C. E. FETHEROLF.

MACHINE FOR WINDING WIRE.

APPLICATION FILED NOV. 25, 1905.

952,005.

Patented Mar. 15, 1910.

2 SHEETS—SHEET 1.

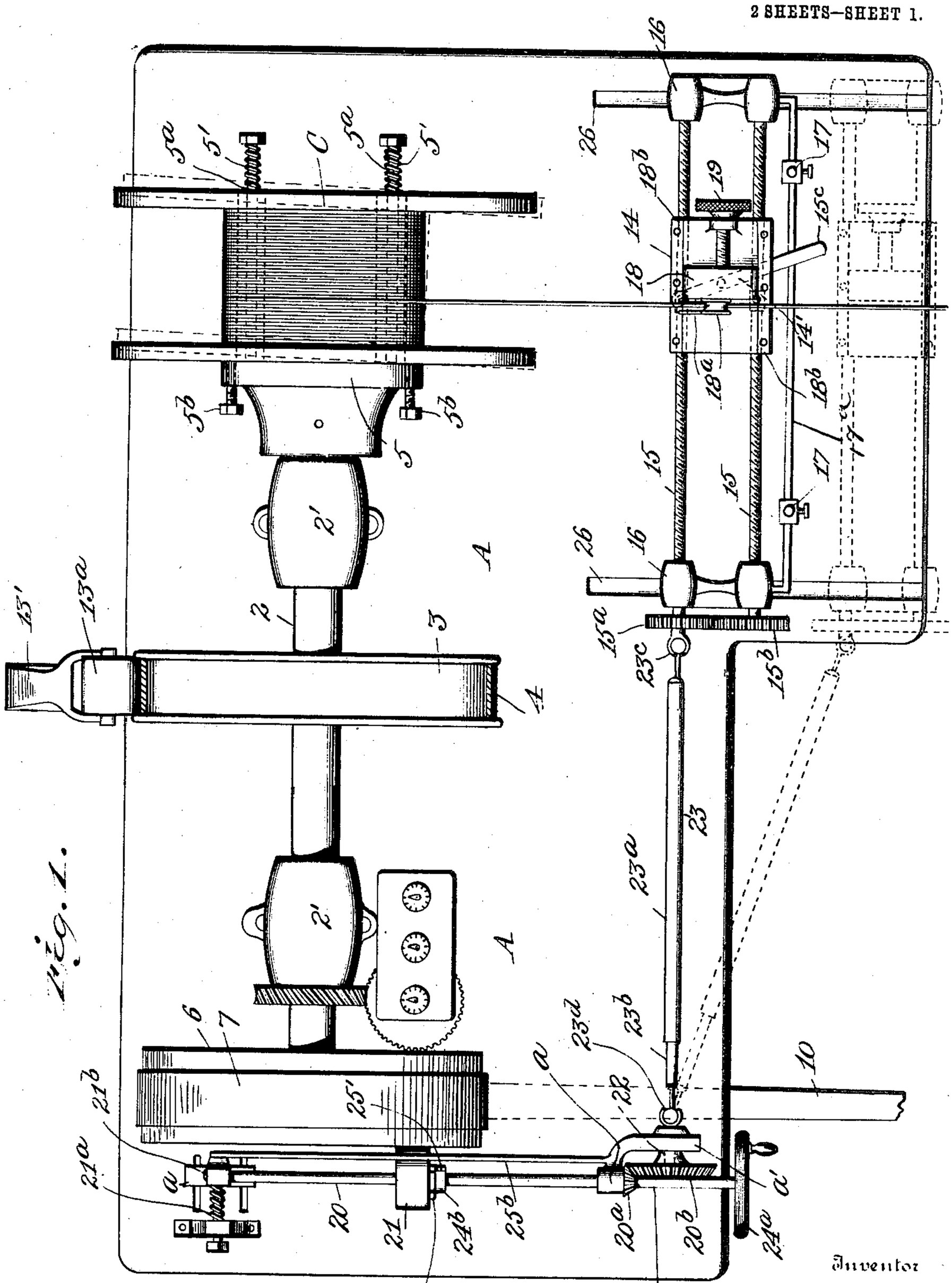

Fig. 1.

