Nov. 17, 1953 S. W. RIPLEY 2,659,192

STRANDING MACHINE

Filed April 6, 1951

5 Sheets-Sheet 1

FIG. 1a

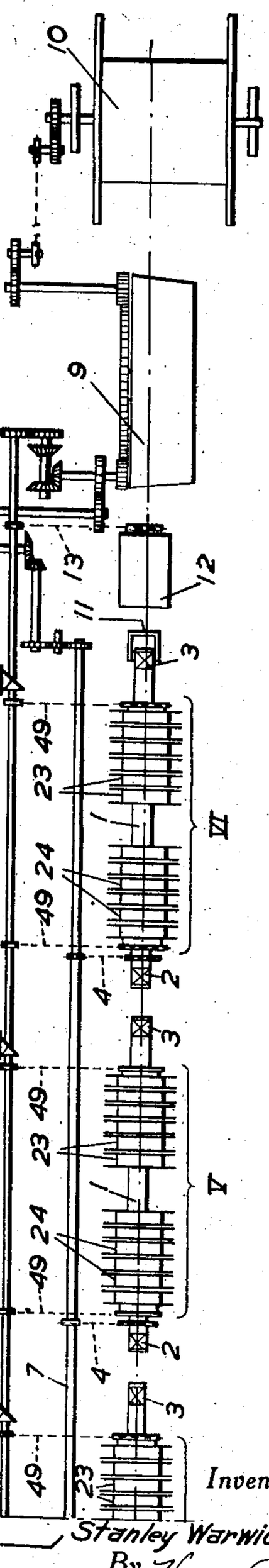
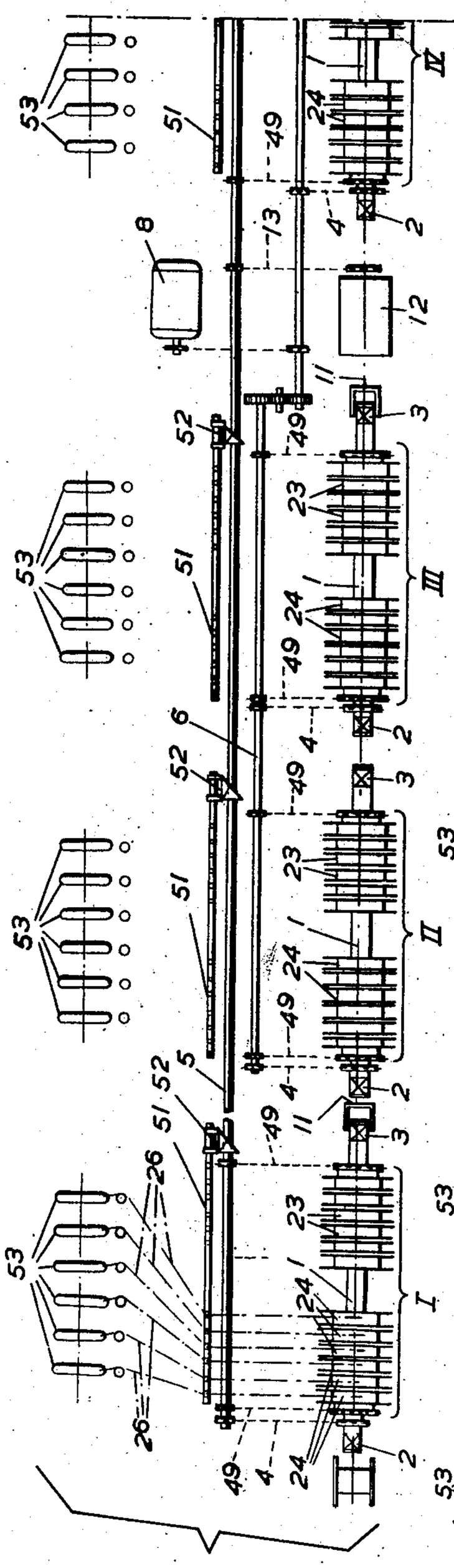


