(No Model.)

5 Sheets—Sheet 1.

W. LEACH.

SPINNING MACHINE.

No. 387,361. Patented Aug. 7, 1888.

FIG. 1

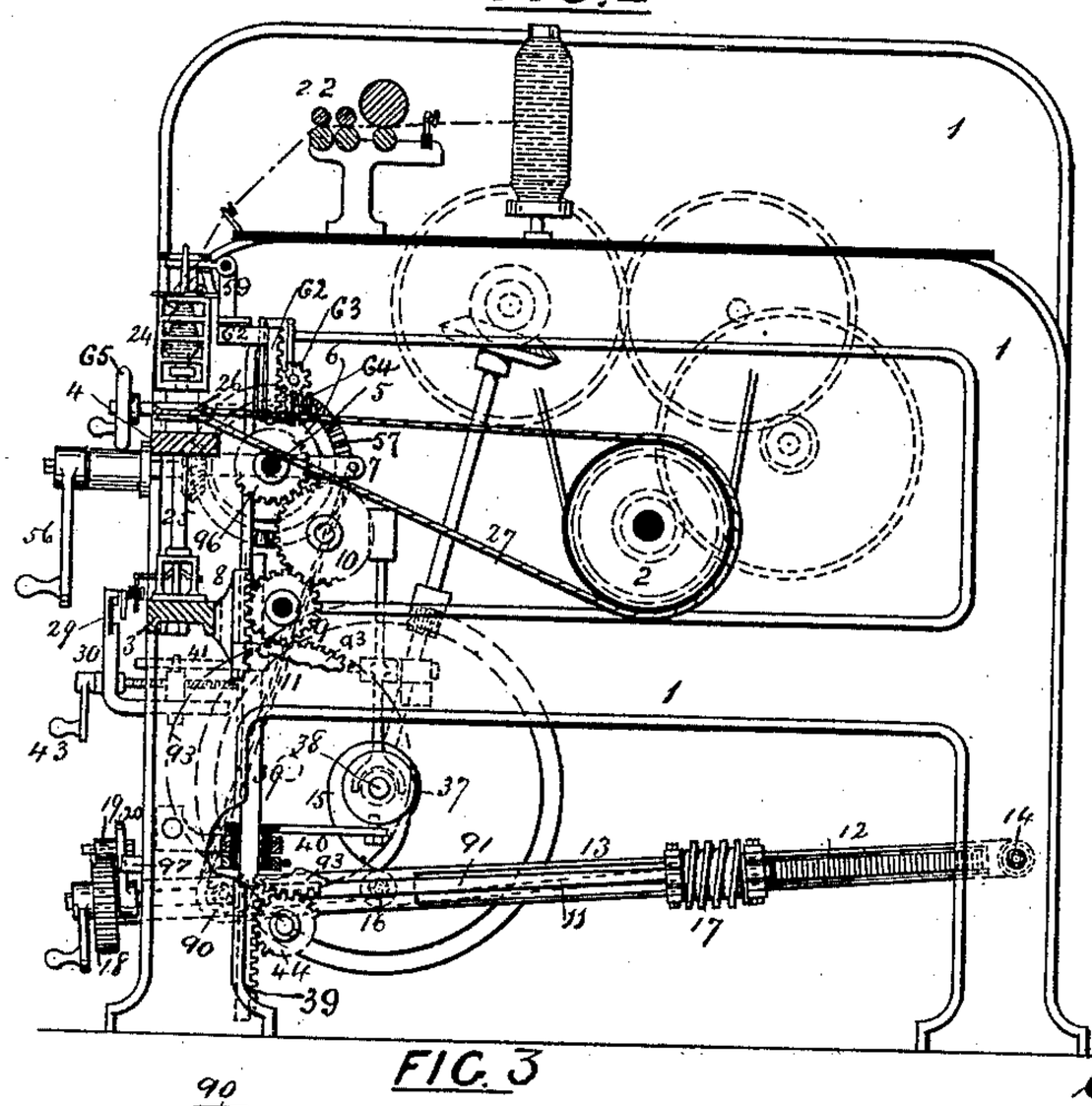

FIG. 2

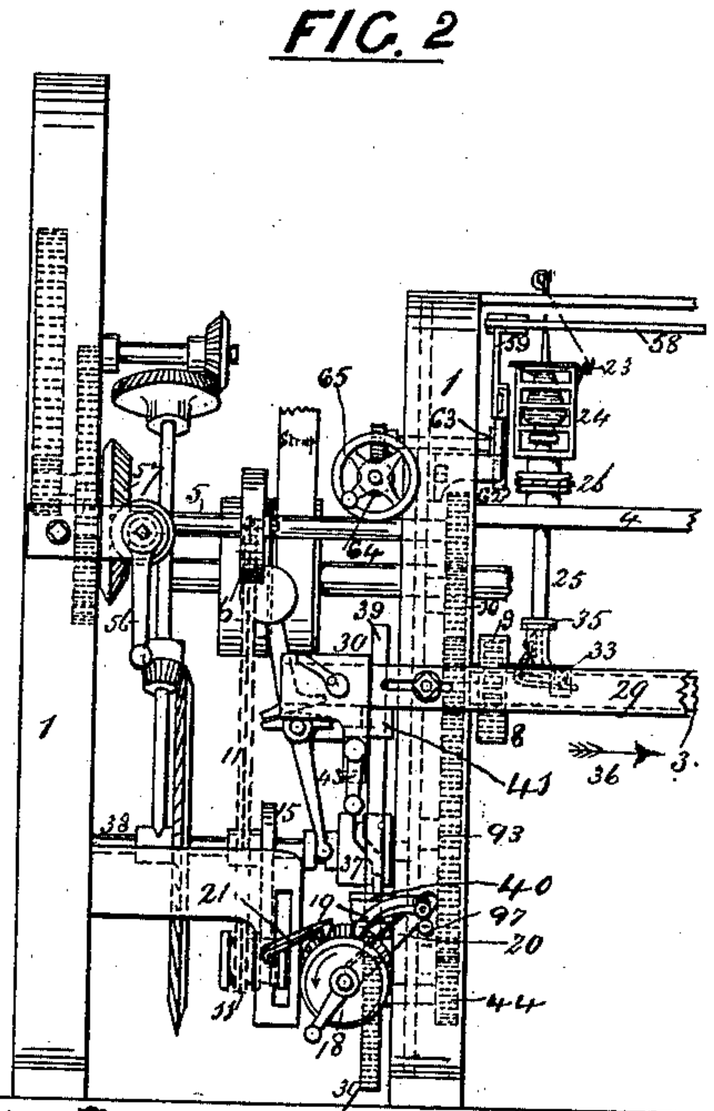

FIG. 3

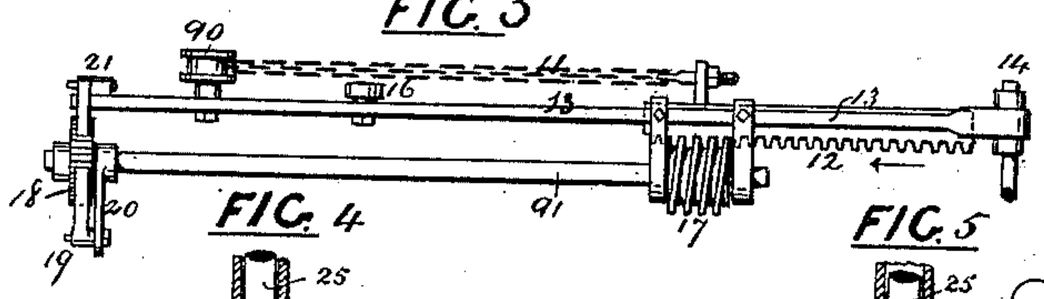

FIG. 4

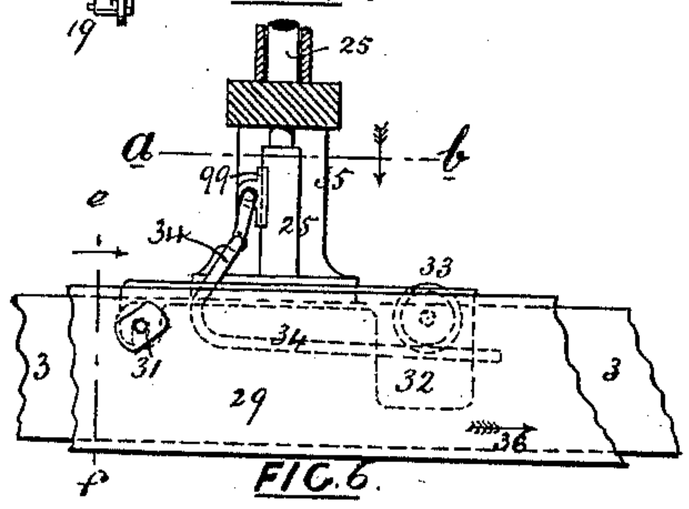

FIG. 5

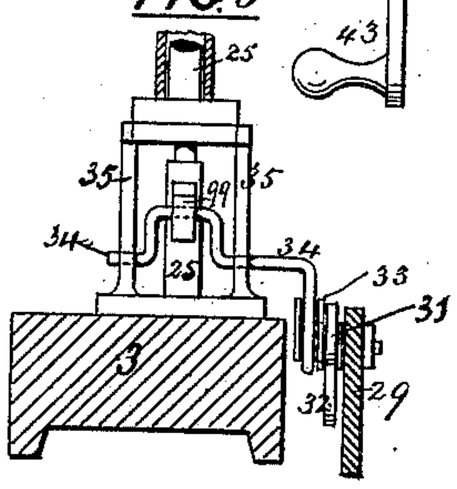

