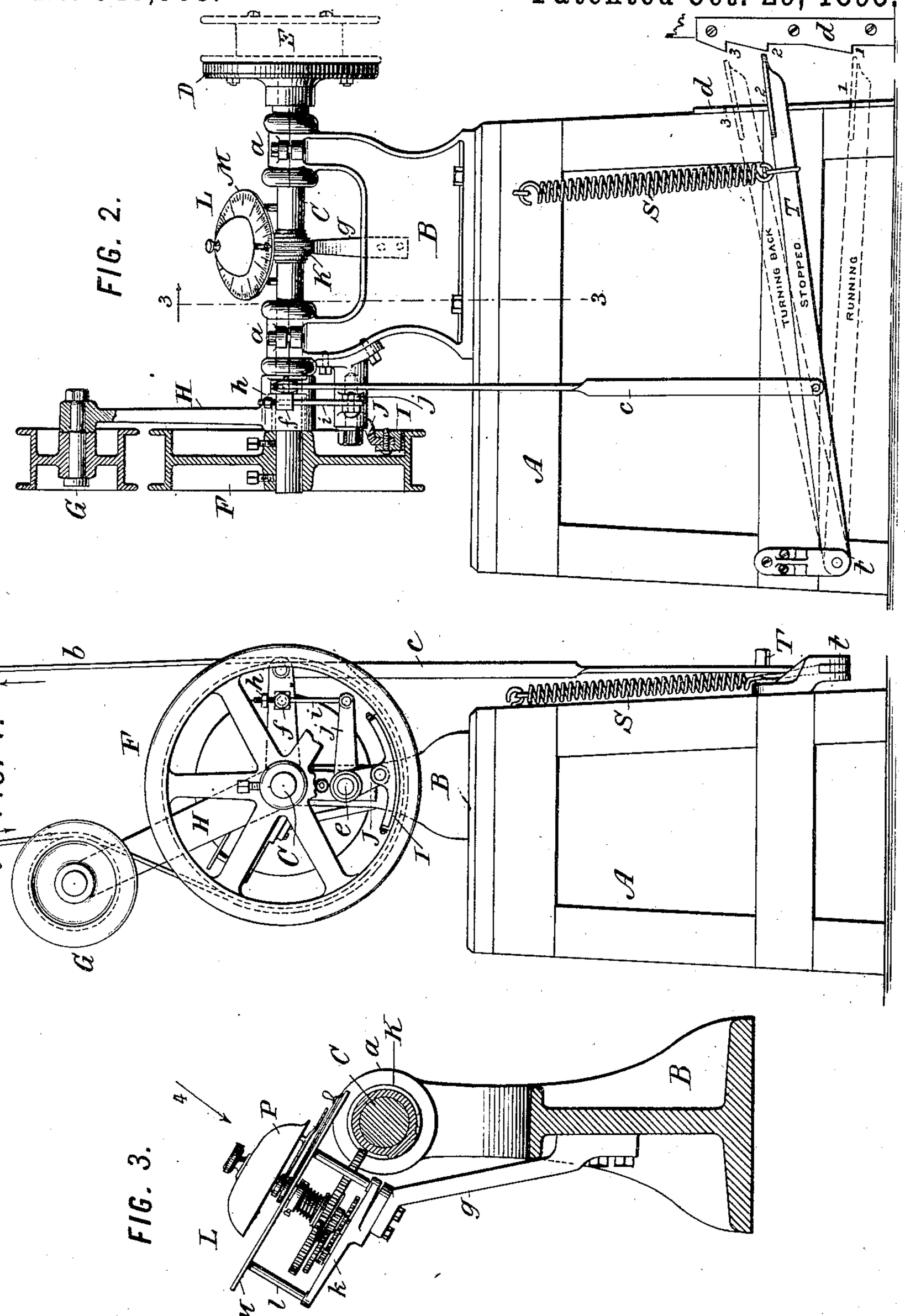
(No Model.) 3 Sheets—Sheet 1.

# J. J. WOOD.

## MACHINE FOR WINDING COILS.

No. 548,903. Patented Oct. 29, 1895.




WITNESSES:

Fred White

Thos. F. Wallace

INVENTOR:

James J. Wood,

By his Attorneys,

Arthur G. Fraser & Co.

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FIG. 4.