FIG. 1b



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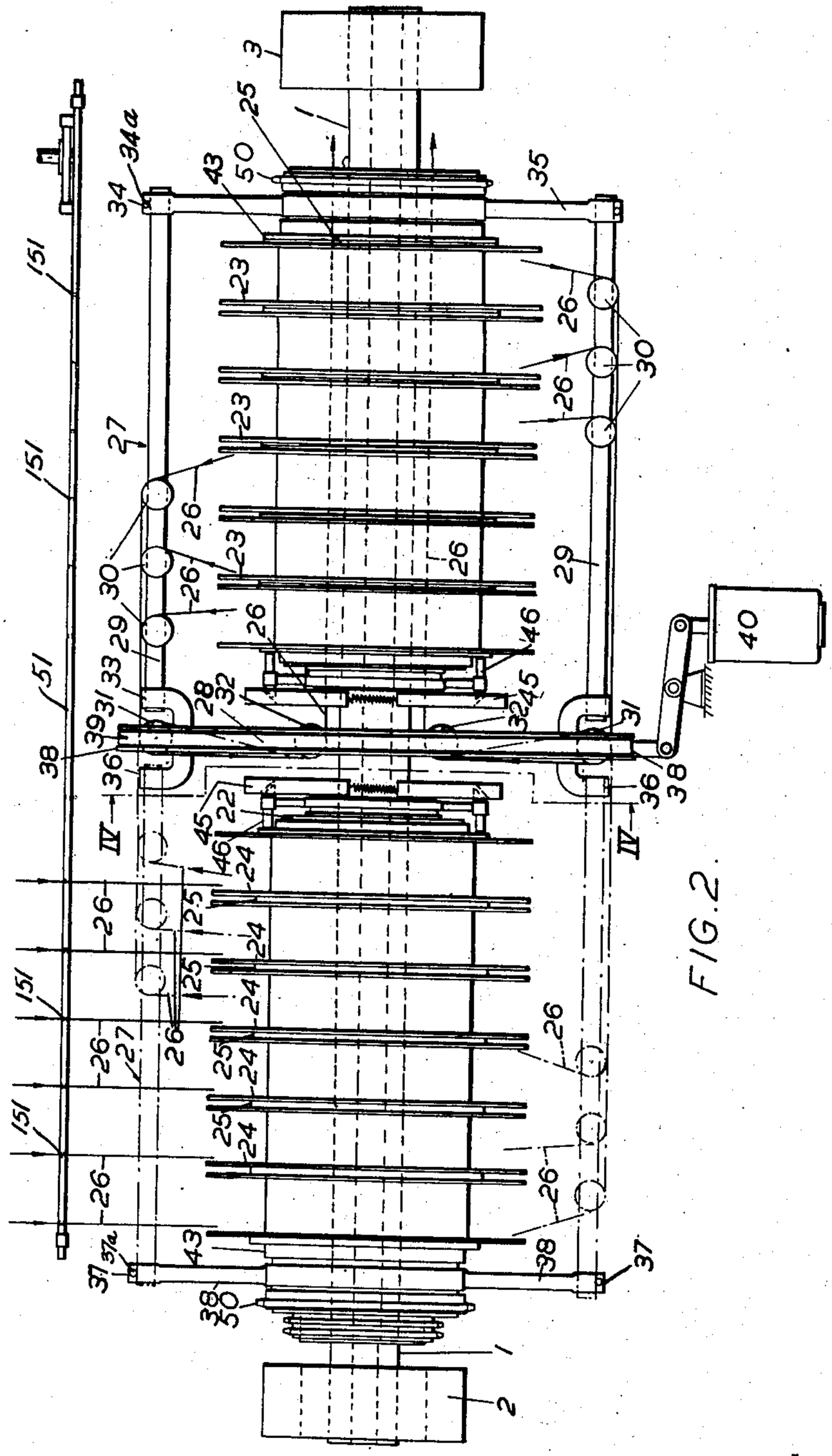

FIG. 2.

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FIG. 3.