Witnesses

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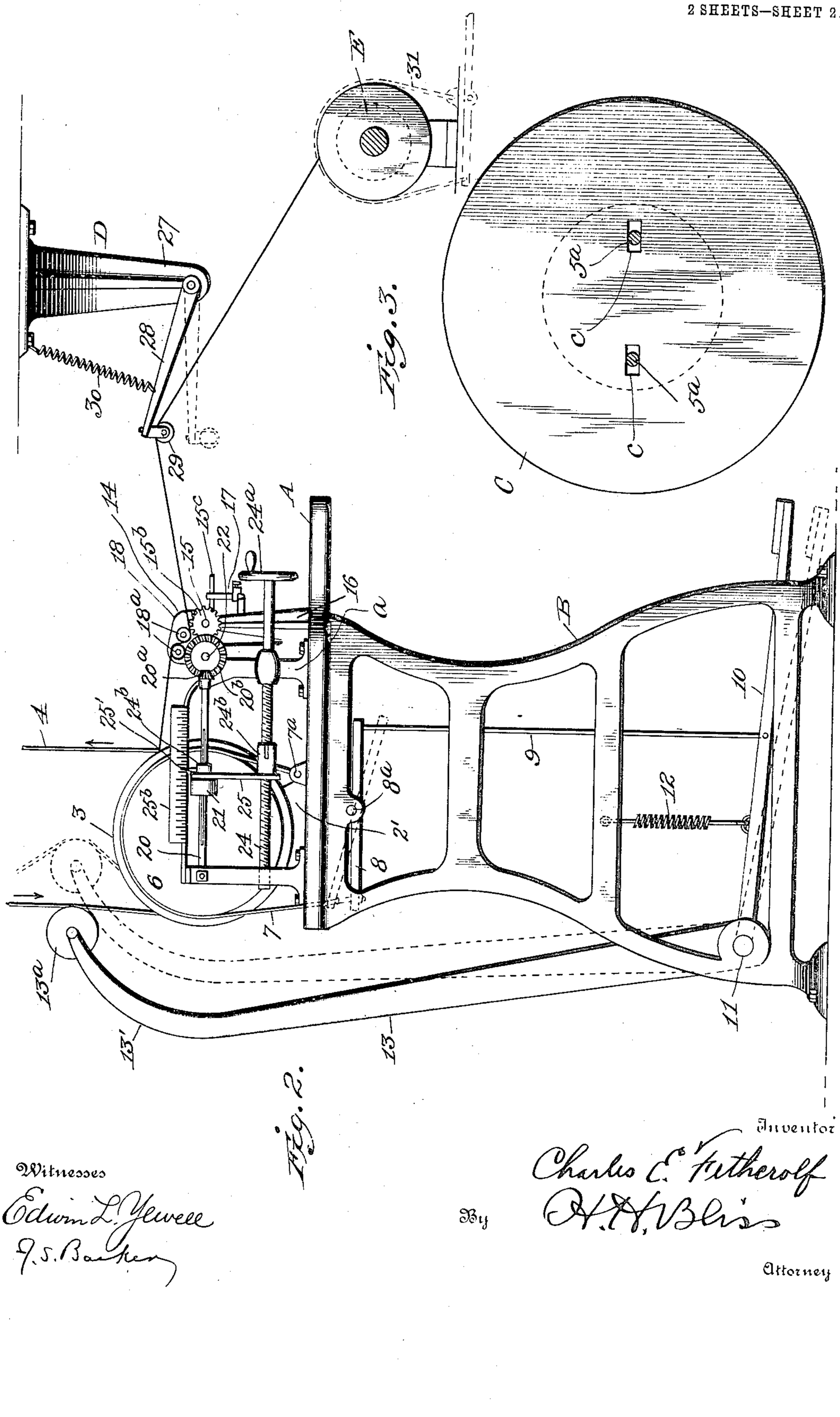

Fig. 2.

Fig. 3.

Witnesses

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UNITED STATES PATENT OFFICE.

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MACHINE FOR WINDING WIRE.

952,005. Specification of Letters Patent. Patented Mar. 15, 1910.

Application filed November 25, 1905. Serial No. 289,120.

To all whom it may concern:

Be it known that I, CHARLES E. FETHEROLF, a citizen of the United States, residing at Columbus, in the county of Franklin and State of Ohio, have invented certain new and useful Improvements in Machines for Winding Wire, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates to machines for winding wire on a form or core.

It has for its object to produce a machine adapted to accurately and uniformly wind coils of wire, and to provide mechanism for properly guiding and feeding wire of different sizes to the article to be wound.

Figure 1 is a top plan view of a machine embodying my invention. Fig. 2 is a side elevation. Fig. 3 is a side view of a form or core to be wound.

In the drawings A represents the base of the machine suitably supported on standards or uprights B.

Arranged on the base A is a shaft 2 mounted in bearings 2′, 2′. Carried on this shaft and preferably centrally thereof is a fixed pulley 3 with which a belt 4, connected with a source of power, engages and is adapted to impart rotation to the shaft. Secured to one end of the shaft is an enlarged head or face plate 5. The form or core C to be wound is secured to this plate by bolts 5ª, 5ª, which extend loosely through slots *c*, *c* in the form and are secured to the face plate by means of screw threads.

5′, 5′ are springs interposed between the core and the heads of the bolts and adapted to hold it against the face plate 5.