FIG. 7

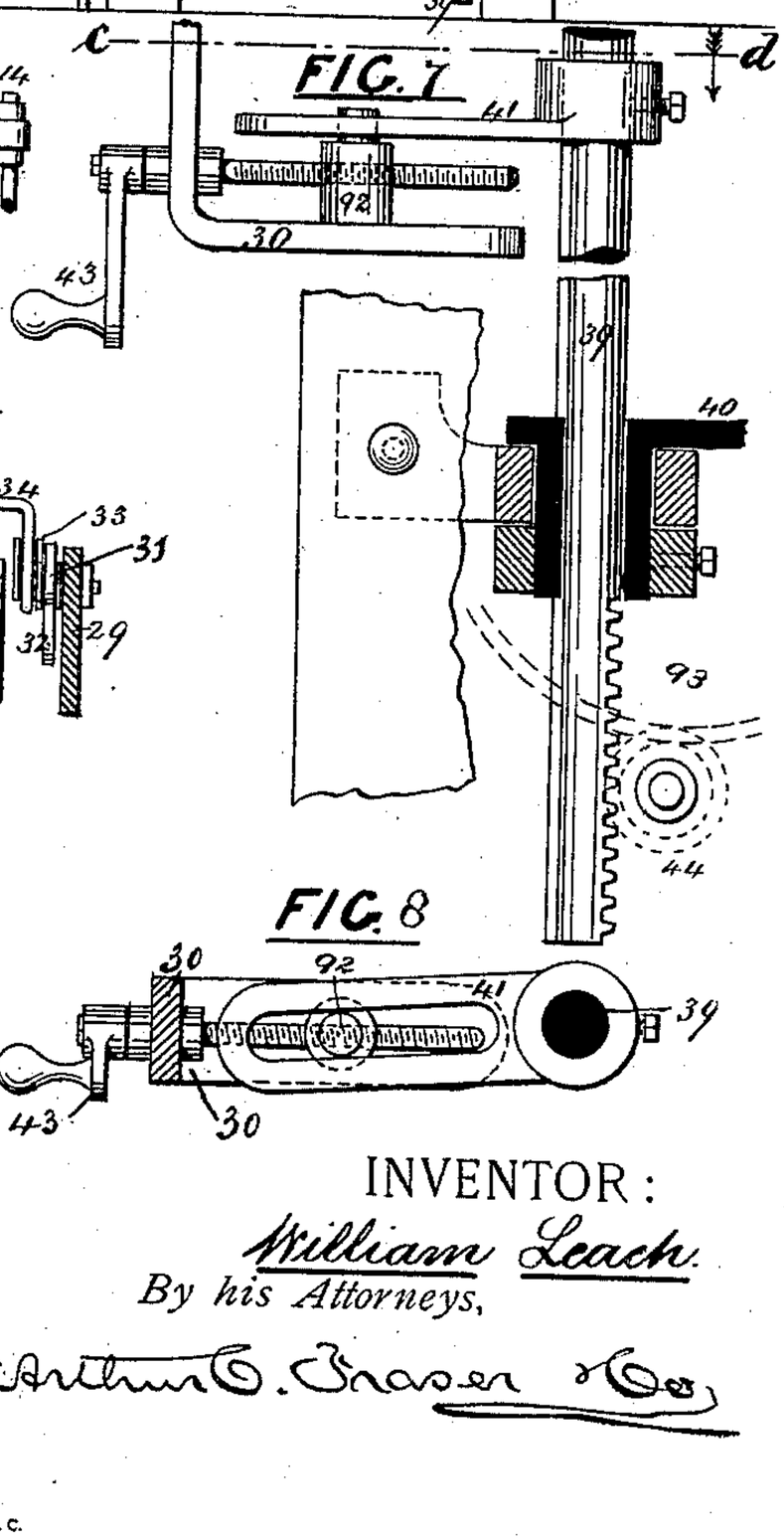

FIG. 6

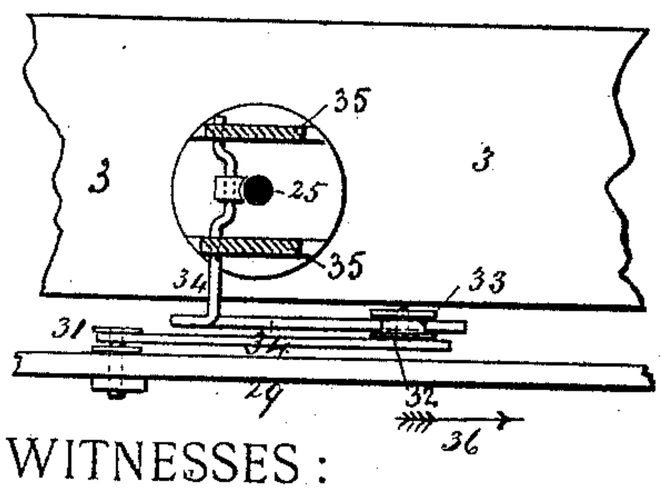

FIG. 8

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(No Model.)

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W. LEACH.

SPINNING MACHINE.

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FIG. 9.