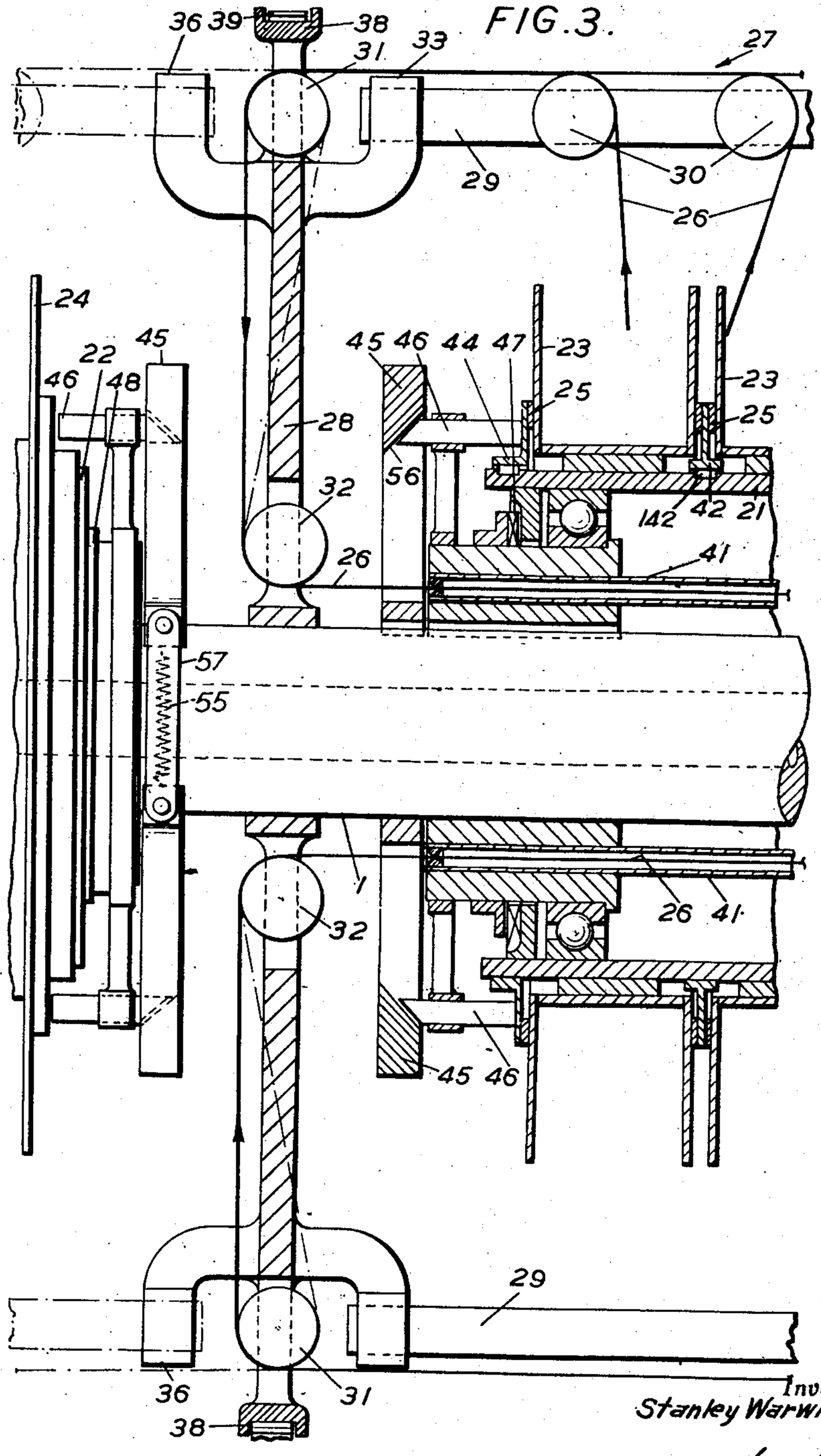

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FIG. 4.

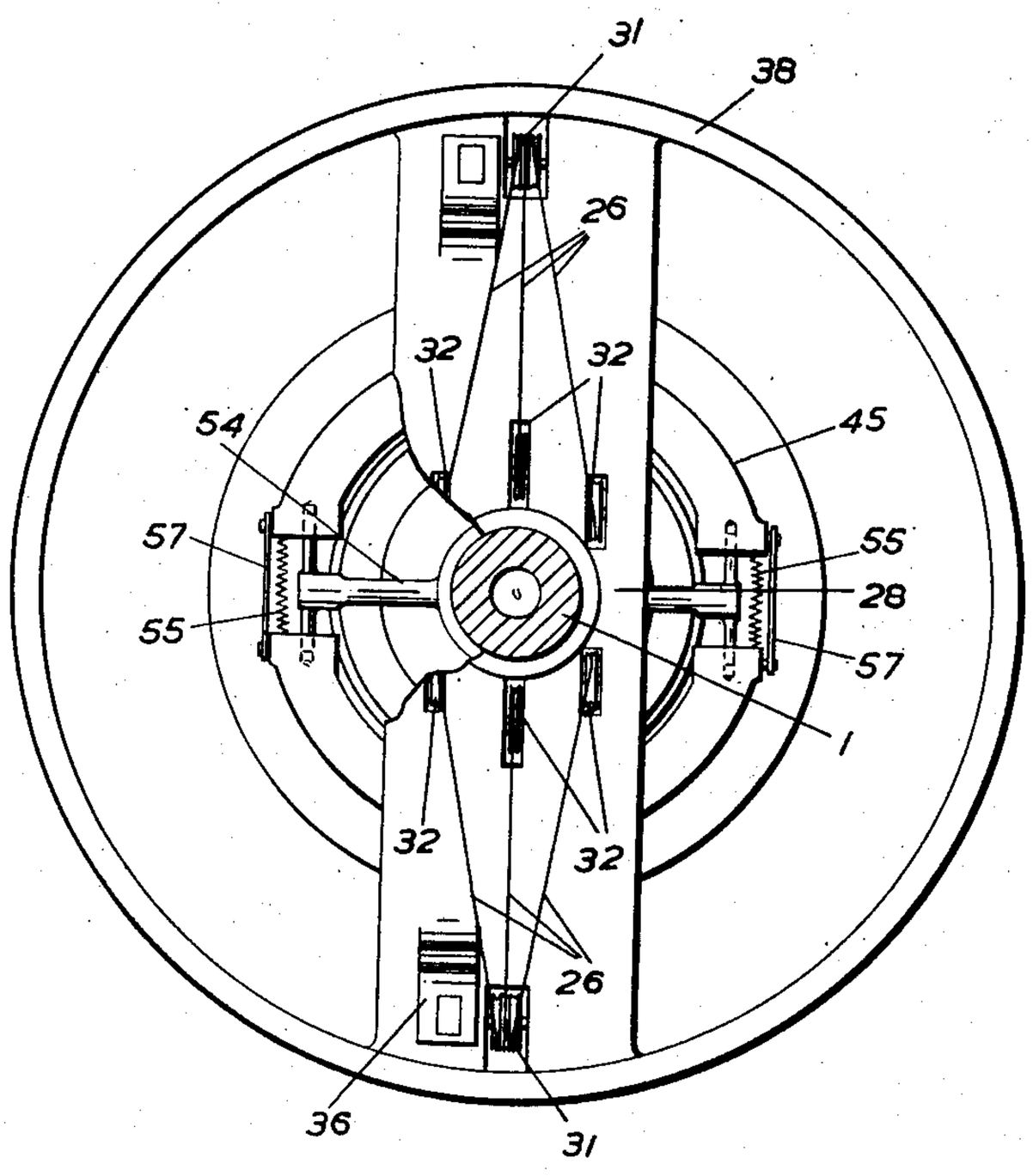

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FIG. 5.

