No. 889,311. PATENTED JUNE 2, 1908.

L. A. JONES.

MACHINE FOR BRAIDING TUBULAR FABRIC.

APPLICATION FILED JUNE 27, 1906.

4 SHEETS—SHEET 1.

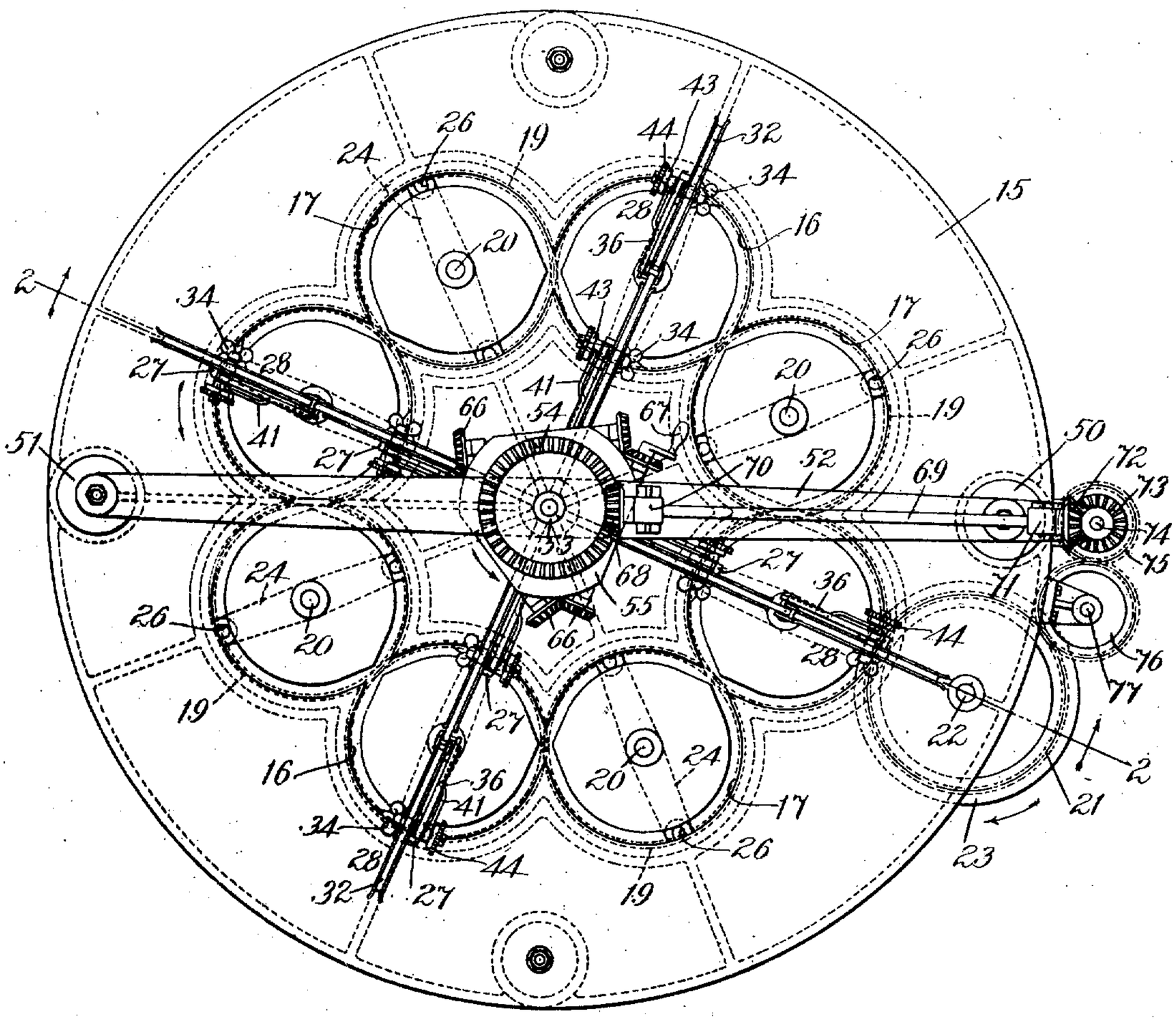

Fig. 1.

Witnesses.
K. M. Sullivan
E. N. Curtis.

Inventor.
Louis A. Jones.
By his Atty Chas. F. Perkins.