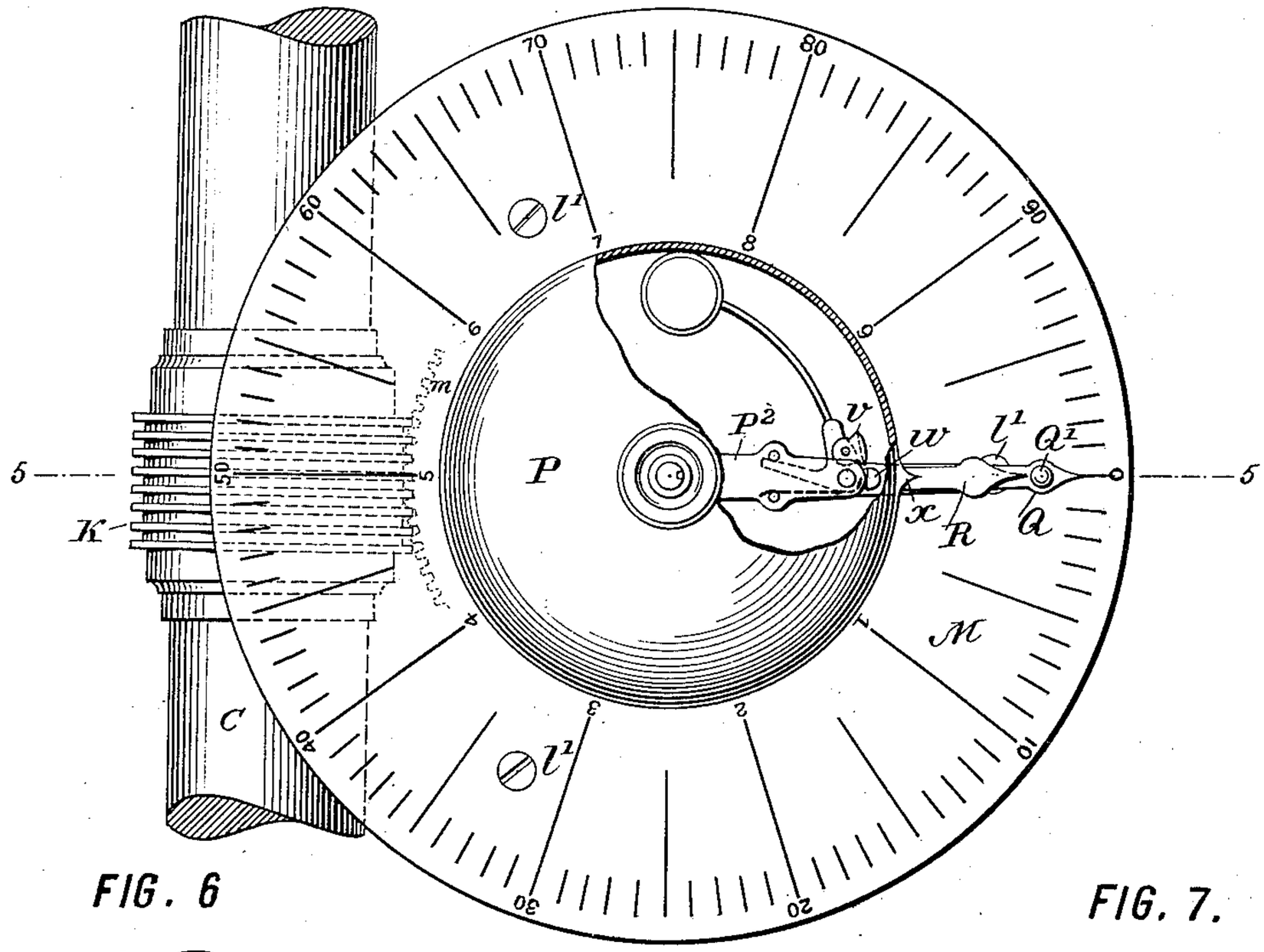


FIG. 6

FIG. 7.

FIG. 5.