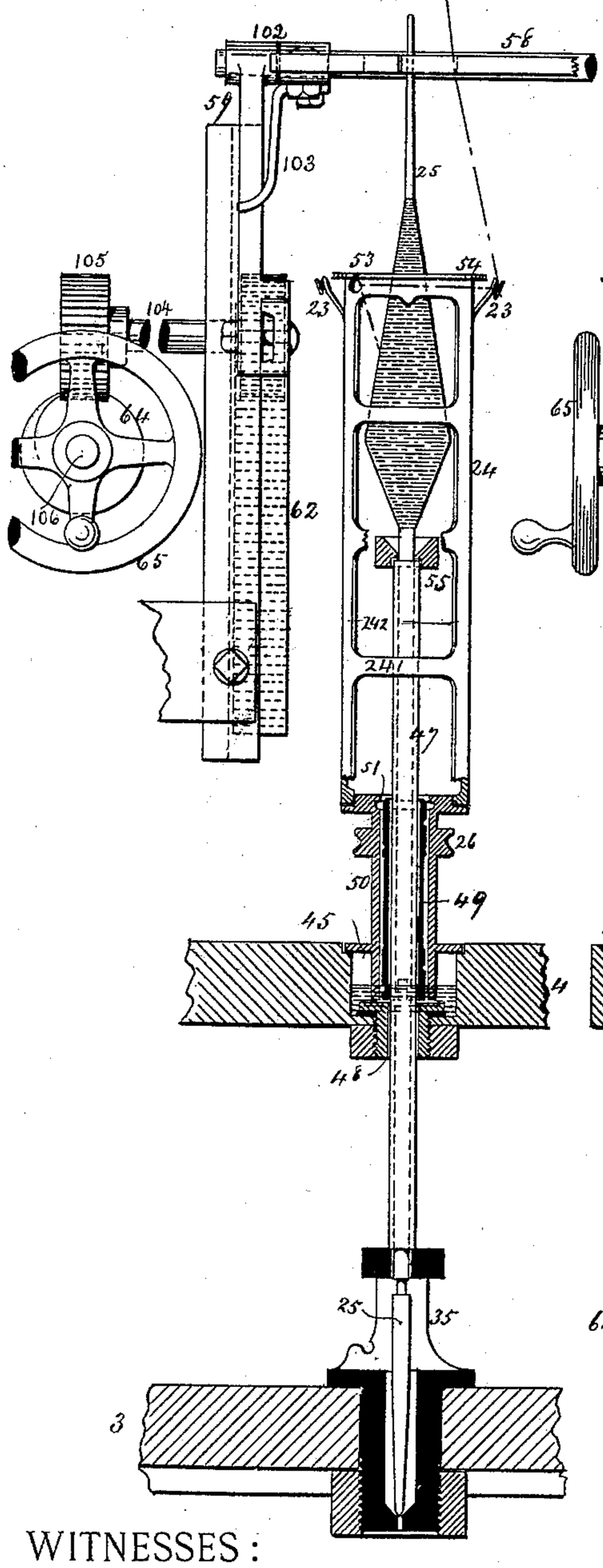

FIG. 10.

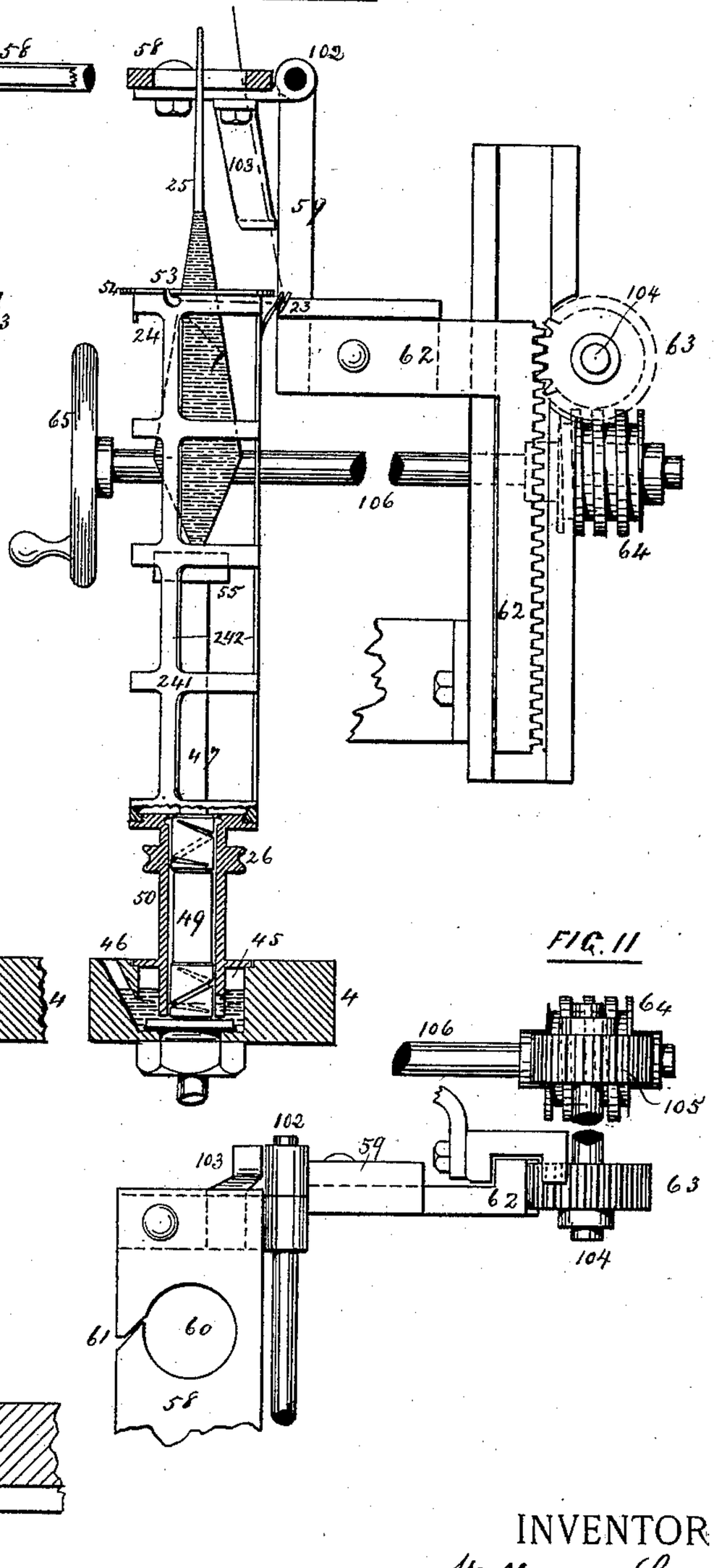

FIG. 11.

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SPINNING MACHINE.

No. 387,361. Patented Aug. 7, 1888.

FIG. 12.