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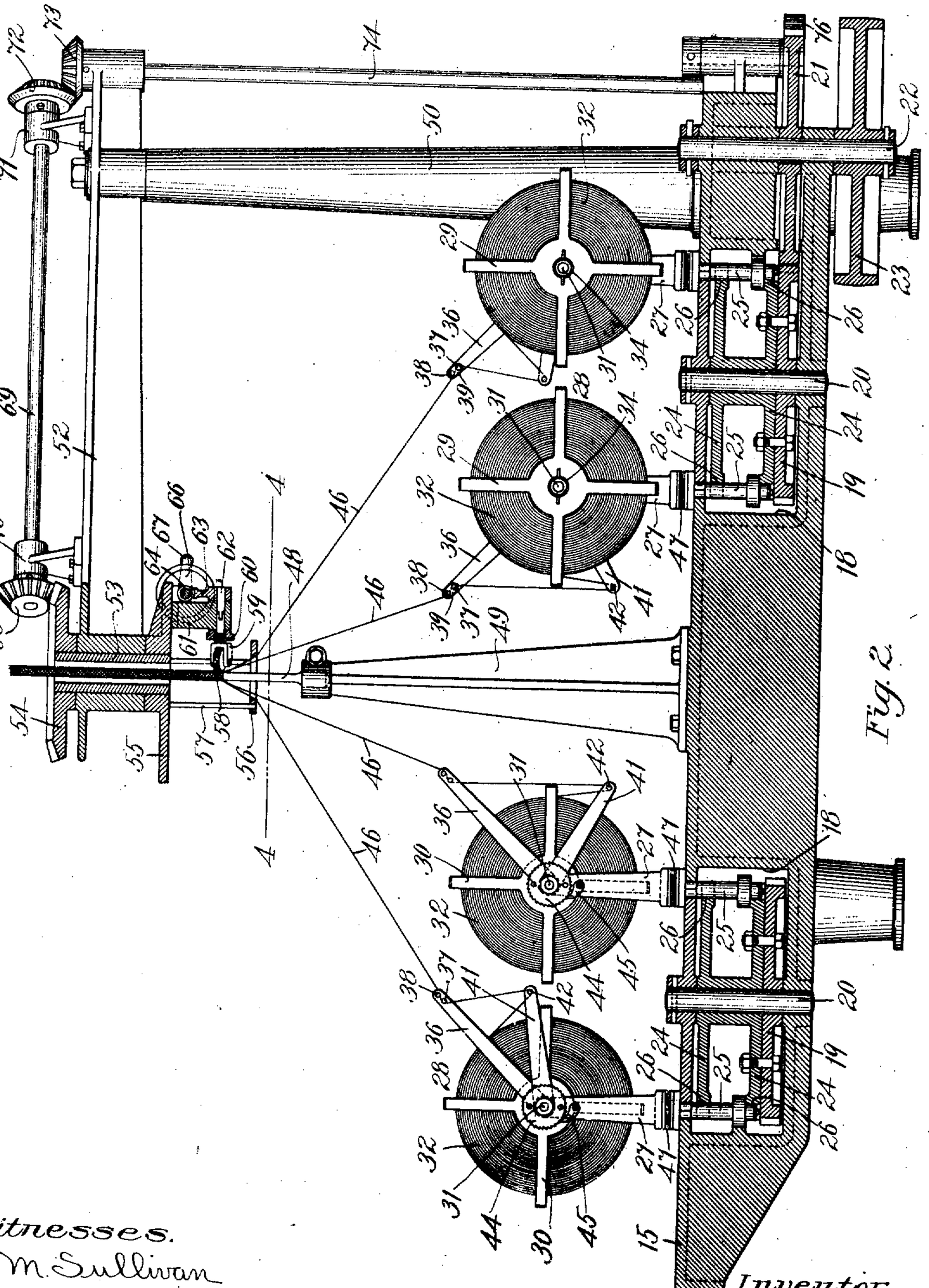

Fig. 2.

Witnesses.
K. M. Sullivan
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4 SHEETS—SHEET 3.