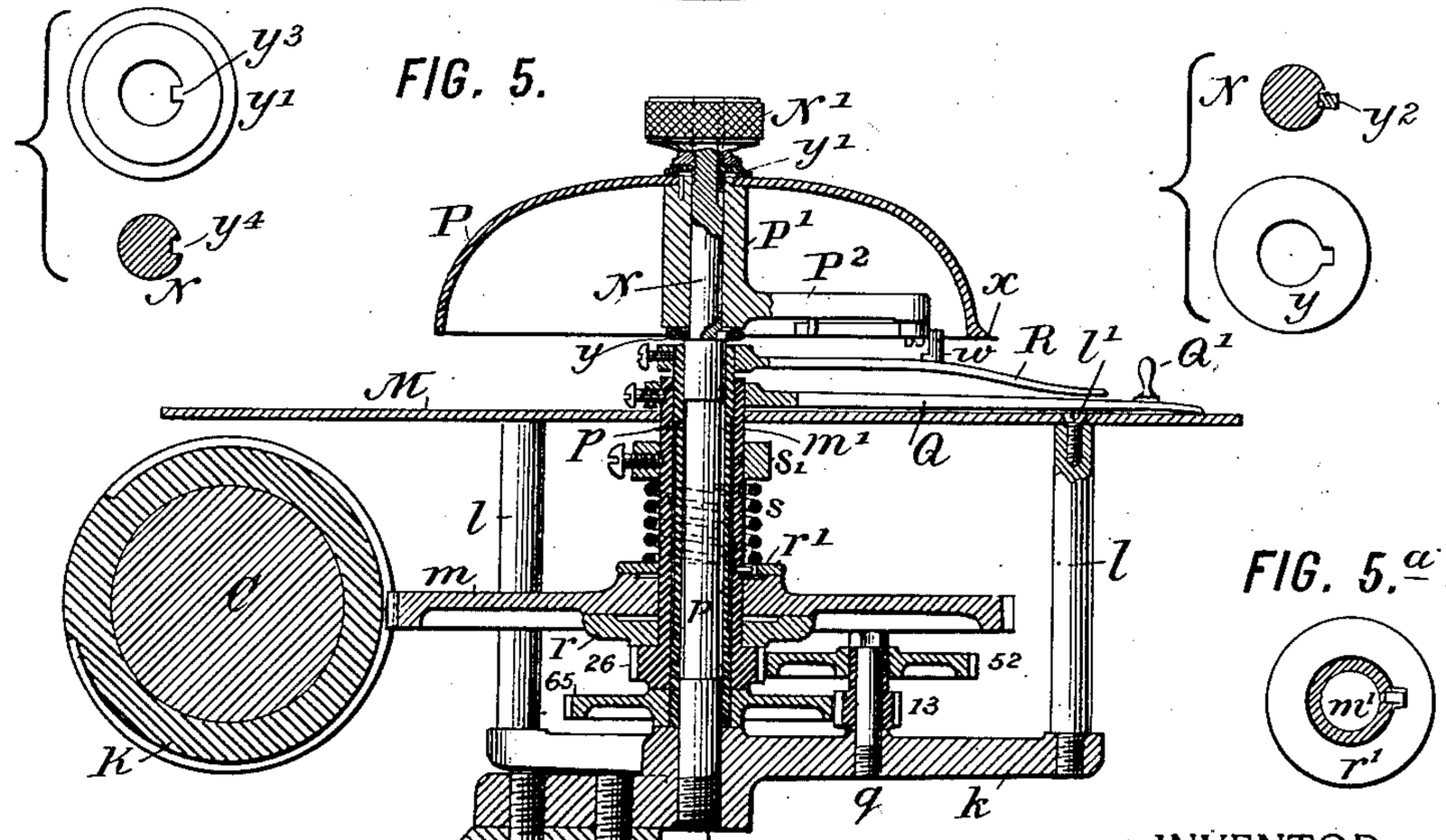


FIG. 5.ª




WITNESSES:

Fred Whitg

Thos. F. Wallace

INVENTOR:

James J. Wood,

By his Attorneys,

Arthur G. Fraser & Co.

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FIG. 8.

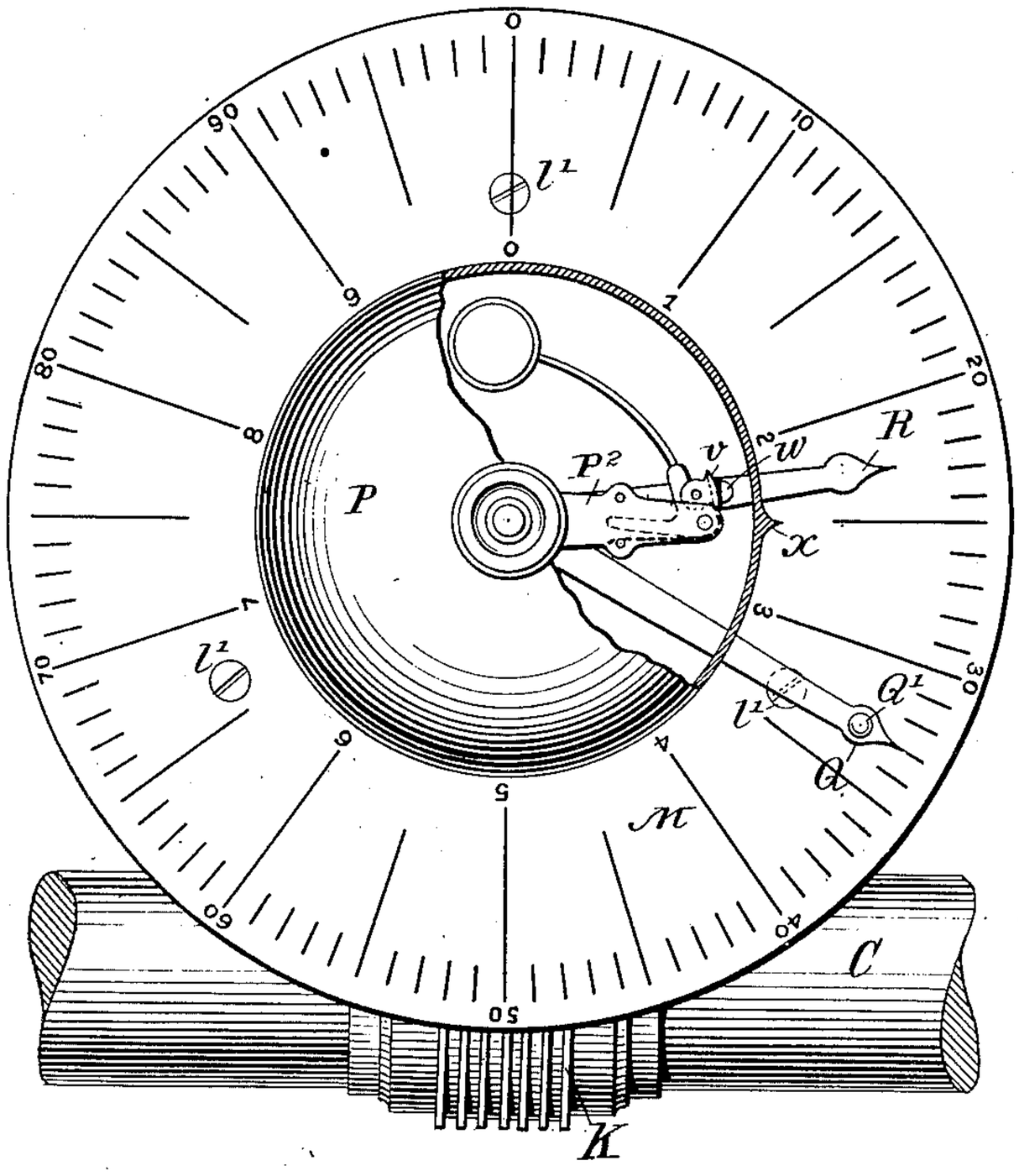
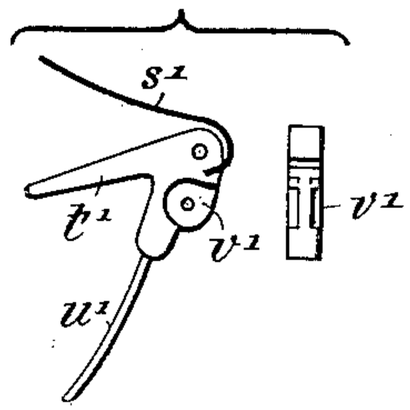