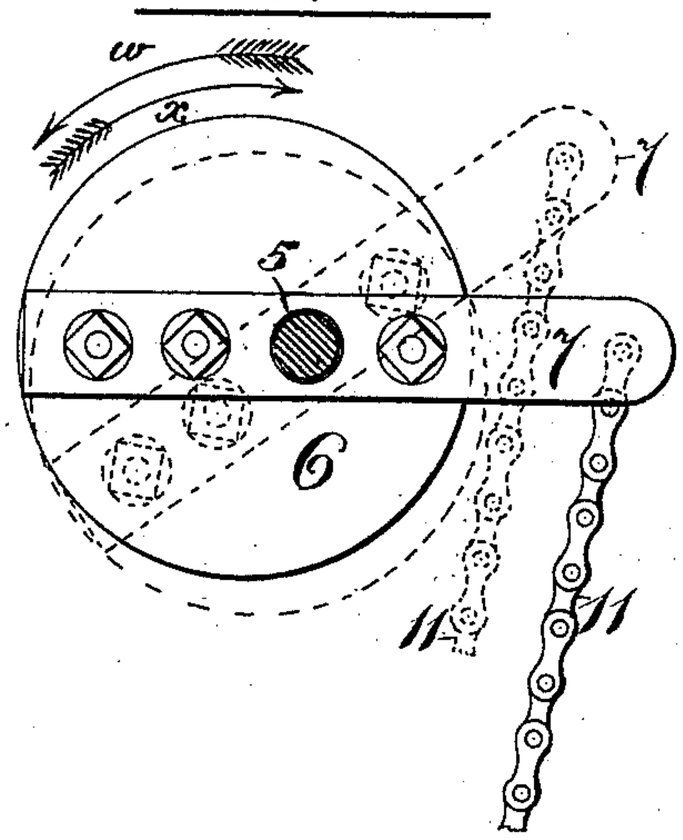


FIG. 13.

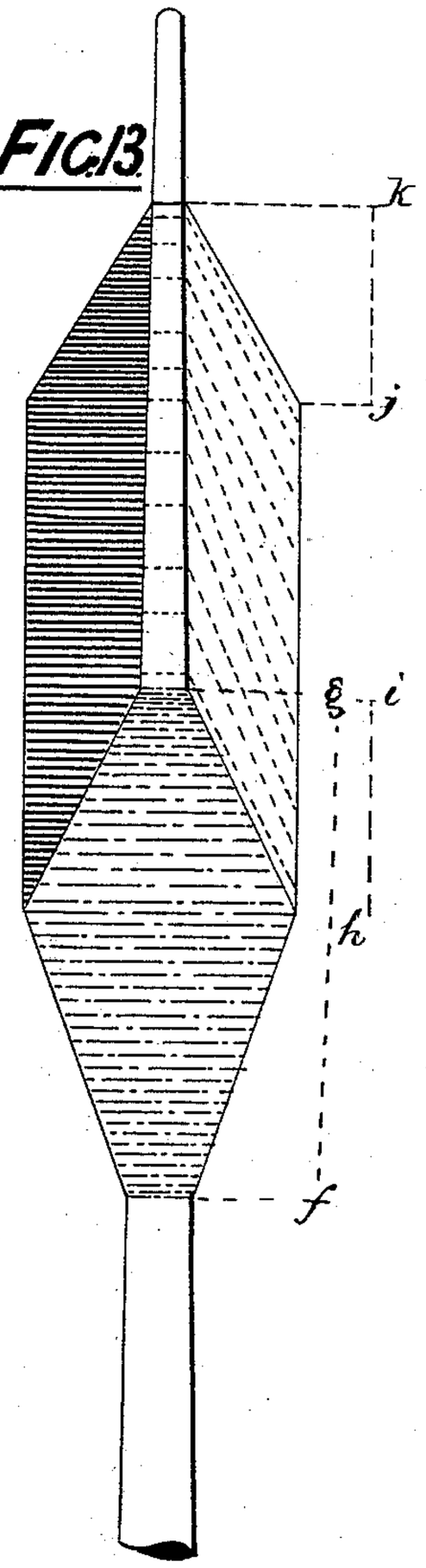


FIG. 14.

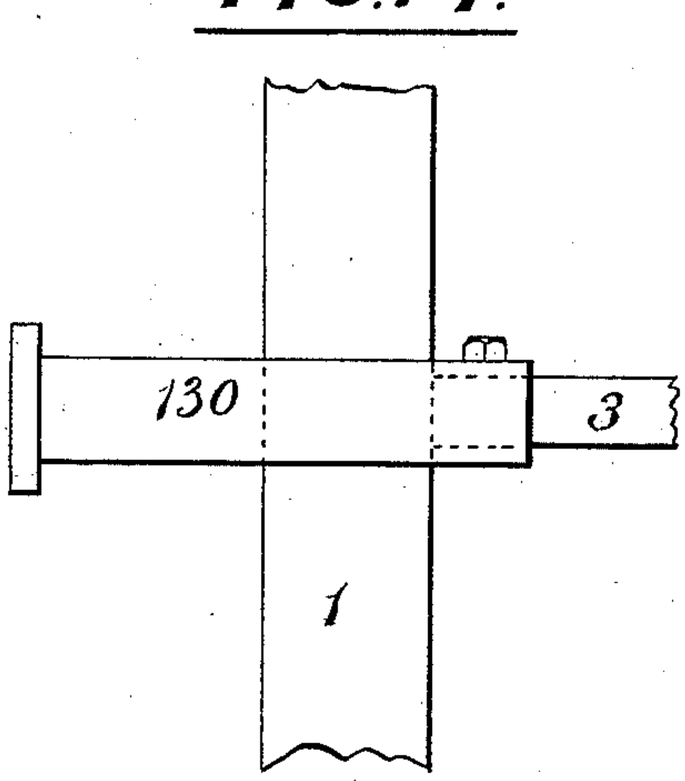
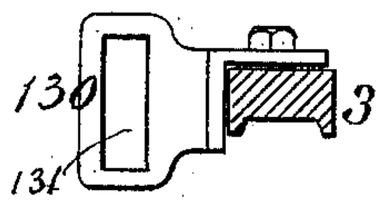


FIG. 15.



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5 Sheets—Sheet 4.