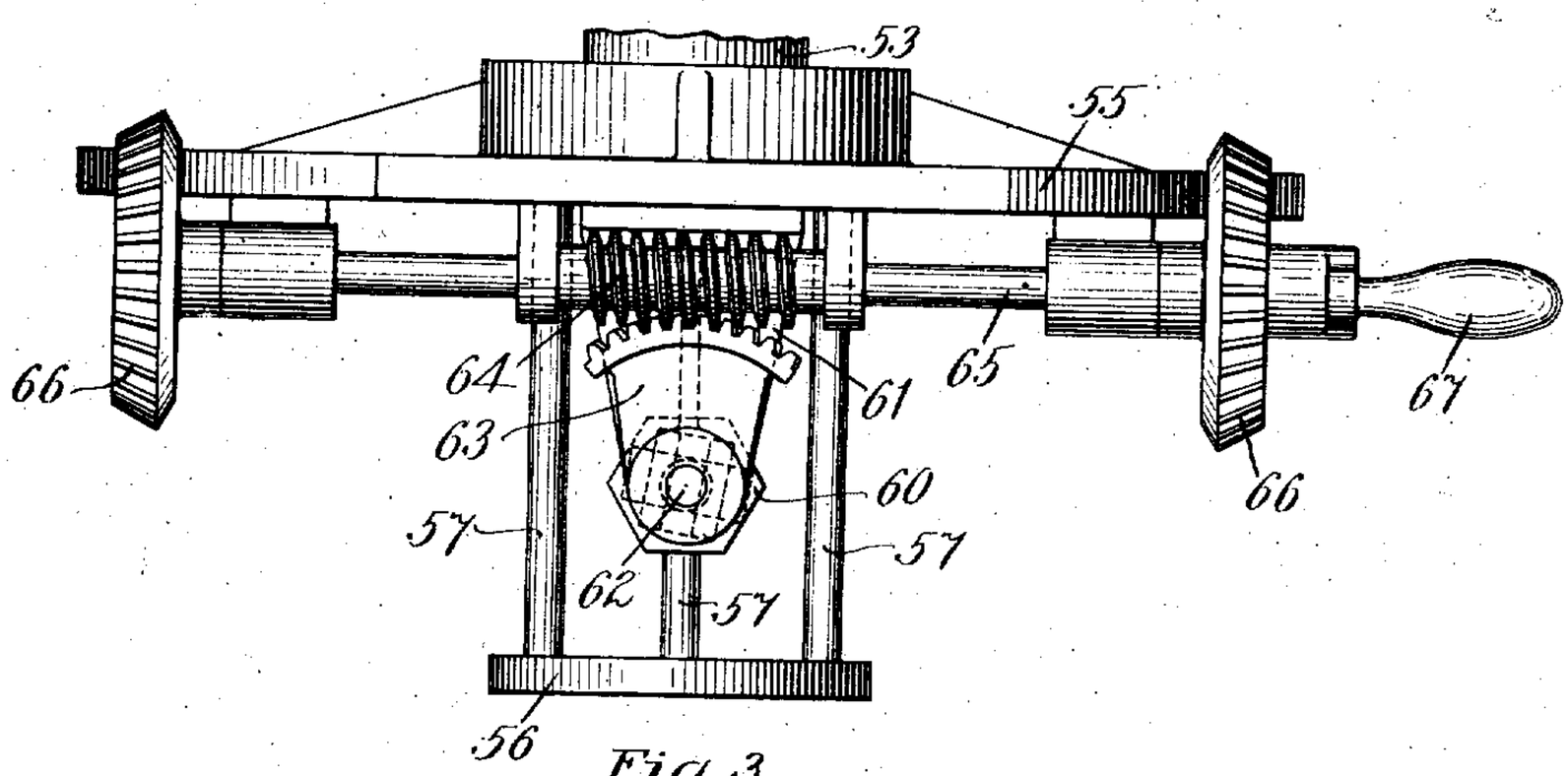

Fig. 3.

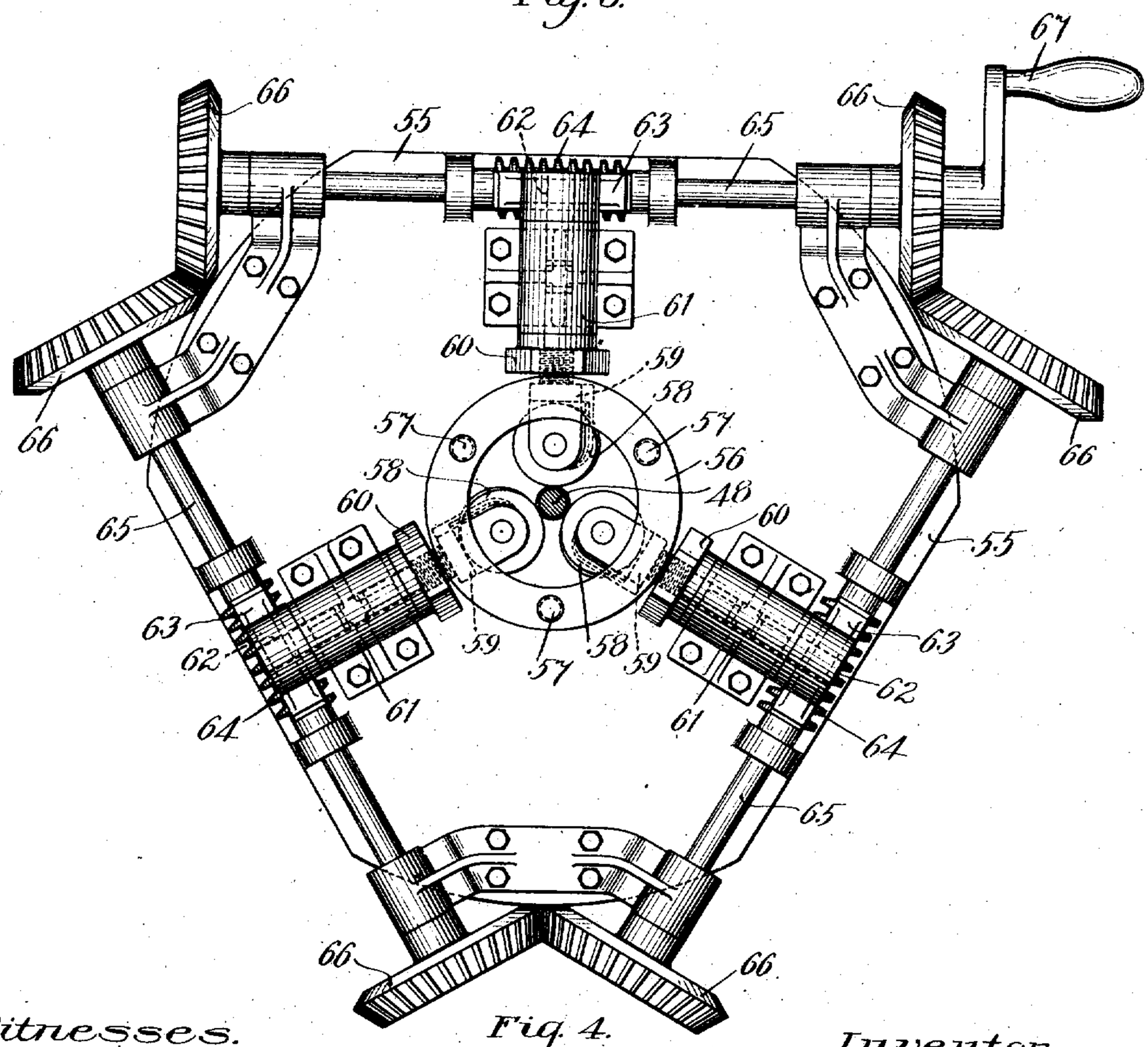

Fig. 4.

Witnesses.
K. M. Sullivan
E. M. Curtis

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4 SHEETS—SHEET 4.