FIG. 9.

FIG 10.



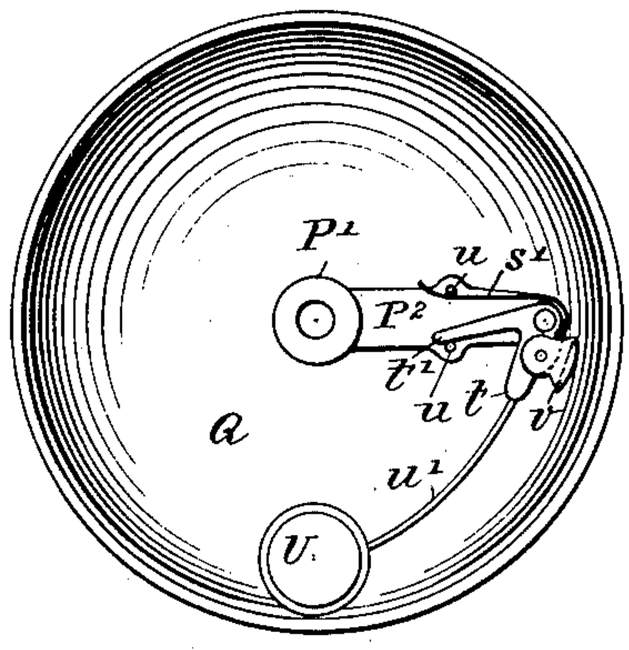
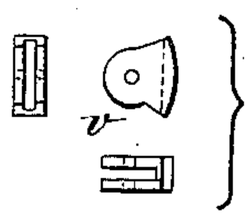




FIG. 11.




WITNESSES:

Fred White

Thomas F. Wallace

INVENTOR:

James J. Wood,

By his Attorneys,

Arthur G. Fraser & Co

# UNITED STATES PATENT OFFICE.

JAMES J. WOOD, OF FORT WAYNE, INDIANA.

## MACHINE FOR WINDING COILS.

SPECIFICATION forming part of Letters Patent No. 548,903, dated October 29, 1895.

Application filed March 17, 1894. Serial No. 503,969. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES J. WOOD, a citizen of the United States, residing at Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Machines for Winding Coils, of which the following is a specification.

The winding of coils for electric transformers, field-magnets, &c., is commonly done by hand, the number of turns of wire laid on being counted by the workman as he proceeds.

This invention provides a machine in the nature of a lathe for performing the winding, with means for keeping it under the control of the operator and for automatically counting the number of turns of wire laid onto the coil.

My improved machine comprises a suitably-mounted shaft or lathe spindle having a face-plate or other means for attaching the spool or coil support, and a belt-pulley or other means for driving it, with means operated by a treadle or other device for applying the driving power and for controlling a brake or check to prevent turning backward. Fixed on the lathe-spindle or connected thereto is a worm which drives an automatic counter, comprising a worm-wheel and gearing communicating motion to two indicating-hands revolving around a dial like the hands of a clock, this dial being graduated to indicate the number of turns. A bell is provided for ringing when the number of turns of wire to which it has been set has been wound on. The operator has accordingly only to set the bell to ring just before the completion of the number of turns desired to be wound on the coil, and to set the counter to zero when he commences winding on, and then to continue the winding rapidly by power until the bell rings, and then slowly until he has completed the exact number of turns required, as shown by the hands on the scale.