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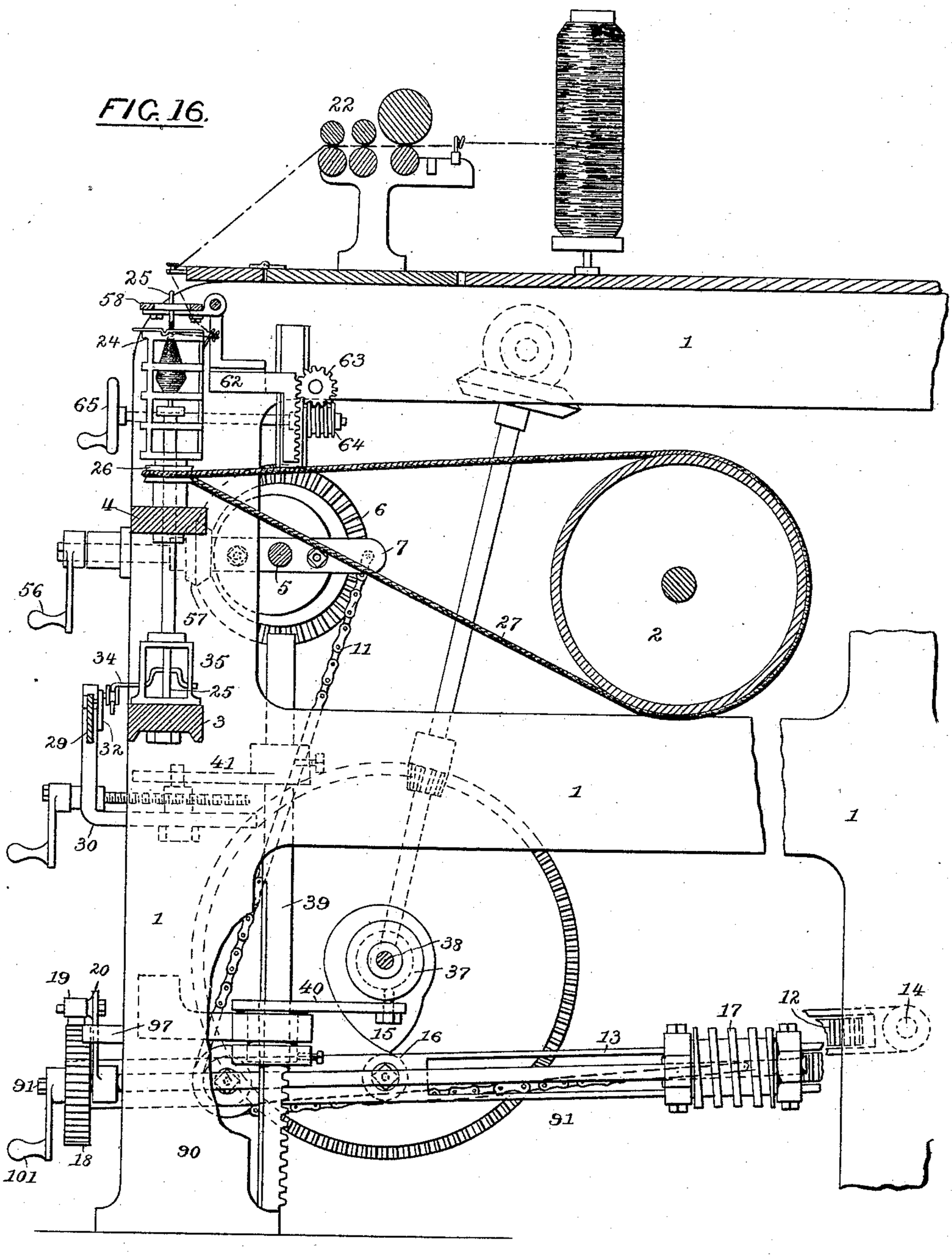
SPINNING MACHINE.

No. 387,361. Patented Aug. 7, 1888.

FIG. 16.



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SPINNING MACHINE.

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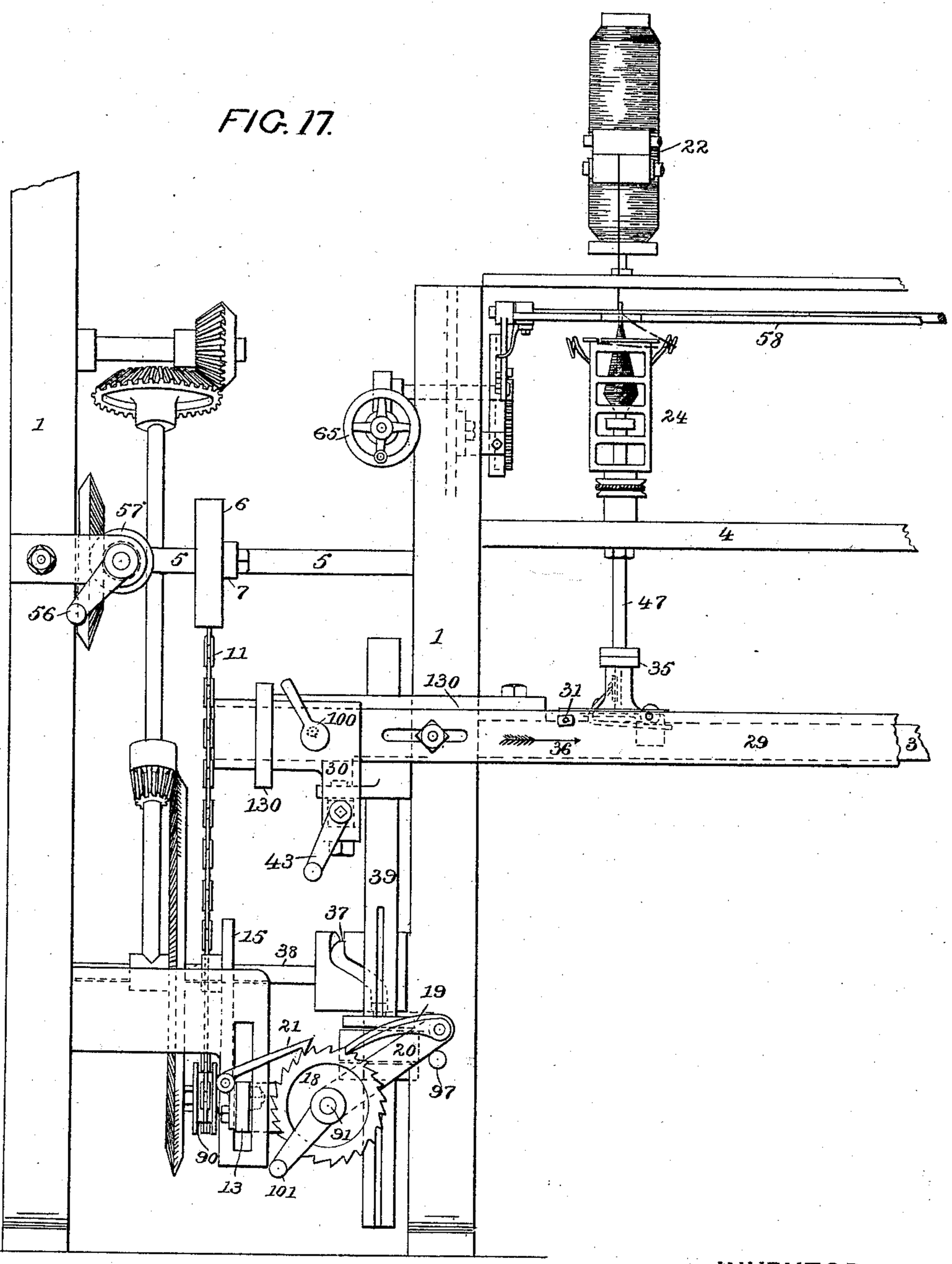
FIG. 17.



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UNITED STATES PATENT OFFICE.

WILLIAM LEACH, OF ACCRINGTON, COUNTY OF LANCASTER, ENGLAND.

SPINNING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 387,361, dated August 7, 1888.

Application filed October 6, 1886. Serial No. 215,498. (No model.) Patented in England April 9, 1884, No. 6,148.

To all whom it may concern:

Be it known that I, WILLIAM LEACH, a citizen of the United Kingdom of Great Britain, residing in Accrington, Lancashire, England, have invented certain new and useful Improvements in Spinning-Machines, (for which I have obtained Letters Patent in Great Britain dated April 9, 1884, No. 6,148,) of which the following is a specification.

My invention provides certain improvements in machinery for spinning and doubling cotton and other fibers, and relates, first, to a new copping motion employed for building the cop; secondly, to means for putting the drag or tension on the spindle; thirdly, to means for lubricating the whirl-tube which rotates upon the spindle; fourthly, to the flier for winding the yarn upon the spindle, fifthly, to means for loosening the cop and facilitating its removal from the spindle; and sixthly, to the ballooning-plates for preventing the yarn from expanding or ballooning in passing from the drawing-rollers to the flier.

My invention in its preferred construction is shown in the accompanying drawings.