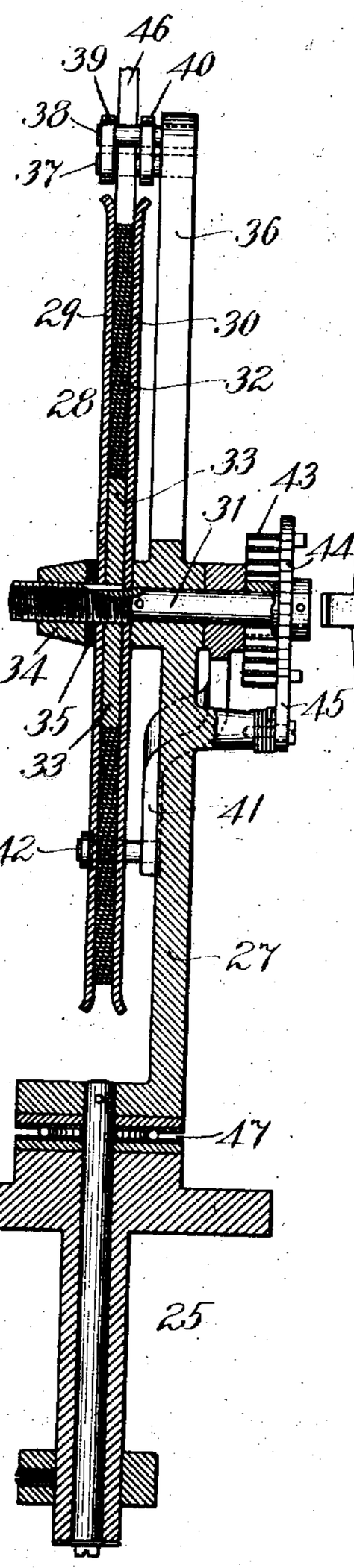

Fig. 6.

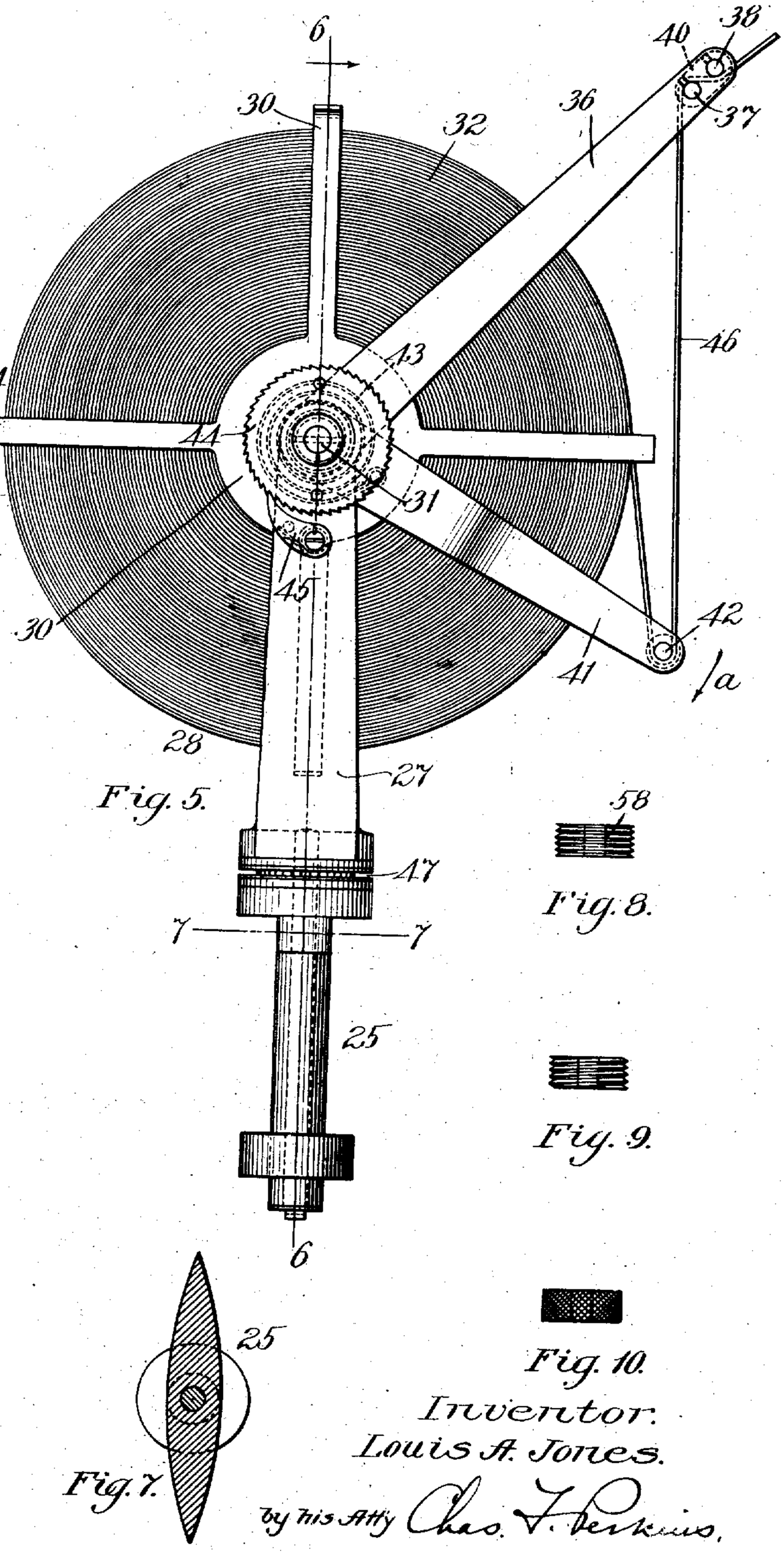

Fig. 5.

Fig. 8.

Fig. 9.

Fig. 7.

Fig. 10.