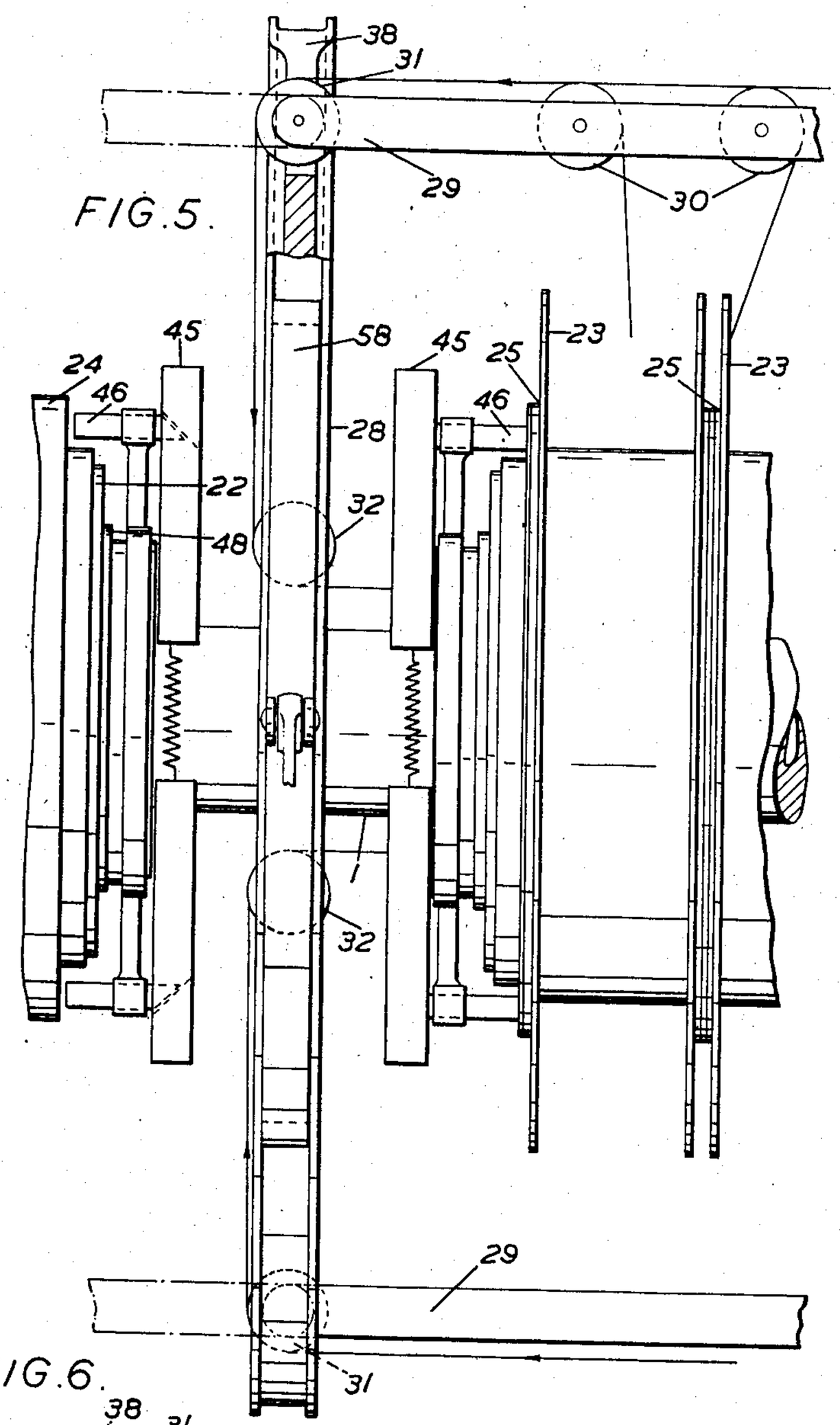
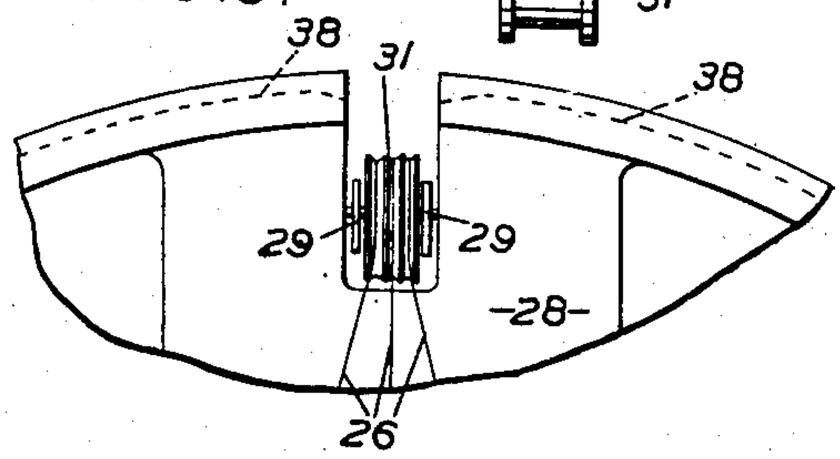


FIG. 6.