Figure 1 is a vertical transverse section of so much of a "mule-throstle" as is necessary to illustrate my improvements. Fig. 2 is a front elevation of one end of the same, and Fig. 3 is a plan of the lifting-lever and attached parts shown in the lower part of Fig. 1. The remaining figures are detail views on a larger scale. Fig. 4 is a fragmentary front view, partly in section, showing the foot of a spindle. Fig. 5 is a transverse section thereof on the line *e f* in Fig. 4. Fig. 6 is a plan thereof in horizontal section on the line *a b* in Fig. 4. Fig. 7 is a side elevation of the mechanism for reciprocating the sliding bar 29, looking in the same direction as Fig. 1; and Fig. 8 is a horizontal section thereof, cut on the line *c d* in Fig. 7. Fig. 9 is a front elevation of the spindle and adjacent parts, partly in section. Fig. 10 is a side view thereof, partly in transverse section; and Fig. 11 is a fragmentary plan. Fig. 12 is a fragmentary enlargement of Fig. 1, showing part of the copping motion. Fig. 13 is an elevation of a spindle with a diagram showing the building up of the cop, and Figs. 14 and 15 are respectively a front elevation and section of part of the lifting-rail. Fig. 16 is an enlargement of the principal parts of Fig. 1, and Fig. 17 is a similar enlargement of the principal parts of Fig. 2.

I will first describe the part of my invention which pertains to the copping-motion or the mechanism for raising and lowering the spindles, referring for that purpose to Figs. 1, 2, 3, 12, 16, and 17.

The reference No. 1 denotes the framing of the machine; 2, the tin cylinder for driving the whirls; 3, the ordinary bottom lifting-rail, which is movable up and down; 4, the top rail, which is stationary; and 5, the lifting-shaft or copping-shaft, on which is fixed eccentrically the pulley 6, Figs. 12 and 16, having an arm, 7, secured to the face thereof.

A rack, 8, Fig. 1, is attached to the lifting-rail 3 and gears with a pinion, 9, which is driven by intermediate wheel, 10, from another wheel, 96, on the lifting-shaft 5. Any equivalent gearing or mechanical connection may be employed for moving the lifting-rail from the shaft 5. To one end of the arm 7, I attach a chain, 11, which is carried thence downward and passed around a sheave, 90, on the usual lifting-lever 13, and its end is connected to a chain take-up carried by said lever. This lever is hinged to the framing at 14 and carries an anti-friction roller, 16, against which comes the periphery of the usual heart-cam, 15. The parts are so arranged that at every revolution of the heart-cam the lever 13 is depressed to its lowest position, as shown on the drawings, and is released and permitted to rise.

The chain take-up is carried by the lever 13, and is adapted to pay out a short length of the chain at each vibration of the lever. It consists of a rack, 12, sliding on the lever, and to which the end of the chain is fastened, and a worm, 17, supported in brackets on the lever and gearing with the rack 12, Figs. 1 and 3. The shaft 91 of said worm extends to the front of the machine and has fixed to it a ratchet-wheel, 18. The teeth of this wheel are engaged (see Fig. 17) by the end of a pushing-pawl, 19, which is pivoted on a short arm, 20, mounted loosely on the worm-shaft. A retaining-pawl, 21, pivoted to the end of the lever 13, engages with the ratchet-wheel 18 and prevents its turning backward.

When the heart-cam 15 depresses the lever

13, the chain 11 is pulled, drawing down the arm 7 and rotating the eccentric-pulley 6 and the lifting-shaft, whereby, through the gearing, the lifting-rail 3 is raised. Just before the lever 13 has reached its lowest point of descent the pawl 19 or its arm 20 will encounter a stop-piece, 97, projecting from the frame end, and be arrested thereby while the lever 13 is completing its downward movement. Hence the pawl 19 will push the ratchet-wheel 18 around a tooth or so, according to requirement, the effect of which is to cause the worm 17 to rotate and thereby slide the rack 12 toward the front of the machine, so as to give out more length of chain. This is repeated at every revolution of the heart-cam, and consequently the lifting-rail at each up and down movement is caused to fall a little lower.

It will be understood that the several spindles (of which only one is shown in the drawings) are caused to rise and fall by the rising and falling movement of the lifting-rail, and that the yarn is wound onto the spindles from the revolving flier through eyes or guides which remain at a uniform height, so that the manner in which the cop is built up depends upon the successive positions that the rising and falling spindles assume relatively to the eye which guides the yarn to it.

Every time the heart-cam presses down the lever 13 the lifting-rail and spindles are raised and upon the reascent of the lever 13 the lifting-rail and spindles are lowered, and at each such movement a lap is wound onto the cops. At starting the lifting-rail is in its highest position, and the yarn is wound on the lower portion of the spindles, and as the winding proceeds the rail at each up and down movement is lowered a little, and the yarn is wound higher up on the spindles. Fig. 13 is a diagram of a cop. The base of the cop, being the portion from *f* to *g*, is first formed, and the yarn is subsequently wound on the portion *h* to *i*, in "chases," as indicated in dotted lines on the right-hand side of the spindle, thus building up the cop parallel until completed, with a conical nose, *j* to *k*.

The purpose of the mechanism thus far described for moving the lifting-rail, and especially of the eccentric 6 and chain 11, is to effect the proper building up of a firm parallel cop and to shorten the nose of the cop. The way in which this is accomplished may now be made clear.

At starting, the rack 12 is fully back, so that all slack of the chain 11 is taken up, and consequently the lifting-rail and spindle are at nearly the highest position and the yarn commences to wind at the base of the cop. At the first revolution of the heart-cam it presses down the lever 13, which raises the lifting-rail and spindle to their highest position, thereby winding the yarn at the lowest part of the cop, and upon the reascent of the lever 13 a part of the chain 11 is paid out, thus lowering the lifting-rail and spindle proportionally. At each subsequent rotation of the heart-cam the lifting-rail and spindle are raised a like distance and dropped to a still lower point. In Fig. 12 the full lines show the position of the parts 5, 6, 7, and 11 at starting. From this position the arm 7 is drawn down each time the chain is pulled by the lever 13, thus oscillating the shaft 5 in the direction of arrow *x*, and each time the lever 13 reascends and more chain is paid out the arm 7 rises higher, thus rotating the shaft 5 farther around each time in the direction of arrow *w*. When the arm 7 reaches the position shown in dotted lines, the base of the cop (from *f* to *g* in Fig. 13) has been completed. While the parallel portion of the cop is being built up, the chain 11 bears upon and winds partly around the eccentric-pulley 6. At first it winds upon the "clock" side of the eccentric, so that but little chain is taken up thereby, and consequently the amount of rise and fall of the lifting-rail is but little reduced; but as more chain is paid out and the eccentric-pulley 6 turns farther and farther around the chain winds each time more on the "full" side of the eccentric, and the same extent of movement of the lever 13 and of the chain consequently oscillates the shaft 5 through a shorter arc, and hence the vertical movement of the lifting-rail and spindle is shortened. The result is that the chases wound on the spindle are successively shorter, although wound in the same time, so that they are successively more obtusely conical. Thus the nose of the cop is shortened, as will be observed by comparing the dimension *h* to *i* in Fig. 13 with *j* to *k*.

The part of the copping-motion which comprises the lifting-lever 13, the chain take-up, by which a little chain is given out at each movement of the lever, and the gearing rotated by the winding and unwinding of the chain and which communicates the movement of the lifting-rail, possesses no special novelty and may be replaced by any known or equivalent mechanism.