Witnesses.
K. M. Sullivan
E. K. Dustin

Inventor:
Louis A. Jones.
by his Atty Chas. F. Perkins.

UNITED STATES PATENT OFFICE.

LOUIS A. JONES, OF CAMBRIDGE, MASSACHUSETTS, ASSIGNOR TO AMERICAN CIRCULAR LOOM COMPANY, OF CHELSEA, MASSACHUSETTS, A CORPORATION OF MAINE.

MACHINE FOR BRAIDING TUBULAR FABRIC.

No. 889,311. Specification of Letters Patent. Patented June 2, 1908.

Application filed June 27, 1906. Serial No. 323,549.

To all whom it may concern:

Be it known that I, LOUIS A. JONES, a citizen of the United States, residing at Cambridge, in the county of Middlesex and State of Massachusetts, have invented new and useful Improvements in Machines for Braiding Tubular Fabric, of which the following is a specification.

This invention relates to braiding machines and more particularly to machines for braiding tubular fabric from strips of sheet material, such, for instance, as paper fiber, and the object is to provide a machine of the character described which shall be simple and efficient, and to provide means whereby the fabric is fed from said machine at a uniform rate of feed, said rate of feed being readily adjustable.

Another object is to provide a machine of the character described which by slight changes and adjustments may be used to braid tubular fabric of different diameters.

The invention consists in the combination and arrangement of parts set forth in the following specification and particularly pointed out in the claims thereof.

Referring to the drawings: Figure 1 is a plan view of my improved braiding machine. Fig. 2 is an enlarged sectional elevation taken on the line 2—2, Fig. 1. Fig. 3 is an enlarged detail elevation of a portion of the feed mechanism viewed from the right of Fig. 2. Fig. 4 is an enlarged underneath plan section taken on line 4—4 of Fig. 2. Fig. 5 is an enlarged detail side elevation of one of the reels together with its reel carrier and reel standard. Fig. 6 is a sectional elevation taken on line 6—6 of Fig. 5, looking toward the right in said figure. Fig. 7 is a detail sectional plan taken on line 7—7 of Fig. 5. Fig. 8 is an enlarged detail side elevation of one of the feed rolls. Fig. 9 is an enlarged detail side elevation of a modified form of feed-roll. Fig. 10 is an enlarged detail side elevation of a second modified form of feed-roll.

Like numerals refer to like parts throughout the several views of the drawings.

In the drawings, 15 is a guide-plate provided with two sinuous intersecting guide slots 16 and 17. The guide-plate 15 is provided with a plurality of recesses 18 in which are located spur gears 19 meshing into each other and forming a continuous train, said gears being journaled on stationary shafts 20. A spur gear 21 is fast to a shaft 22, said shaft journaled in the guide-plate 15 and said gear meshing into one of the gears 19. A driving pulley 23 is fast to the shaft 22. A plurality of exchange plates 24 are journaled on the shafts 20 and are fast to the gears 19 and rotate therewith. A plurality of reel carriers 25 are located in the guide slots 16 and 17, there being two series of said reel carriers, one series of four being located in the guide slot 16 and another series of four being located in the guide slot 17.

The exchange plates 24 are provided with notches 26 located diametrically opposite each other, said notches adapted to engage the reel carriers 25 and move them in the slots 16 and 17. One series of four reel carriers is moved in one direction in the guide slot 16 while the other series of four reel carriers is moved in the opposite direction in the guide slot 17, thus crossing and recrossing each other's paths in a manner well known to those skilled in the art. Reel standards 27 are journaled to oscillate about vertical axes on the reel carriers 25. The reel mechanisms are all identical in construction and operation and the following description of one will apply equally as well to all.

A reel 28 comprising in its construction two side plates 29 and 30 is mounted on a shaft 31, said shaft being fast to the reel standard 27. The side plate 30 is keyed to the shaft 31, but the side plate 29 is loose and free to turn on said shaft. A strip of sheet material in the form of a roll 32 is wound on a spool 33, said spool being journaled on the shaft 31. A thumb-nut 34 has screw-threaded engagement with the shaft 31. A leather friction washer 35 intervenes between the thumb-nut 34 and the side plate 29 of the reel 28. The amount of friction of the side plate 29 against the roll 32 and the spool 33 may be adjusted by means of the thumb-nut 34. A guide arm 36 preferably formed integral with the reel standard 27, is provided with two guide pins 37 and 38. Guide collars 39 and 40 are mounted on both of the guide pins 37 and 38. A take-up arm 41 provided with a pin 42 extending outwardly therefrom, is journaled to oscillate on the shaft 31. A spiral coil spring 43 is fast at one end to the take-up arm 41 and at its other end to the hub of a ratchet 44. The spring 43 tends to move the take-up arm 41 in the direction of the arrow *a*, Fig. 5. The

tension of the spring 43 may be adjusted by turning the ratchet 44, said tension being held by means of a pawl 45 pivoted to the reel carrier 27. The strand 46 leading from the roll 32 passes part way around the pin 42 on the take-up arm 41 and thence part way around the pin 37 and part way around the pin 38. As the reel carrier 35 together with the reel mechanism mounted thereon moves toward and away from the center of the machine, the take-up arm 41 by reason of the tension of the spring 43 moves down and up, thus preventing any slack in the strand 46. In order that the reel standard 27 may turn freely on the reel carrier a ball bearing 47 is provided, said ball bearing intervening between said reel standard and said reel carrier.