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Patented Nov. 17, 1953

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UNITED STATES PATENT OFFICE

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STRANDING MACHINE

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Application April 6, 1951, Serial No. 219,610

Claims priority, application Great Britain April 20, 1950

12 Claims. (Cl. 57—34)

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This invention relates to stranding machines, that is, to machines for stranding together a number of wires to form a stranded electric conductor or a wire rope. In such machines each component wire is drawn off from a supply reel or bobbin and led to and passed through a rotating guide or lay plate which lays it helically, generally around an advancing centre core, which may be a single wire or a previously stranded group of wires. In particular the invention is concerned with stranding machines of the kind in which (or in a section of which) the wire-containing bobbins are mounted with their axes coincident with the machine axis, and the wires as they are drawn off from the bobbins due to the forward movement imparted to the stranded conductor by the draw off wheel or capstan are guided towards a lay plate by a rotating flyer. In such machines, as indeed with most types of stranding machines, it is necessary, when the bobbins run out, to stop the machine, remove the empty bobbins and insert full bobbins in their places, to join the tail ends of the wires from the run out bobbins to the leading ends of the wires from the full bobbins and then to restart the machine.

By the present invention we provide a stranding machine having one or more sections of axially aligned bobbins which eliminates the need for handling the bobbins in such section or sections and considerably reduces the duration of stoppages due to the bobbins of such section or sections running out. In our improved machine, which comprises a section or unit (or a number of sections or units), consisting of two axially aligned groups of axially aligned bobbins, provision is made for drawing off wires from each of the two groups alternately and guiding them towards a lay plate. Means are also provided for rotatably driving the bobbins of each group of a section independently of those of the other group of the section for the purpose of re-winding them whilst in the machine and whilst wire is being drawn off from those of the other group.

The invention will be more fully explained with the aid of the accompanying drawings, wherein

Figures 1*a* and 1*b* together constitute a diagrammatic plan of an example of stranding machine constructed in accordance with the invention,

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Figure 2 is a plan on a greatly enlarged scale as compared with Figures 1*a* and 1*b*, showing one of the sections of two groups of axially aligned bobbins, of which the machine shown diagrammatically in Figure 1 is built up,

Figure 3 is a fragmental sectional view drawn to a still larger scale and showing in greater detail the way in which one of the groups of bobbins of the section or unit shown in Figure 2 is supported and the speed of the bobbins controlled,

Figure 4 is an enlarged cross-section taken on line IV—IV in Figure 2, and

Figure 5 is a fragmental elevation of one of the sections of two groups of axially aligned bobbins of a modified form of the machine shown in Figures 1–4, and

Figure 6 is a fragmental end view of the brake-drum shown in Figure 5.

Referring first to Figures 1*a* and 1*b*, it is explained that the machine shown is designed to strand together thirty-seven wires to form a stranded conductor comprising an inner layer of six wires laid around a central wire, an intermediate layer of twelve wires laid around the inner layer and an outer layer of eighteen wires laid around the intermediate layer. To this end it comprises six axially aligned sections or units designated I, II . . . VI. These sections or units are similar and each consists of two axially aligned groups of axially aligned bobbins. They are arranged to form three groups, the first of which consists of section I the bobbins of which supply the wires for the inner layer, the second of sections II and III, which together contain the bobbins supplying the wires for the intermediate layer, and the third of sections IV, V and VI, which together contain the bobbins supplying the wires for the outer layer of the stranded conductor. Each section comprises a main support tube 1 which is rotatably supported in bearings 2, 3 and is rotatably driven by a chain and sprocket drive 4, the rear section, section I, being driven from lay shaft 5, sections II and III forming the intermediate group being driven through a second lay shaft 6, and the front section being driven through a third lay shaft 7. All three lay shafts are driven by a motor 8, which through lay shaft 7, also drives a draw-off capstan 9 and a take-up reel 10. The front end of the main

support tube of the rear section, section I, carries a lay plate 11 which guides the wires from the section to the stranding point for that section. The corresponding parts of the sections III and VI each carry a lay plate which guides the wires from the section and from the section or sections with which it is associated to form a group, to the stranding point for the group. To impart to the stranded conductor as it is being produced a non-circular section and a pre-spiralled formation, a pre-spiralling head 12 is located in front of the lay plate of the second group of sections, and a second pre-spiralling head 12 in front of the lay plate of the third group of sections. Each of these heads 12 is driven by a chain and sprocket drive 13 from the lay shaft 5 at the same speed as the main support tube of section I.

As will be seen more clearly from Figures 2 and 3, the main support tube 1 of each section carries a pair of bobbin support tubes 21 and 22 each of which surrounds the main support tube 1 and is rotatably supported thereon and adapted to be driven by the support tube and independently of that tube, alternatively. On the front bobbin support tube 21 is rotatably mounted a group of six bobbins 23, each of which is adapted to be driven by the bobbin support tube through one or more friction couplings 25. These couplings are adjustable. They may be adjusted to allow wire to be drawn off the bobbin under appropriate tension, that is without undue tension on the one hand or over-running of the bobbin on the other. In this case they serve to brake the bobbins relative to the bobbin support tube. Alternatively the friction couplings may be adjusted to allow the bobbins to be driven by the bobbin support tube without slip, for the purpose of re-winding the bobbins. A second group of six bobbins 24 is similarly mounted on and similarly driven by the rear bobbin support tube 22.