Figure 1 of the accompanying drawings is a left-hand side elevation of the machine. Fig. 2 is a front elevation, the driving and tightening pulleys and brake or check being shown in vertical section. Fig. 3 is a transverse section on the line 3 3 in Fig. 2, showing the counter in elevation on a larger scale. Fig. 4 is a face view of the counter looking in the direction of the arrow 4 in Fig. 3—that is, perpendicular to the plane of the dial-plate—on a still larger scale. Fig. 5 is a transverse section in a vertical plane on the line 5 5 in Fig. 4. Fig. 5ª is a transverse section of a tubular spindle $m'$ and washer $r'$. Figs. 6 and 7 are transverse sections of the post N, Fig. 6 showing, also, a washer $y'$ and Fig. 7 showing a washer $y$. Fig. 8 is a similar view to Fig. 4, showing the counter in operation. Fig. 9 is an under side view of the bell and hammer. Figs. 10 and 11 are details of parts of the hammer on a larger scale.

Referring to Figs. 1 and 2, let A designate any suitable bench or framework for supporting the machine, and B the iron frame mounted on this bench and providing bearings $a$ $a$ for the revolving shaft or spindle C. On one end, preferably the right-hand end of this shaft, is fixed a face-plate D or any other suitable means for the attachment of the spool or other support on which the coil is to be wound. This spool or support is shown in dotted lines at E in Fig. 2. On the opposite end of the shaft C is fixed a belt-pulley F, which drives it. This pulley is driven by a belt $b$, which runs loose except when tightened against the pulley by a tightening-sheave G. This sheave is mounted to revolve loosely on a pin carried on the upper arm of an elbow-lever H, the hub of which is mounted to turn freely on the shaft C or on a bushing concentric with this shaft and projecting from the left-hand bearing $a$, or is otherwise pivotally mounted, as may be preferred. The other arm of this lever H projects forward, as shown in Fig. 1, and to its front end is jointed a rod $c$, which extends down and is jointed at its lower end to a treadle-lever T. This treadle is somewhat loosely fulcrumed at $t$, while its right-hand end projects beyond the frame A to be acted on by the foot of the operator. A spring S is provided for drawing up the treadle, and at its right-hand end it engages with notches or overhanging shoulders in a plate $d$, fastened to the frame A. This plate is shown in the sketch at the right of Fig. 2. It has three notches or overhanging shoulders marked 1, 2, and 3, with either of which the treadle-le-

ver may be engaged to hold it down against the tension of the spring S. When the treadle is pressed down and caught under the lower shoulder 1, the tightening-sheave G is pressed against the belt, so as to tighten the latter around the pulley F to drive the machine. This is the position of normal running while winding on the wire. When the treadle is in the position shown in full lines engaged with notch 2, the sheave so slackens the belt that the pulley F is not driven. This is the position of rest or stoppage. In this position the backward rotation of the shaft C is prevented by a stop device consisting of a friction pawl or brake, (shown as a curved brake-shoe I,) bearing against the inner face of the pulley F, and hung on a lever-arm J, pivoted to the frame B at *e*, on a center eccentric to the axis of rotation, so that as this arm J is moved in the direction tending to bring it in line with a radius drawn from the rotative axis through the pivotal center *e*, it acts in the manner of one of the links of a toggle to exert a thrust, pressing the shoe I against the inner face of the pulley. The arrangement of the arm J is such that any effort to turn the pulley F backward, which would carry the shoe I with it, frictionally moves the arm J thus in the direction tending to straighten it, and thereby forces the shoe firmly against the pulley, the thrust being transmitted through the shoe and arm to the stud *e* to check the backward rotation. The brake-shoe is faced with leather or other frictional material. This friction stop or pawl has no effect during the forward rotation of the pulley, since the tendency at such time is to move the arm J into such positon as to draw back the shoe from the pulley. This friction-stop is a feature of great practical importance, since the wire is wound onto the coil under considerable tension, which upon the slackening of the belt would act to revolve the spindle and spool backward and thereby partly unwind the wire and disturb the coil or portion of the coil already wound. It is sometimes necessary, however, to permit the shaft to turn backward, as in case the winding has been carried a little too far, so that it is necessary to take off a turn or two of wire or in case any mistake has been made during the winding. To provide for this I construct the machine with means for throwing the friction-stop out of action. To this end I provide the lever J with an arm *j* fixed to it and extending forward and having jointed to its end a link *i*, which passes freely through a hole in a block or projection *f* on the forwardly-projecting arm of the lever H. On the link *i* is screwed a nut *h* to serve as a stop or shoulder against which the block *f* may strike as the lever H is thrown upward. In the position shown in full lines this nut *h* stands somewhat above the block *f*, so that the friction-stop is not affected; but if it is desired to release the shaft and permit it to turn backward, the operator elevates the treadle T to its uppermost position engaged by the notch 3, Fig. 2, which motion throws up the lever II far enough to cause the block *f* to encounter and displace the nut *h*, thereby lifting the link *i* and lever-arm *j* and swinging the lever J around far enough to lift the shoe I out of contact with the pawl. The operator may then turn the shaft by hand in either direction freely as may be necessary. It is thus seen that the starting and stopping of the machine, and also the releasing of the friction-brake, so as to enable it to be turned backward, are all under the instant and ready control of the operator through the medium of the treadle T, so that the operator can effectually control the machine by his foot while both hands are occupied with the work of guiding the wire onto the coil.

