustrated example may be replaced by a single tube through which the group of wires 11 and the core wire 15 are conveyed in spaced relationship, and the nest of tubes 43 by a single tube concentric with the inner single tube, the wires from the second cage, being conveyed to the front end of the machine in the annular space between the two tubes. In

this case groups of wires rotating at different speeds are segregated.

It will be appreciated that the wires 11 may rotate about the central wire 15 at any desired speed and in either direction, that the wires 28 may rotate about the central wires and the inner group of wires 11 at any desired speed and in either direction and that the outer wires 56 may rotate about the central wires 15, the inner group of wires 11, and the group of wires 28, at any desired speed and in either direction, the speed and direction of each group of wires being chosen according to the type of stranded cable required to be produced. The single closing die may be of circular or non-circular form and may or may not rotate about the axis of the machine. In Figures 1 and 4 is shown diagrammatically a closing die of the type described in the specification of U. S. application Serial No. 542,259, filed June 5, 1932. Rotation is imparted to the die box 76 by the lay shaft 6 through gearing 77, 78, 79 and 80 and the shaped pre-spiralled strand 83 is withdrawn from the closing die by the draw-off capstan 81, also driven from the lay shaft at an appropriate speed through gearing 82.

It will be further appreciated that, by arranging the controller gear 84 operating the motor driving the lay shaft 6 near the closing die arrangement, a single operator is enabled effectively to supervise the running of the complete machine.

What I claim as my invention and desire to secure by Letters Patent is:—

1. A stranding machine of the "cage" type which includes at least three axially aligned rotatable cages, each carried upon a separate mandrel and containing an appropriate number of wire-containing bobbins, said machine comprising a number of guide plates (one plate for each cage) located in front of the final cage, a single closing die arrangement located in front of the said guide plates, means for rotating each cage at an appropriate speed, means for guiding the wires from each individual cage (excepting the final cage) to the guide plate which appertains to that individual cage through the mandrel of each cage located between that cage and the closing die arrangement, means for rotating each guide plate at the same speed as that of the cage to which such guide plate appertains and means for effecting the drawing off of the stranded wires from the said single closing die arrangement.

2. A stranding machine of the "cage" type which includes at least three axially aligned rotatable cages, each carried upon a separate mandrel and containing an appropriate number of wire-containing bobbins, said machine comprising a number of guide plates (one plate for each cage) located in front of the final cage, a single closing die arrangement

- located in front of the said guide plates, means for rotating each cage at an appropriate speed, means adapted both to guide the wires from all the cages, excepting the final cage, through the mandrels to the appropriate guide plates and to provide for the segregation of the group of wires from one cage from the group from an adjacent cage during their passage through the mandrels, means for rotating each guide plate at the same speed as that of the cage to which such guide plate appertains and means for effecting the drawing off of the stranded wires from the said single closing die arrangement.
3. A stranding machine of the "cage" type which includes at least three axially aligned rotatable cages, each carried upon a separate mandrel and each containing an appropriate number of wire containing bobbins, said machine comprising a number of guide plates (one plate for each cage) located in front of the final cage, a single closing die arrangement located in front of the said guide plates, means for rotating each cage at an appropriate speed, means adapted both to guide the wires from each individual cage (excepting the final cage) through the mandrels and to the guide plate which appertains to that individual cage and to segregate each wire from each other wire during their passage through the mandrels, means for rotating each guide plate at the same speed as that of the cage to which it appertains, and means for effecting the drawing off of the stranded wires from the said single closing die arrangement.
4. A stranding machine of the "cage" type which includes at least three axially aligned rotatable cages, each carried upon a separate mandrel and containing an appropriate number of wire-containing bobbins, said machine comprising a number of guide plates (one plate for each cage) located in front of the final cage, a single closing die arrangement located in front of the said guide plates, means for rotating each cage at an appropriate speed, means adapted to guide the wires from all the cages, excepting the last cage, through the mandrels to the appropriate guide plates and to provide for the segregation of the group of wires from one cage from the group from an adjacent cage during their passage through the mandrels, said means also serving to rotate each guide plate (excepting the final guide plate) at the same speed as that of the cage to which it appertains, means for rotating the guide plate for the final cage at the speed of that cage, and means for effecting the drawing off of the stranded wires from the single closing die arrangement.
5. A stranding machine of the "cage" type which includes at least three axially aligned rotatable cages, each carried upon a separate mandrel and containing an appropriate number of wire-containing bobbins, said machine comprising a number of guide plates (one plate for each cage) located in front of the final cage, a single closing die arrangement located in front of the said guide plates, means for rotating each cage at an appropriate speed, a number of concentrically arranged units (one associated with each cage excepting the final cage) rotatable about the axis of the stranding machine, each at its rear end mechanically coupled to the cage with which it is associated, extending through the mandrel of each succeeding cage, at its front end mechanically coupled to the guide plate appertaining to such cage and consisting of a number of tubes by which the individual wires from the said cage are segregated from each other during their transit through the mandrel of each succeeding cage, means for rotating the guide plate for the final cage at the speed of that cage, and means for effecting the drawing off of the stranded wires from the single closing die arrangement.
- In testimony whereof I affix my signature.
HARRY HILL.

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