A mandrel 48 which is preferably slightly tapered is detachably fastened to a stand 49, said stand being rigidly mounted on the guide-plate 15. Posts 50 and 51 extending outwardly from the guide-plate 15 support a frame 52. A hollow shaft 53 journaled in the frame 52 has fast thereto at its upper end a bevel gear 54 and at its lower end a plate 55. A ring 56 is secured to the plate 55 by rods 57, 57, 57. Feed-rolls 58 are journaled in slides 59, by means of which said feed-rolls 58 may be adjusted toward and away from the mandrel 48, thus causing said feed-rolls to bear with more or less pressure against the fabric braided upon said mandrel. Said adjustment is accomplished by adjusting nuts 60 having screw-threaded engagement with the slides 59, said nuts bearing against brackets 61 fast to the plate 55. The feed rolls 58 are preferably provided with one or more annular grooves or corrugations. Shafts 62 journaled in the brackets 61 have tongue and groove engagement with the slides 59.

Worm segments 63 fast to the shafts 62 mesh into worms 64, said worms being fast to shafts 65. The shafts 65 are preferably arranged in the form of an equilateral triangle and are journaled in suitable bearings on the plate 55. Bevel gears 66 fast to the shafts 65 and meshing together in pairs cause said shafts to rotate in unison when one of them is rotated by a crank 67. By turning the crank 67, an angular relation between the axes of the feed-rolls 59 and the axis of the mandrel 48 may be varied for a purpose hereinafter described. A bevel pinion 68 meshing into the bevel gear 54 is fast to a shaft 69 mounted in bearings 70 and 71 on the frame 52. A bevel gear 72 fast to the shaft 69 meshes into a bevel gear 73. The bevel gear 73 is fast to a vertical shaft 74 mounted in suitable bearings on the post 50. A spur gear 75 fast to the shaft 74 meshes into an intermediate gear 76, said intermediate gear being fast to a shaft 77 journaled in suitable bearings. The intermediate gear 76 meshes into the driving gear 21.

The operation is as follows: Considering for a moment one reel carrier, its standard, and reel, the reel carrier being in engagement with one of the notches 26 of an exchange plate 24, said reel carrier is moved along the slot 17 until it reaches one of the intersections of said slot with the slot 16, the adjacent exchange plate then engages the reel carrier and said reel carrier passes into the notch of this latter exchange plate and is guided by its shoe across the intersection of the slots. The reel carrier is thus moved continuously in a sinuous path from one exchange plate to another. It will be observed that the operation of all of the reel carriers and reels is similar to that just described and that the reel carriers of one series continually cross and recross the path of the reel carrier of the other series thus interlacing the strands alternately over and under each other. The guiding arms 36 extend beyond the vertical axes of their respective standards towards the mandrel and by the tension of the strands the reels are always maintained in alinement with the mandrel. The feed-rolls 58, the axes of which are at all times inclined to the axis of the mandrel 48, and revolve around said mandrel bearing with a suitable pressure against the fabric braided on said mandrel act on said fabric in a manner similar to the action of a screw, causing said fabric to be fed upwardly on said mandrel. The rate of feed of the fabric may be adjusted by changing the angularity of the axes of the feed-rolls 58 with relation to the axis of the mandrel 48 as hereinbefore described, this adjustment being similar to increasing or decreasing the pitch of a screw. Although the corrugations on the feed-rolls 58 are preferably annular grooves, I may substitute therefor modified feed-rolls illustrated in Fig. 9 in which a screw-thread is substituted for the annular grooves, or I may knurl said rolls as shown in Fig. 10. The ring 56 prevents the portions of the stand 49 which intervene between said ring and the mandrel 48, from having too great an angular relation to said mandrel. The arms 36 of the reel standards 27 coöperating with the strands 46 maintain the reels 28 each with its axis at right angles to a plane in which the axes of the reel standard 27 and the mandrel 48 are located.

When it is desired to braid fabric of another diameter, the mandrel 48 may be removed and replaced by another mandrel of suitable size.

Although in the embodiment of my invention illustrated in the drawings, the reels are arranged with their axes located in a plane at right angles to the axis of the mandrel, it will be evident that I may arrange said reels with their axes either parallel or oblique to the axis of said mandrel without departing from the spirit of my invention.

Having thus described my invention what I claim and desire by Letters Patent to secure is:

1. In a machine for braiding strips of sheet material in the form of a tube, two series of reels, mechanism for moving each series in an opposite direction to that of the other, a mandrel upon which to braid the fabric, a corrugated feed-roll adapted to press said fabric against said mandrel, and mechanism to revolve said feed-roll about said mandrel, whereby said fabric is fed off of said mandrel.

2. In a machine for braiding strips of sheet material in the form of a tube, two series of reels, mechanism for moving each series in an opposite direction to that of the other, a tapered mandrel upon which to braid the fabric, a corrugated feed-roll adapted to press said fabric against said mandrel, and mechanism to revolve said feed-roll about said mandrel, whereby said fabric is fed off of said mandrel.

3. In a machine for braiding strips of sheet material in the form of a tube, two series of reels, mechanism for moving each series in an opposite direction to that of the other, a mandrel upon which to braid the fabric, a plurality of feed-rolls adapted to press said fabric against said mandrel, and mechanism for revolving said feed-rolls about said mandrel, whereby said fabric is fed off of said mandrel.

4. In a machine for braiding strips of sheet material in the form of a tube, two series of reels, mechanism for moving each series in an opposite direction to that of the other, a mandrel upon which to braid the fabric, a plurality of feed-rolls adapted to press said fabric against said mandrel, mechanism for revolving said feed-rolls about said mandrel, and mechanism for varying the pressure of said feed-rolls against said fabric.