The means for guiding wires 26 drawn off from each of the two groups of bobbins 23 and 24, alternately, may comprise a pair of flyers (one for each group) either of which can be held stationary whilst the bobbins of the group with which it is associated are being rotatably driven independently of the group being driven by the main support tube, for the purpose of re-winding them. Alternatively the part or parts of the flyer which rotate around the bobbins can be made readily detachable to allow re-winding of the bobbins when driven independently of the main support tube. We prefer however, to use a two-position flyer 27 capable of guiding wire from each of the two groups of the section alternately.

In th preferred arrangement employing a two-position flyer, which is shown in Figures 2 and 3, each of the wires 26 from the front group of bobbins 23, is guided by the flyer 27, first outwards from the machine axis then backwards to a point between the two groups of bobbins 23 and 24, then inwards towards the main support tube 1 and then forwards, between the front bobbin tube 21 and the main support tube 1, towards the lay plate 11 (Figure 1). When the front group of bobbins 23 is being re-wound, each of the wires 26 from the rear group of bobbins is guided by the flyer 27 in its alternative position first outwards and then forwards to a point between the two groups of bobbins 23 and 24, then inwards towards the support tube and forwards between the front bobbin tube and the support tube to the lay plate 11, as shown by the broken lines in Figure 2. The flyer 27 may comprise a disc 28 (or alternatively a number of radially extending

spokes) mounted on the main support tube 1 between the two bobbin tubes 21 and 22 and carrying at its periphery a number of arms 29, for instance, two disposed on diametrically opposite sides of the main support tube 1. These arms extend more or less parallel with the axis of the machine either forward or rearward and carry pulleys 30 which serve to guide towards the disc 28 the wires from either the front group of bobbins or from the rear group, depending upon the position of the arms 29. The disc carries appropriately placed pulleys 31 and 32 for guiding the wires 26 inwardly towards the main support tube 1 and then forwardly between that tube and the front bobbin tube 21. The arms 29 of the flyer may be pivotally attached to the disc 28 as shown in Figures 5 and 6 so that by swinging each arm through an arc of 180° it may be transferred from the front group of bobbins 23 to the rear group 24. In this case provision will be made to anchor the extremities of the arms 29 in a readily detachable manner to the front end of the front bobbin tube 21 and to the rear end of the rear bobbin tube 22, alternatively. Instead of pivotally attaching the arms to the disc 28, each arm 29 may, as shown, be supported at one end in a bearing 33 on the disc 28 and at its other end in a bearing 34 carried by a radial arm 35 on the front end of the front bobbin tube 21 or, alternatively, in a bearing 36 on the disc 28 and in a bearing 37 carried by a radial arm 38 on the rear end of the rear bobbin tube 22. With this arrangement each of the arms 29 is transferred from one position to the other by removing it from one pair of bearings 33, 34 and inserting it into the second pair 36, 37, one or both bearings of each pair being laterally openable, as by removal of a retaining pin 34*a* or 37*a*, to facilitate the transfer. This arrangement is preferred to the pivotal form of attachment because it has the advantage of leaving the periphery of the disc 28 free to serve as a brake drum 38 for a central band brake 39 which is operated by an electric thruster 40 and enables the section to be brought rapidly to rest when desired or in the event of wire breakage. In the arrangement shown in Figures 5 and 6 the brake band 39 is replaced by a pair of brake shoes 58.

Preferably the wires 26 passing forward between the main support tube 1 and the bobbin tube 21 are segregated from one another by arranging a number of small bore tubes 41 around the main support tube 1 and passing one wire through each of these tubes.

The friction couplings 25 may be of any suitable form but those between each two bobbins 23 preferably comprise a flanged collar 42 which carries a friction disc on each face of its flange and which is permitted to move longitudinally with respect to the bobbin support tubes 21 but is prevented from rotating on the tube by means of a parallel key 142. The friction couplings 25 between bobbins 22 are similar. At the front end of the front bobbin tube 21 (and the rear end of the rear bobbin tube 22) the friction coupling 25 preferably takes the form of an axially adjustable collar 43 which serves as an abutment and carries a friction disc on the side facing the adjacent bobbin, and the friction coupling 25 at the rear end of the front tube (and the front end of the rear tube) preferably takes the form of a collar 44 which carries a friction disc on the side facing the bobbin adjacent to it. This second collar 44 is allowed to move axially along the bobbin tube 21 to a

limited extent but is prevented from rotating with it in the same way as the axially movable collars **42**. Means are provided for exerting axial pressure upon the collar **44** whereby a frictional retarding force is applied to each of the bobbins when wire is being drawn from them. This axial pressure may be controlled by centrifugal force so as to have a maximum value when the machine is starting or stopping. This result may be obtained by means of a split ring **45** which is supported on radial arms **54** mounted on the main support tube **1**. The ring, which is constrained to rotate with the main support tube **1** and of which the two halves are held together as by springs **55**, carries inclined surfaces **56**. These engage the ends of a number of axially slidable thrust pins **46** which bear upon the sliding collar **44** on the bobbin support tube so that these pins exert a thrust upon the collar which is a maximum when the machine is stationary, gradually diminishes as the machine speeds up and the two halves of the ring move apart, and gradually increases as the machine slows down and the two halves of the ring draw together, thereby preventing excessive slip when the machine starts up and over-running when the machine slows down.