Fixed on the shaft or spindle C is a worm K, which drives the movable parts of the counter L. This counter is supported from the frame B by a bracket-arm *g*, Fig. 3, to which is bolted the base frame or tripod *k* of the counter. To the three arms of this tripod are fixed three posts *l l*, which support the dial plate or disk M, which is fastened to these posts by screws *l'*, Figs. 4 and 5. In the middle of the tripod *k* is fastened a fixed post N, which projects up through the center of the dial-plate M and to a considerable height above it, and carries on its upper end a stationary bell P. The worm K has preferably a single left-hand thread. It meshes with a large gear-wheel *m*, having preferably one hundred teeth. This wheel *m* is connected frictionally to a tubular shaft *m'*, Fig. 5, which projects up through the dial-plate M and has fixed on its upper end a units hand or pointer Q, adapted to sweep or revolve around the dial-plate and just above its surface. The dial-plate is graduated in any suitable manner, preferably into one hundred equal spaces, as shown in Fig. 4, each space corresponding with one tooth on the wheel *m* and consequently with one revolution of the shaft C. If the hand Q starts at zero, it will as the shaft C revolves move over one space to each revolution. A tens hand or pointer R is also provided, fixed on a tubular shaft or spindle *p*, turning freely around the post N and within the tubular spindle *m'*. The spindles *m'* and *p* are geared together by any suitable gearing in the ratio of ten to one, in order that when the pointer Q executes an entire revolution covering one hundred spaces the pointer R shall move over ten spaces. To effect this I have shown a train of gears consisting of a pinion 26, fixed on or formed integrally with the spindle *m'* and meshing with a gear 52, to which is fixed a pinion 13, the two turning freely on a fixed post *q*, and this pinion meshing with a gear-wheel 65, which is fixed on or formed integrally with the inner spindle *p*. In the construction shown the pinion 26 has twenty-six teeth, 52 has fifty-two teeth, 13 has thirteen teeth, and 65 has sixty-five teeth,

whereby the speed of rotation is reduced to one-tenth.

In order to enable the operator to turn the hands backward or forward to zero without having to correspondingly revolve the shaft C, the gear-wheel *m* is not fixedly connected to the spindle *m'*, but is connected thereto by a frictional connection forming a sort of friction-clutch. Accordingly the wheel M is unattached to the spindle *m'* and is held frictionally between two disks *r* and *r'* on opposite sides, which disks are pressed firmly together by a strong spring *s* acting against the disk *r'* and reacting against a set collar *s'*, fastened to the spindle *m'*. The disk *r* is pressed tightly onto the spindle *m'*, being thus fixedly attached thereto, while the disk *r'* is compelled to turn with the spindle by being formed at one side with a notch engaged by a pin projecting from the spindle *m'*, as shown in Fig. 5ª. Thus both the disks *r* and *r'* have rotative connection with the spindle, and the wheel *m*, being embraced strongly between them under the tension of the spring *s*, has a strong frictional engagement with them sufficient to cause the rotation of the wheel to drive the spindle, the train of gears, and the inner spindle *p*, and hence to drive the two hands Q and R without slipping. At the same time, however, this construction admits of the operator turning the hand Q in either direction, while the wheel *m* is held stationary by its engagement with the worm K. To facilitate this turning of the hands, the hand Q has fixed to it a projecting handle Q'.

To operate the counter the workman has only to take hold of the handle Q' and turn the hand Q around in either direction until both hands are brought to zero, as shown in Fig. 4, this being the position of the counter at the starting of the winding operation. As the winding on proceeds, the hands travel around the scale, the hand Q completing the circuit of the scale at one hundred revolutions, at which time the hand R points to "10," or being read by the inner series of numbers indicating hundreds it points to "1." The operator has only to follow the motion of the hands until they approach the number corresponding to the number of turns of wire required to be wound onto the coil, and to stop or slow up the machine as this number is approached, and, finally, to bring the machine to the exact number of turns indicated by the position of the hand on the dial corresponding to the required number of turns to be wound on the coil. For example, if seven hundred and forty-three turns are required, he will follow the progress of the hand R until it reaches "7" (indicating seven hundred) and will then follow the motion of the hand Q until it approaches "40," whereupon by working the treadle he will reduce the speed of the machine and wind slowly until the hand points to "43" when he will stop the winding and cut off the wire. Thus the use of the alarm-bell is not strictly necessary, but as it facilitates the operation and requires less close attention on the part of the workman I prefer to provide it.