5. In a tubular braiding machine, a guide-plate provided with two sinuous intersecting guide slots, two series of reel carriers, each series adapted to engage, respectively, one of said guide slots, reel standards journaled to oscillate about vertical axes on said reel carriers, reels journaled on said reel standards with their axes in a substantially horizontal plane, a mandrel upon which to braid the fabric, a plurality of feed-rolls adapted to press said fabric against said mandrel, the axes of said rolls located at an angle to the axis of said mandrel, and mechanism for revolving said feed-rolls about said mandrel, whereby said fabric is fed off of said mandrel.

6. In a machine for braiding strips of sheet material in the form of a tube, two series of reels, mechanism for moving each series in an opposite direction to that of the other, a mandrel upon which to braid the fabric, a corrugated feed-roll adapted to press said fabric against said mandrel, the axis of said feed-roll located at an angle to the axis of said mandrel, and mechanism for revolving said feed-roll about said mandrel, whereby said fabric is fed off of said mandrel.

7. In a machine for braiding strips of sheet material in the form of a tube, two series of reels, mechanism for moving each series in an opposite direction to that of the other, a mandrel upon which to braid the fabric, a corrugated feed-roll adapted to press said fabric against said mandrel, the axis of said feed-roll located at an angle to the axis of said mandrel, mechanism for revolving said feed-roll about said mandrel, whereby said fabric is fed off of said mandrel, and means for varying the angle of the axis of said feed-roll relative to the axis of said mandrel.

8. In a tubular braiding machine, two series of reel carriers, a guide-plate provided with two sinuous intersecting guide slots, two series of reel carriers, each series adapted to engage, respectively, one of said guide slots, reel standards journaled to oscillate about vertical axes on said reel carriers, reels journaled on said reel standards with their axes in a substantially horizontal plane, a mandrel upon which to braid the fabric, a plurality of feed-rolls adapted to press said fabric against said mandrel, the axes of said rolls located at an angle to the axis of said mandrel, mechanism for revolving said feed-rolls about said mandrel, whereby said fabric is fed off of said mandrel, and means for varying the angle of the axes of said feed-rolls relative to the axis of said mandrel.

9. In a tubular braiding machine, two series of reel carriers, a guide-plate provided with two sinuous intersecting guide slots, two series of reel carriers, each series adapted to engage, respectively, one of said guide slots, reel standards journaled to oscillate about vertical axes on said reel carriers, reels journaled on said reel standards with their axes in a substantially horizontal plane, a mandrel upon which to braid the fabric, a plurality of feed-rolls adapted to press said fabric against said mandrel, the axes of said rolls located at an angle to the axis of said mandrel, mechanism for revolving said feed-rolls about said mandrel, whereby said fabric is fed off of said mandrel, and means for simultaneously varying the angle of the axes of said feed-rolls relative to the axis of said mandrel.

10. In a machine for braiding strips of sheet material in the form of a tube, a guide-plate provided with two sinuous intersecting guide slots, two series of reel carriers, each series adapted to engage, respectively, one of said slots, mechanism for moving said series in opposite directions, respectively, reel standards journaled to oscillate about vertical axes on said reel carriers, reels journaled on said reel standards with their axes in a substantially horizontal plane, posts ex-

tending upwardly from said guide-plate, a frame supported upon said posts, a substantially vertical hollow shaft journaled on said frame with its axis coincident with the vertical median line of said guide-plate, an upwardly extending mandrel fast to said guide-plate, a plurality of feed-rolls carried by said hollow shaft, the axes of said rolls located at an angle to the axis of said mandrel, and mechanism for rotating said shaft, whereby said fabric is fed off of said mandrel.

11. In a machine for braiding strips of sheet material in the form of a tube, a mandrel upon which to braid the fabric, a guide-plate provided with a sinuous guide slot, a reel carrier adapted to engage said slot, mechanism for moving said reel carrier in said slot, a reel standard journaled to oscillate about a vertical axis on said reel carrier, a reel journaled on said reel standard with its axis in a substantially horizontal plane, said reel adapted to contain a strip of sheet material in the form of a roll, frictional tension means acting on said roll, a spring-actuated take-up arm pivoted to said reel standard, and a strand guide arm fast to said reel standard, whereby said reel by the tension on said strip is maintained with its axis at substantially right angles to a plane in which the axis of said reel standard and the axis of said mandrel are located.

12. In a tubular braiding machine, two series of reels, mechanism for moving each series in an opposite direction to that of the other, a mandrel upon which to braid the fabric, a feed-roll adapted to press said fabric against said mandrel, and mechanism to revolve said feed-roll about said mandrel, whereby said fabric is fed off of said mandrel.

13. In a tubular braiding machine, two series of reels, mechanism for moving each series in an opposite direction to that of the other, a mandrel upon which to braid the fabric, a plurality of feed-rolls adapted to press said fabric against said mandrel, and mechanism for revolving said feed-rolls about said mandrel, whereby said fabric is fed off of said mandrel.

14. In a tubular braiding machine, two series of reels, mechanism for moving each series in an opposite direction to that of the other, a mandrel upon which to braid the fabric, a plurality of feed-rolls adapted to press said fabric against said mandrel, means for varying the pressure of said feed-rolls against said fabric, and mechanism for revolving said feed-rolls about said mandrel, whereby said fabric is fed off of said mandrel.

15. In a tubular braiding machine, two series of reels, mechanism for moving each series in an opposite direction to that of the other, a mandrel upon which to braid the fabric, a plurality of feed-rolls adapted to press said fabric against said mandrel, the axes of said rolls located at an angle to the axis of said mandrel, and mechanism for revolving said feed-rolls about said mandrel, whereby said fabric is fed off of said mandrel.