During the stranding operation the bobbin tube **21** (or **22**) carrying the bobbins **23** (or **24**) from which wire is being drawn off is locked to the support tube **1**, as by means of a dog clutch **47** (or **48**). During the operation of re-winding the empty bobbins **24** (or **23**), the bobbin tube **22** (or **21**) carrying those bobbins is permitted to rotate relative to the main tube **1** by releasing the dog clutch **48** (or **47**) and is driven at an appropriate speed, for instance, by means of a chain drive **49** to a chain wheel **50** mounted, in the case of the front bobbin tube **21**, at the front end of the tube, and in the case of the rear bobbin tube **22**, at the rear end of the tube. During the re-winding operation the thrust pins **46** of the bobbin group being re-wound are locked in their positions of maximum thrust as by links **57**, to enable the bobbins to be driven without slip by the independently driven bobbin support tube.

For the purpose of re-winding the bobbins there may be mounted alongside each section a flaking bar **51** (Figure 1) carrying a number of wire guides **151** (one for each bobbin of the section). This bar may be reciprocated longitudinally by a constant velocity cam **52** so as to guide the wires **26** uniformly on to the bobbins that are being re-wound from a corresponding number of swifts **53**. The latter may be mounted upon a movable support so as to serve both groups of bobbins.

It will be understood from the preceding description that in this specification the term "section" does not necessarily designate the whole of that part of a stranding machine which applies all the component wires of any one layer of a standard conductor or cable comprising two or more layers of wires but may imply a portion of such part, in other words, by a "section" we mean a part of a stranding machine which applies some or all of the component wires of any one layer.

Naturally the maximum advantage as regards reduced handling of bobbins will generally be derived from the invention when the invention is applied to all sections of a stranding machine.

What I claim as my invention is:

1. A wire stranding machine comprising at least one section comprising axially aligned front and rear groups of axially aligned bobbins, means for drawing off wires from said front and rear groups of bobbins alternately and guiding them towards a lay plate, and means for rotatably driving the bobbins of each group independently of those of the other group for the purpose of re-winding the bobbins of one group whilst wires are being drawn off from the bobbins of the other group.

2. A wire stranding machine comprising at least one section comprising a main support tube, means for driving said tube in rotation about its axis, a pair of bobbin support tubes rotatably mounted on said main support tube, two groups of axially aligned bobbins rotatably mounted, one group on each of said bobbin support tubes, means for driving each bobbin support tube by said main support tube and independently of said main support tube, alternatively, means comprising at least one friction coupling for coupling each bobbin to its bobbin support tube, means for drawing off wires from each group of bobbins alternately, and means for adjusting the friction couplings of each group of bobbins independently of those of the other groups whereby to allow wires to be drawn off under appropriate tension from the bobbins of one group whilst the bobbins of the other group are driven by their bobbin support tube without slip for the purpose of re-winding them.

3. A wire stranding machine comprising at least one section comprising a main support tube, means for driving said tube in rotation about its axis, a pair of bobbin support tubes rotatably mounted on said main support tube, two groups of axially aligned bobbins rotatably mounted, one group on each of said bobbin support tubes, releasable locking means for locking each of said bobbin support tubes to said main support tube, means for driving each of said bobbin support tubes independently of said main support tube at a speed differing from that of said main support tube, means comprising at least one friction coupling for coupling each bobbin to its bobbin support tube, means for drawing off wires from each group of bobbins alternately, and means for adjusting the friction couplings of each group of bobbins independently of those of the other group whereby to allow wires to be drawn off under appropriate tension from the bobbins of one group whilst those of the other group are driven by their bobbin support tube without slip for the purpose of re-winding them.

4. A wire stranding machine comprising at least one section comprising a main support tube, means for driving said tube in rotation about its axis, a pair of bobbin support tubes rotatably mounted on said main support tube, two groups of axially aligned bobbins rotatably mounted, one group on each of said bobbin support tubes, means for driving each bobbin support tube by said main support tube and independently of said main support tube, alternatively, means comprising at least one friction coupling for coupling each bobbin to its bobbin support tube, means for drawing off wires from each group of bobbins alternately, centrifugally controlled means for adjusting the friction couplings of each group of bobbins whilst wires are being drawn off from the bobbins of the group, whereby said couplings are more effective at low than at high machine speeds, and means for setting the friction couplings of each group of bobbins to drive the bob-

bins of the group without slip throughout the operation of re-winding them.

5. A wire stranding machine comprising at least one section comprising a main support tube, means for driving said tube in rotation about its axis, a pair of bobbin support tubes rotatably mounted on said main support tube, two groups of axially aligned bobbins rotatably mounted, one group on each of said bobbin support tubes, means for driving each bobbin support tube by said main support tube and independently of said main support tube, alternatively, a fixed end collar and an axially slidable collar on each of said bobbin support tube, a plurality of bobbins on each bobbin support tube between the end collars thereon, a plurality of axially slidable intermediate collars on each bobbin support tube, one between each two adjacent bobbins, means constraining the end and intermediate collars on each bobbin support tube to rotate therewith, friction facings on said collars for engaging end faces on the bobbins adjacent them, means for drawing off wires from each group of bobbins alternately, and means for applying a controlled degree of pressure to the slidable end collar on each bobbin support tube for the purpose of exerting a controlled retarding force on each bobbin whilst wire is being drawn off from it and for the purpose of driving it without slip whilst re-winding it.