The bell P is fixed to a hub P', fitting freely over the upper reduced end of the post N, Fig. 5. From this hub projects an arm $P^2$, to the outer end of which is pivoted the hammer-arm *t*, which is in the form of an elbow-lever having a tail *t'*, working beween two stop-pins *u u*, projecting downward from the arm $P^2$, Fig. 9. The hammer U is connected to the arm *t* through a flexible stem *u'*, as usual, and the arm is pressed so as to throw the hammer toward the bell by a spring *s'*. Pivoted to the hammer-arm *t* is a dog *v*, (shown separately in Fig. 11,) which dog is engaged by a pin *w*, projecting upwardly from the hand R, to trip the dog and ring the bell. The hammer-arm *t* is shown in detail in Fig. 10, being flattened or reduced at *v'*, where it is embraced by the pivotal wings or ears of the dog *v*. This dog has sufficient freedom of movement in either direction to enable it to rock to such a position as to free itself instantly from the pin *w* when it has been pressed back by the passage of this pin, and it is also constructed to operate in whichever direction the pin is moved. As the pin strikes the dog it first tilts it until its opposite shoulder seats itself against the corresponding shoulder on the lever *t'*, whereupon the dog and lever act as one piece, and the pin *w*, by wedging against the curved outer face of the dog, thrusts back the lever *t* against the spring *s'* and thereby thrusts the hammer in away from the bell until the instant when the pointer passes the further edge of the dog, whereupon the lever is released and the hammer flies toward the bell and strikes a single blow.

In order to enable the bell to be adjusted, so as to ring at any desired number, the hub P' is made freely rotative on the post N, with means for clamping it in place in any position, so that the dog *v* may be brought to where it will be encountered by the pin *w* at any point around the circle at which it is desired to have the bell ring. The means for clamping the bell consists of a clamping-nut N', screwing on the threaded upper end of the post N, and serving to press together two clamping disks or washers *y* and *y'*, having a non-rotative engagement with the post. The lower washer *y* is seated against a shoulder formed on the post, as shown in Fig. 5, and is kept from turning by being formed on one side with a notch, as shown in Fig. 7, which is engaged by a pin or key $y^2$ projecting from the post, as shown in the upper half of Fig. 7, which is a transverse section through the post at this point. The upper disk *y'* is slipped over the top of the post after the bell is placed in position, and is kept from rotating by being formed with an inwardly-pro-

jecting tooth $y^3$, Fig. 6, which enters a vertical slot or keyway formed in the post, as shown in Fig. 5, and at $y^4$ in the lower half of Fig. 6, which view is a transverse section through the post taken at the disk $y'$. It results from this construction that by loosening the clamping-nut N', the bell may be turned to any position, and will be held stationary in such position by again tightening this nut.

In order to afford an indication for guiding the operator in properly setting the bell, the latter is formed on one side with a projecting tooth or pointer $x$, Figs. 4 and 9, which at the instant of ringing the bell coincides with the center of the hand R or with a mark thereon. Consequently it is only necessary, in order properly to set the bell, for the operator to first turn the hands to the position they should occupy at the instant he wishes the bell to ring—that is to say, for example, a half-turn or one or two turns in advance of the number of coils to be wound on—and then with the hands in this position to set the bell so that its pointer $x$ coincides with the central mark on the hand R. The bell will then ring each time that the hands reach this position. Consequently during the winding the operator has nothing to do but to attend to the proper laying on of the wire on the coil until the bell rings, whereupon he will slow the machine and lay on the final turns slowly and carefully, as already explained. Where several coils are to be wound with the same number of turns, which is the most frequent condition in practice, the use of the bell is highly advantageous; but if only one or two coils are to be wound the operator may prefer to be guided by watching the hands rather than take the trouble to set the bell.

It must not be inferred from the detail with which I have described the preferred construction of my invention that is shown in the drawings that my invention is limited to this particular construction, since in fact it is susceptible of considerable modification without departing from its essential features, which are hereinafter set forth in the claims. For example, the shaft or spindle C may be driven otherwise than by a belt and pulley, and the starting and stopping may be otherwise effected than by the use of a belt-tightener, various means for accomplishing this purpose being known in the arts by which the starting and stopping of a machine may be controlled through the medium of a treadle or other controlling lever. The stop device for preventing backward rotation of the shaft is essentially a friction-pawl, and may be substituted by any other known and suitable construction of friction-pawl or by any other equivalent stop device acting in one direction to check back motion, while permitting a free motion in the opposite or normal direction. In lieu of connecting the stop device or pawl J to the controlling-lever through the medium of a rod $i$ and adjustable head or nut $h$ encountered by a block $f$, any other mechanical connection may be employed adapted to engage and move the pawl or stop device to throw it out of action upon the throwing of the controlling-lever to an abnormal position. Thus a chain would constitute an equivalent for the parts $i$, $h$, and $f$. Instead of driving the counter by a worm on the shaft C, it may be driven through any other suitable sort of gearing or mechanical connection.