I will now describe the second part of my invention, which relates to means to be employed for putting the drag or tension on the spindle, to resist its rotation by the tension of the yarn in winding on.

The yarn under operation comes from the delivery-rollers 22, Fig. 1, to the flier or cage 24, where it passes through one or more eyelets, 23, Fig. 9, whence the yarn passes to the spindle 25, onto which it is wound, the tension thereon pulling the spindle around, but the rotation of the spindle varying according to the difference between the outer diameter of the cop and the bare spindle, which varies as each chase or conical layer is laid on. The cage is driven positively and at one uniform speed by being carried with the whirl 26, which is driven by the band 27 from the tin cylinder 2, Fig. 1. Consequently the spindle and cage rotate at different speeds. Hence it is necessary to secure a uniform tension on the yarn that the drag on the spindle shall be varied in proportion as the diameter of the cop

varies at the point where the yarn is winding on. For this purpose I employ a reciprocating bar, 29, Figs. 16 and 17, caused to slide endwise, and connected to and carried up and down by the lifting-rail 3 through the medium of a bracket, 130, fastened thereto, as shown in Figs. 14, 15, and 17. This reciprocatory bar is provided with studs 31, Figs. 4, 5, and 6, one for each spindle, and on each stud is placed a weighted lever, 32, carrying at its weighted end a small grooved roller, 33, which bears on the lower arm of a bell-crank lever, 34, attached to the side of the footstep 35, while the other end of the said bell-crank lever bears against the spindle either directly or through a brake-shoe, 99, as shown. It will be understood that when the reciprocatory bar 29 moves in the direction of the arrow 36 the roller 33 on the weighted end of the lever 32 will advance to the end of the bell-crank lever, whereby the latter will be depressed to such an extent that the brake-shoe will be brought to bear against the spindle, the pressure thereof varying according to requirement. The opposite movement of the reciprocatory bar releases the bell-crank lever. The grooved roller thus acts as a shifting weight, moving out or in along the horizontal arm of the bell-crank lever, and consequently acting at greater or less leverage. The effect of sliding the bar 29 to the right is thus to apply more pressure to the brake-shoes 99, while its movement to the left releases this pressure.

Reciprocatory motion is given to bar 29 by a grooved cam, 37, Figs. 1 and 17, fixed upon the heart-wheel shaft 38. A vertical shaft is shown at 39, Fig. 16, which receives oscillatory motion from cam 37 by means of a stud projecting from an arm, 40, projecting from said shaft, which stud enters the cam-groove in the said cam 37. The arm 40 is splined on the shaft 39, so that it turns the latter, and it is kept from moving vertically with the shaft by being socketed in the frame, as shown in Fig. 7.

41 is a slotted plate secured near the top of the vertical shaft 39. (See Figs. 7 and 8.) This slotted plate 41 receives a stud, 92, projecting up from a cranked bracket, 30, which bracket is secured to the reciprocatory bar 29. In order, therefore, to impart a two and fro motion to the said bar 29, the rotation of the cam 37 will vibrate the arm 40, in doing which the vertical shaft is oscillated, causing the slotted plate 41 to vibrate, and hence reciprocating the stud 92 and the bracket 30, which communicates the motion to the bar 29. The extent of the movement can be regulated by turning a crank, 43, and the screw fixed thereto, which passes through the stud 92, whereby the stud is moved out or in along the slot. As the reciprocatory bar 29 is borne by the lifting-rail 3, it necessarily follows that the said bar will rise and fall with the lifting-rail; but as the slotted plate 41 is fixed to the vertical rocking shaft 39, it will be necessary for the said rocking shaft also to rise and fall at the same time and speed as the lifting-rail. To accomplish this, I have formed a rack at the bottom of the rocking shaft 39, which is engaged by a pinion, 44. This pinion receives rotary motion from the pinion 9 through an intermediate gear, 93, Fig. 1, and hence the shaft 39 and its arm 41 are caused to rise and fall in unison with the lifting-rail.

The bracket 30, through which the horizontal reciprocatory motion is transmitted to the bar 29, slides in the opening 131, Fig. 15, of bracket 130. The bracket 30 is provided with an eccentric, 100, by turning which the bar 29, which is engaged by the eccentric-wrist shown in dotted lines in Fig. 17, may be moved bodily to right or left relatively to the bracket 30. By thus adjusting the bar 29 the initial tension or drag exerted on the spindles by means of the rolling weights carried by the bar 29 may be adjusted at will to adapt it to spinning different classes of yarn. For example, for spinning heavy yarns a less degree of drag on the spindles is required than for spinning finer yarns. This adjustment is made only when necessary to suit the different kinds of yarn used and does not affect the reciprocatory action of the bar 29.

I will now describe the third part of my invention, which consists in a novel construction of the spindle and whirl, whereby their lubrication is improved. This part of my invention is shown best in Figs. 9 and 10 of the drawings. The spindles are connected to the ordinary lifting-rail of the machine, so that they rise and fall with it.

In Figs. 9 and 10, 3 is the lifting-rail, and 4 is the top rail, which is stationary. 25 is one of the spindles, which is stepped at its foot in the footstep 35, as usual. The spindle passes freely through a long tube, 47, which is bushed at the top for steadying the spindle, and which is fastened at its lower end to the footstep 35, so that it is non-rotative and rises and falls with the lifting rail and spindle. This tube 47 passes through the top rail, 4, and in the latter is formed an oil cup, 45, (one for each spindle,) supplied with oil through a channel, 46, Fig. 10. In the bottom of the oil-cup is a screwed bush, 48, which steadies the tube 47. A tube, 49, is placed around the tube 47 with its lower end in the oil-cup. The whirl 26 is formed on a tube, 50, which passes freely over the tube 49 and is guided thereby. The lower end of tube 50 rests in the bottom of the cup and is submerged in the oil contained therein, which oil is forced up between the tubes 49 and 50 to lubricate the same.

The tube 49 has two spiral grooves on its surface, Fig. 10, the lower spiral groove guiding the oil upward from the cup, and the upper spiral groove guiding it back again for the purpose of lubricating the tube 50. An annular groove, 51, is formed in the upper end of the whirl-tube, which prevents the oil from working out at the top. By means of this construction the lubrication of the rapidly-rotating whirl is effective and continuous.

The means of winding the yarn upon the spindle, constituting the fourth feature of my invention, is also best shown in Figs. 9 and 10. As the flier I employ a cage or long perforated collar, 24, which, when in position, surrounds the spindle, and is attached by any suitable means to the top of the whirl 26. The cage is cylindrical in form, concentric with the axis of the spindle, and is constructed with a succession of rings, 241, one above another, connected by upright bars 242. Near the top of the cage are three or other suitable number of eyelets or hooks, 23, through one or more of which the yarn passes on being wound onto the spindle. When spinning, the yarn, after leaving the front drawing-rollers, 22, Fig. 1, passes through an eyelet in the ordinary eyelet-board, then through an eyelet or hook on the cage, and around or partially around the latter to a slit, 53, made in the top thereof, and finally it is conducted to the spindle 25, upon which it is wound. The several eyelets or hooks on the cage may be employed to vary the drag or tension on the yarn, in which case the yarn can be made to bear more or less upon the periphery of the cage, according to the drag required and according to the counts of yarn being spun. In order to prevent the yarn slipping off the top of the cage, a rim or flange, 54, or a groove, is formed on or attached to the top of the cage, under which rim the yarn passes.