16. In a tubular braiding machine, two series of reels, mechanism for moving each series in an opposite direction to that of the other, a mandrel upon which to braid the fabric, a plurality of feed-rolls adapted to press said fabric against said mandrel, the axes of said rolls located at an angle to the axis of said mandrel, means for varying the angle of the axes of said feed-rolls relative to the axis of said mandrel, and mechanism for revolving said feed-rolls about said mandrel, whereby said fabric is fed off of said mandrel.

17. In a tubular braiding machine, two series of reels, mechanism for moving each series in an opposite direction to that of the other, a mandrel upon which to braid the fabric, a feed-roll adapted to press said fabric against said mandrel, the axis of said roll located at an angle to the axis of said mandrel, and mechanism for revolving said feed-roll about said mandrel, whereby said fabric is fed off of said mandrel.

18. In a tubular braiding machine, two series of reels, mechanism for moving each series in an opposite direction to that of the other, a mandrel upon which to braid the fabric, a feed-roll adapted to press said fabric against said mandrel, the axis of said feed-roll located at an angle to the axis of said mandrel, means for varying the angle of the axis of said feed-roll relative to the axis of said mandrel, and mechanism for revolving said feed-roll about said mandrel.

19. In a tubular braiding machine, two series of reels, mechanism for moving each series in an opposite direction to that of the other, a mandrel upon which to braid the fabric, a frame, a substantially vertical hollow shaft journaled on said frame with its axis coincident with said mandrel, a feed-roll carried by said hollow shaft, and mechanism for rotating said shaft, whereby said feed-roll is revolved about said mandrel and said fabric is fed off of said mandrel.

20. In a tubular braiding machine, two series of reels, mechanism for moving each series in an opposite direction to that of the other, a mandrel upon which to braid the fabric, a frame, a substantially vertical hollow shaft journaled on said frame with its axis coincident with the axis of said mandrel, a feed-roll carried by said hollow shaft, the axis of said feed-roll located at an angle to the axis of said mandrel, and mechanism for rotating said shaft, whereby said roll is revolved about said mandrel and said fabric is fed off of said mandrel.

21. In a tubular braiding machine, two series of reels, mechanism for moving each series in an opposite direction to that of the other, a mandrel upon which to braid the fabric, a frame, a substantially vertical hol-

low shaft journaled on said frame with its axis coincident with the axis of said mandrel, a feed-roll carried by said hollow shaft, the axis of said feed-roll located at an angle to the axis of said mandrel, means for varying the angle of the axis of said feed-roll relative to the axis of said mandrel, and mechanism for rotating said shaft, whereby said roll is revolved about said mandrel and said fabric is fed off of said mandrel.

22. In a tubular braiding machine, two series of reels, mechanism for moving each series in an opposite direction to that of the other, a mandrel upon which to braid the fabric, a frame, a substantially vertical hollow shaft journaled on said frame with its axis coincident with the axis of said mandrel, a plurality of feed-rolls carried by said hollow shaft, and mechanism for rotating said shaft, whereby said feed-rolls are revolved about said mandrel and said fabric is fed off of said mandrel.

23. In a tubular braiding machine, two series of reels, mechanism for moving each series in an opposite direction to that of the other, a mandrel upon which to braid the fabric, a frame, a substantially vertical hollow shaft journaled on said frame with its axis coincident with the axis of said mandrel, a plurality of feed-rolls carried by said hollow shaft, the axes of said feed-rolls located at an angle to the axis of said mandrel, and mechanism for rotating said shaft, whereby said feed-rolls are revolved about said mandrel and said fabric is fed off of said mandrel.

24. In a tubular braiding machine, two series of reels, mechanism for moving each series in an opposite direction to that of the other, a mandrel upon which to braid the fabric, a frame, a substantially vertical hollow shaft journaled on said frame with its axis coincident with the axis of said mandrel, a plurality of feed-rolls carried by said hollow shaft, the axes of said feed-rolls located at an angle to the axis of said mandrel, means for varying the angle of the axes of said feed-rolls relative to the axis of said mandrel, and mechanism for rotating said shaft, whereby said feed-rolls are revolved about said mandrel and said fabric is fed off of said mandrel.

25. In a tubular braiding machine, two series of reels, mechanism for moving each series in an opposite direction to that of the other, a mandrel upon which to braid the fabric, a frame, a substantially vertical hollow shaft journaled on said frame with its axis coincident with the axis of said mandrel, a plurality of feed-rolls carried by said hollow shaft, the axes of said feed-rolls located at an angle to the axis of said mandrel, means for simultaneously varying the angle of the axes of said feed-rolls relative to the axis of said mandrel, and mechanism for rotating said shaft, whereby said feed-rolls are revolved about said mandrel and said fabric is fed off of said mandrel.

26. In a tubular braiding machine, two series of reels, mechanism for moving each series in an opposite direction to that of the other, a mandrel upon which to braid the fabric, a frame, a substantially vertical hollow shaft journaled on said frame with its axis coincident with the axis of said mandrel, a plurality of circumferentially grooved feed-rolls carried by said hollow shaft, the axes of said feed-rolls located at an angle to the axis of said mandrel, and mechanism for rotating said shaft, whereby said feed-rolls are revolved about said mandrel and said fabric is fed off of said mandrel.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses, this twenty-second day of June, 1906.

LOUIS A. JONES.

Witnesses:
EVERETT W. CURTIS,
ELMER L. BRIGGS.