I claim as my invention the following-defined novel features, substantially as hereinbefore specified, namely:

1. The combination of a rotary shaft, a motor-device for driving said shaft, a stop-device for preventing backward motion of said shaft consisting of a pawl normally engaging a flange carried by said shaft, a controlling lever operatively connected to said motor device to throw the latter on and drive the shaft when moved from an intermediate to a running position, and a mechanical connection from said lever to said stop-device adapted by an opposite movement of the lever beyond said intermediate position to release said pawl and permit the shaft to turn backward.

2. The combination of shaft C, pulley F, belt tightener G, lever H, stop device for preventing backward motion of pulley F consisting of friction shoe I and lever J pivoted eccentrically to pulley F, and a connection between levers J and H adapted to throw out the stop device upon the movement of the lever H beyond the position in which the belt tightener is released to stop the rotation.

3. The combination of shaft C, pulley F, belt tightener G, lever H, stop device consisting of friction shoe I and lever J, and a connection between levers J and H adapted to throw out the stop device upon the movement of the lever H, beyond the position for releasing the belt tightener with controlling treadle T connected to lever H, spring S tending to lift it, and notched plate $d$ having three notches adapted to hold the treadle in either of three positions corresponding to the positions of normal running, of stoppage, and of retraction of the stop device, to permit of turning backward.

4. A machine for winding coils comprising a rotary shaft, means for driving it, means for fastening to it the spool or support for the coil being wound, and an automatic counter comprising a graduated dial plate, and a hand driven from said shaft and traveling around said plate to indicate the number of revolutions of said shaft, and a friction clutch interposed between said hand and the gearing for driving it, whereby it is driven frictionally and may be turned manually back to zero at will independently of said gearing or shaft.

5. In a machine for winding coils, the combination to form an automatic counter, of a gear-wheel driven from the winding shaft, a rotary spindle having two disks between

which said gear-wheel is embraced, the one fixed to the spindle and the other movable thereon and connected thereto so as to rotate therewith, and a spring for pressing the latter disk toward the former to constitute a friction clutch coupling said gear wheel frictionally to said spindle, a hand carried by said spindle, and a stationary graduated disk over which said hand turns.

6. In a machine for winding coils, the combination to form an automatic counter, of a base-plate *k*, a dial-plate M mounted thereon, a fixed post N, a tubular spindle *p* turning on said post and carrying a hand R and a gear-wheel 65, a tubular spindle *m'* turning around said spindle *p* and carrying a hand Q and pinion 26, reducing gears 52 and 13 meshing respectively with said pinion 26 and gear-wheel 65 for driving the inner spindle from the outer one at a reduced speed, a gear-wheel *m* driven from the winding shaft, and a friction clutch applied to said spindle *m'* and embracing said gear-wheel, whereby the spindles are driven frictionally and may be turned manually without displacing said gear.

7. In a machine for winding coils, the combination to form an automatic counter, of a stationary dial plate, a hand R revolving around said plate having a trip-pin *w*, gearing for driving this hand from the winding shaft, an alarm bell P and its hammer mounted on a hammer arm *t* and adapted to be engaged by said trip-pin *w* to ring the bell.

8. In a machine for winding coils, the combination to form an automatic counter, of a stationary dial plate, a hand R revolving around said plate having a trip-pin *w*, gearing for driving this hand from the winding shaft, an alarm bell P, its hammer mounted on a hammer arm *t* adapted to be tripped by said pin *w* to ring the bell, an adjustable arm $P^2$ carrying this hammer arm, and means for clamping it in place in different positions to cause the bell to be rung in any desired position of the hand R.

9. In a machine for winding coils, the combination to form an automatic counter, of a dial plate M, a hand R revolving around said plate having a trip-pin *w*, gearing for driving this hand from the winding shaft, an alarm bell P mounted concentrically with said hand, having an arm carrying its hammer arm, and said hammer arm adapted to be actuated by said trip-pin to ring the bell, a clamp for fastening the bell in any rotative position, and a pointer *x* on the bell adapted to coincide with said hand R at the instant of ringing the bell, whereby to facilitate the setting of the bell to be rung after any desired number of revolutions.

10. In a machine for winding coils, the combination to form an automatic counter, of a base plate *k*, a stationary dial plate M mounted thereon, a fixed post N, a tubular spindle *p* turning on said post, a hand R fixed to said spindle and carrying a trip-pin *w*, gearing for driving this hand R from the winding shaft, an alarm bell P with its hammer arm constructed to be tripped by said pin, a hub P' carrying the bell and having an arm $P^2$ carrying said hammer arm and rotatively mounted on said post, and a clamping device for fixing the bell to said post in any rotative position, whereby it may be adjusted to be rung in different positions of the hand R.

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

JAMES J. WOOD.

Witnesses:
JOHN W. HALL,
WILLARD KNIGHT.