The form of cage or perforated long collar 24 is such that it covers up the cop-bottom, so that the latter is out of reach of the operative when "doffing." In order, therefore, to enable the cop to be loosened, so that it may be easily removed, I provide a washer, 55, which rests loosely on the top of the long tube 47, Fig. 9, so that when the cop is completed the spindle may be lowered (below its lowest spinning position) until this washer rests on the bottom of the cage and arrests the cop, holding it while the spindle is still farther lowered and pulled down through the cop some little distance, until the cop is loosened, so that it may be easily taken off. To thus lower the spindles, the crank 56 is operated, and by means of bevel-wheels 57 the shaft 5 is partially rotated, thereby (through gearing 8, 9, 10, and 96) lowering the lifting-rail 3 and the spindles. To enable the lifting-rail to be thus lowered, the chain 11 must first be paid out, which is done by screwing forward the rack 12 on the lever 13 by turning the crank 101 on the worm-shaft 91. The cops are then removed and the lifting-rail is put back ready for another operation.

Lastly, my invention has reference to the ballooning-plates employed for the purpose of preventing the yarn from expanding or ballooning as it is being wound upon the spindle. These ballooning-plates are placed above the cage and have large holes in them concentric with the axes of the spindles. The yarn whirls around within the holes in the plate, and the size of the hole prevents the yarn ballooning or being thrown out centrifugally beyond the diameter of the hole, so that it cannot come into contact with the yarn being wound upon the next spindle. I hinge the plates so that they may be thrown back, and provide a lifting-gear for running them up, where they shall be out of the way in doffing. This part of my invention is shown in Figs. 1 and 2, and in Figs. 9, 10, and 11, which are enlarged views. 58 is the ballooning-plate, hinged to the bracket 59 by hinges 102, and provided with arms 103, which when it is turned down strike the bracket 59 and serve as stops to hold the plate in horizontal position. In order that the yarn may be inserted in the hole 60 there are slits 61 made therein, as seen in the plan view, Fig. 11. When the cops are fully formed and it is necessary to remove them from the spindles, the ballooning-plate is raised to a position above the spindles and sufficiently high to permit the cops to be removed from the spindle. For this purpose the bracket 59, carrying the ballooning-plate, is attached to a rack, 62, Fig. 10, gearing with a pinion, 63, fixed on shaft 104, carrying worm-wheel 105, which is driven by worm 64, on the shaft 106 of which is a hand-wheel, 65. These parts, or any equivalent ones, constitute the lifting-gear for the ballooning-plate. When the cops are full and ready for removal, the hand-wheel 65 is turned and the rack 62 elevated thereby, so as to lift the ballooning-plate clear of the spindle.

I claim as my invention the following-defined features and combinations as applied to spinning-machines, namely:

1. The combination, with the spindles and lifting-rail, of a copping-motion consisting of a vibrating lifting-lever and mechanical connections between said lever and the lifting-rail for imparting reciprocating motion from the former to the latter, and including as part of said connections a chain, a chain take-up adapted to pay out a portion of said chain at each vibration of the lever, and an eccentric-pulley arranged relatively to said chain, substantially as described, so that as the chain is paid out at each reciprocation it will wind each time more on the eccentric-pulley, whereby a given reciprocation of the chain produces each time a decreased oscillation of the pulley, which, being communicated to the lifting-rail, results not only in lowering the latter at each reciprocation to a lower level, but also successively shortens its reciprocating movement, and thereby builds up the cop with chases which are successively more obtusely conical.

2. The combination, with the spindles and lifting-rail, of a copping-motion consisting of a lifting-shaft geared to the lifting-rail, an eccentric-pulley on said shaft, a chain connected to and adapted to wind on said pulley, a vibrating lifting-lever to which said chain is connected, whereby on the vibration of said lever it alternately pulls and releases the chain, and thereby causes the oscillation of said pulley, and a chain take-up carried by said lever and

adapted to pay out a portion of said chain at each vibration of the lever, substantially as set forth.

3. The combination, with the spindles and lifting-rail, of a copping-motion consisting of lifting-shaft 5, geared to the lifting-rail, an eccentric-pulley, 6, on said shaft, an arm, 7, fixed to said shaft, a chain, 11, connected to said arm and adapted to wind on said pulley, a lifting-lever, 13, to which the opposite end of said chain is connected, and a chain take-up carried by said lever and adapted to pay out a portion of said chain at each vibration of the lever, substantially as set forth.

4. The combination, with the lifting-rail and the spindles carried thereby, of tension-levers bearing against said spindles in order to apply a drag thereto, shifting weights applied to said levers and adapted by moving toward or from their fulcra to vary said drag, and a reciprocatory sliding bar arranged parallel with the series of levers and connected to said weights, whereby the reciprocation of said bar simultaneously shifts all of said weights and varies the drag equally on all the spindles.

5. The combination, with a spindle, of a tension-lever bearing against said spindle in order to apply a drag thereto, a shifting weight consisting of a weighted arm having a roller rolling on one arm of said lever, a reciprocatory bar to which said weighted arm is pivoted, and mechanism, substantially as set forth, for reciprocating said bar.

6. The combination, with a spindle, of a tension-lever bearing against said spindle to apply a drag thereto, a shifting weight bearing against one arm of said lever, a lifting-rail for lifting the spindles, a reciprocatory bar borne by said lifting-rail and rising and falling with it, and connected to said shifting-weight and adapted to shift the same, and mechanism, substantially as set forth, for reciprocating said bar.

7. The combination, with a spindle, of a tension-lever, a shifting weight bearing against one arm of said lever, a lifting-rail for lifting the spindles, a reciprocatory bar borne by said lifting-rail, connected to said shifting weight to shift the same, a cam-shaft, mechanism driven from said shaft for lifting and lowering said lifting-rail, and mechanism, substantially as set forth, driven from the same shaft for reciprocating said bar.

8. The combination, with a spindle, of a tube inclosing it, the lifting-rail for raising and lowering the spindle, the stationary rail through which the spindle and tube pass, an oil-cup in said rail, a screw-bushing beneath said oil-cup and embracing said tube, and the whirl and its tube, with the latter projecting into the oil-cup, substantially as set forth.

9. The combination of the spindle, the mechanism for raising and lowering it, the rotary cage inclosing the spindle having an outwardly-projecting flange at its top, and eyelets for guiding the yarn and applying a tension thereto, and the whirl attached to said cage, substantially as set forth.

10. The combination of the spindle, the mechanism for raising and lowering it, a rotary cage arranged to inclose the spindle and cop, constructed of cylindrical form, with an outwardly-projecting flange, 54, at its top, and having eyelets 23 for guiding the yarn around the cage beneath said flange to apply a tension thereto, and eyelets 53 for guiding the yarn to the cop, and the whirl attached to said cage, substantially as set forth.

11. The combination of the spindle, mechanism for lowering it, a tube inclosing it, the rotary cage inclosing the spindle, and a loose washer at the top of said tube, whereby on lowering the spindle said washer is arrested by the bottom of the cage and holds the cop while the spindle is lowered within it to loosen the cop, substantially as set forth.

12. The combination, with the spindles, of the ballooning-plate, a vertically-moving frame by which said plate is carried, and a lifting-gear for raising said frame in order to lift the ballooning-plate sufficiently to facilitate doffing, substantially as set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

WILLIAM LEACH.

Witnesses:

GODFREY RHODES,
Solicitor and Notary, Halifax.

A. B. CROSSLEY,
Commercial Street, Halifax.