6. A wire standing machine comprising at least one section comprising a main support tube, means for driving said tube in rotation about its axis, a pair of bobbin support tubes rotatably mounted on said main support tube, two groups of axially aligned bobbins rotatably mounted, one group on each of said bobbin support tubes, means for driving each bobbin support tube by said main support tube and independently of said main support tube, alternatively, a fixed end collar and an axially slidable collar on each of said bobbin support tubes, a plurality of bobbins on each bobbin support tube between the end collars thereon, a plurality of axially slidable intermediate collars on each bobbin support tube, one between each two adjacent bobbins, means constraining the end and intermediate collars on each bobbin support tube to rotate therewith, friction facings on said collars for engaging end faces on the bobbins adjacent them, means for drawing off wires from each group of bobbins alternately, a plurality of axially slidable thrust pins on each bobbin support tube for applying an axial thrust to its axially slidable end collar, a split ring driven by said main support tube and comprising parts that move outwards against the action of spring force under the effect of centrifugal force, inclined surfaces on said ring engaging said thrust pins and applying thereto a thrust which diminishes with increase in speed of rotation of the main support tube, whereby to exert a controlled retarding force on each bobbin on the tube whilst wire is being drawn off from it.

7. A wire stranding machine as claimed in claim 6, having means for locking said thrust pins in their positions of maximum thrust.

8. A wire stranding machine comprising a section which includes a main support tube, axially aligned front and rear groups of axially aligned, wire-carrying bobbins rotatably mounted on said tube, rotating flyer means for guiding wires from the bobbins of the front and rear groups, alternatively, towards a lay plate, said flyer means guiding the wires from the front group first outwards from the machine axis, then backwards to a point between the two groups of bobbins, then inwards towards said main support tube and forwards towards the lay plate and guiding the wires from the bobbins of the rear group first outwards from the machine axis, then forwards to a point between the two groups of bobbins, then inwards towards the main support tube and forwards through the front group of bobbins towards the lay plate, and means for driving the bobbins of each group independently of those of the other group for the purpose of re-winding the bobbins of one group whilst wires are being drawn off from the bobbins of the other group.

9. A wire stranding machine comprising a section which comprises a main support tube, axially aligned front and rear groups of axially aligned, wire-carrying bobbins rotatably mounted on said support tube, a two-position flyer adjustable to guide wires from each of said two groups of bobbins, alternately, towards a lay plate, said flyer in one of its two positions guiding the wires from the bobbins of the front group first outwards from the machine axis, then backwards to a point between the two groups of bobbins, then inwards towards said main support tube and forwards towards the lay plate and in the other of its two positions guiding the wires from the bobbins of the rear group first outwards from the machine axis, then forwards to a point between the two groups of bobbins, then inwards towards the said main support tube and forwards through the front group of bobbins towards the lay plate, and means for driving the bobbins of each group independently of those of the other group for the purpose of re-winding the bobbins of one group whilst wires are being drawn off from the bobbins of the other group.

10. A wire stranding machine comprising a section which comprises a rotatably driven main support tube, front and rear bobbin support tubes rotatably mounted on said main support tube, a front group of axially aligned, wire-carrying bobbins mounted on said front bobbin support tube, a rear group of axially aligned, wire-carrying bobbins mounted on said rear bobbin support tube, a two-position flyer adjustable to guide wires from each of said two groups of bobbins, alternately, towards a lay plate, and means for driving the bobbins of each group independently of those of the other group for the purpose of re-winding the bobbins of one group whilst wires are being drawn off from the bobbins of the other group, said flyer comprising a central support located on said main support tube between said front and rear bobbin support tubes, a pair of end supports, located one at the front end of said front bobbin support tube and one at the rear end of said rear bobbin support tube, at least two arms and means for detachably securing said arms to said central and front end support and to said central and rear end support, alternately, whereby said arms extend longitudinally of said front and rear groups of bobbins, alternately, pulleys on said arms for guiding wires from the bobbins of the neighbouring group towards said central support, and pulleys on said central support for guiding said wires inwards and forwards between said main support tube and said front bobbin support tube.

11. A wire stranding machine as claimed in claim 10, wherein the central support is a circular member of which the periphery comprises a brake drum.

12. A wire stranding machine for the manufacture of a multi-layered stranded wire product,

comprising a number of axially aligned units of similar construction arranged in groups, each of said groups comprising at least one unit and containing bobbins for supplying the wires for one layer of said stranded wire product, each of said units including axially aligned front and rear groups of axially aligned bobbins, means for drawing off wires from said front and rear groups of the unit, alternately, and guiding them towards a lay plate for the unit, and means for rotatably driving the bobbins of each group of the unit independently of those of the other group

of the unit for the purpose of re-winding them whilst wire is being drawn off from the bobbins of the other group of the unit.

STANLEY WARWICK RIPLEY.

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