On the other end of the shaft opposite to the form C is fixedly secured a combined friction and brake wheel 6 arranged to be engaged by a brake band 7. The brake band is secured at one end 7ª to the base A and its opposite end extends through a hole in the base and is secured to a lever 8 fulcrumed at 8ª, the outer end of which is controlled by a rod 9 extending downward therefrom and pivotally attached at its lower end to a pedal 10 fixed to a shaft 11 mounted in the standards B. Arranged between one of the cross members of the upright B and the pedal 10 is a spring 12 which operates, through the pedal 10, rod 9, and lever 8 to hold the brake band normally in engagement with the brake wheel.

13 represents a rod fixed to the shaft 11 and movable therewith. It extends upward and has its free end curved or bent inward at 13′.

13ª is an anti-friction pulley secured to the free end of the rod 13 and adapted to be swung therewith and to engage the belt 4 and thereby tighten the same to cause it to grip the pulley 3. When the pedal 10 is depressed the brake band is simultaneously released, and the rod 13 moves into the position shown in dotted lines in Fig. 2 tightening the belt 4 whereby power is transmitted to drive the shaft 2.

The feeding and guiding device for the wire comprises a traveling carriage 14, mounted on a pair of screw threaded shafts 15 arranged parallel to each other and themselves suitably mounted in bearings in the brackets 16. 16 on the frame. The screw threaded shafts 15, 15 are provided at one end with spur gears 15ª, 15ᵇ which mesh with each other and when driven cause the shafts to rotate in opposite directions. The carriage 14 is provided with screw threaded means, preferably a double acting clutch as indicated at 14′ arranged alternately to engage one of the shafts 15 and to move thereon longitudinally in one direction relative to the form or core C. Pivotally mounted in the carriage and connected with the said screw threaded means or double acting clutch 14′ is a lever 15ᶜ the outer end of which engages with stops 17. The stops 17 are mounted on the rod 17ª which is carried by the standards 26 and are adapted to shift the lever 15ᶜ to cause it to operate the double acting clutch 14′ and change the direction of travel of the carriage. As indicated these stops 17 are adjustable longitudinally of the screw threaded rods 15 to vary the travel of the carriage and accommodate it to the winding of various lengths of cores or forms.

Mounted on the carriage 14 is a sliding block 18 provided with two rollers 18ª, one above the other and preferably out of axial alinement with each other, and between which the wire fed to the form C runs. To prevent the wire from overlapping or piling up at the end of each layer the block 18 to

which the guide rollers are attached is mounted in guides 18^b on the carriage and is adjustable longitudinally therein by means of the thumb screw 19 suitably mounted in the carriage and connected to the block 18.

Mounted in bearings in brackets *a*, *a* at the opposite end of the base A from the form C is a transverse shaft 20 arranged transversely and preferably at right angles to and in the same plane with the shaft 2.

21 is a friction pinion or pulley mounted to slide longitudinally of the shaft 20 to which it is keyed or splined. It is normally held yieldingly in frictional engagement with the outside friction face of the friction and brake wheel 6 by means of the spring 21^a, which bears against the end 21^b of the shaft 20. At the opposite end of the shaft 20 is secured a bevel gear 20^a which meshes with a bevel gear 20^b secured to a shaft 22 the latter being mounted in suitable bearings in the arm *a'* of the adjacent brackets *a*.

Motion is imparted to the screw threaded shafts 15, 15 by means of a longitudinally adjustable driving shaft 23. This shaft 23 is formed of two pieces 23^a, 23^b one of which 23^a, is hollow so that the other piece 23^b may slide into it like a telescope. One of these parts is keyed or splined and the other grooved to form a slidable connection between the parts which will cause them to rotate together when either one is rotated. The free end of the hollow rod 23^a is connected by a universal joint 23^c to one of the threaded shafts 15. The free end of the rod 23^b is connected by a universal joint 23^d with the inner end of the shaft 22.

In order to feed the wire to the core and to cause the carriage to reciprocate longitudinally relatively to the core fast or slow according to the size of the wire to be wound thereon, I provide means for adjusting the pinion 21 on the shaft 20 radially along the face of the friction and brake wheel 6 relatively to the axis of the shaft 2. These means comprise a countershaft 24 mounted in suitable bearings in the brackets *a*, *a*, which shaft is rotated by a crank wheel 24^a. This shaft 24 is screw threaded for a portion of its length and has mounted on it an internally threaded sleeve or nut 24^b. To the sleeve or nut 24^b is secured a rod 25 which engages with the pinion 21 by means of forked arms or any suitable manner and is adapted to move the said friction pinion along the shaft 24.

25^b is a scale arranged adjacent to and parallel to the shaft 24, and 25' is an indicator carried by the rod 25 and adapted to indicate the ratio of reduction between the core or form on the shaft 2 and the travel of the carriage 14 feeding onto the core or frame a layer of wire of a given size.

The reciprocating carriage 14 is adjustable toward and from the core or form C as may be desired according to the size of the core to be wound. For this purpose I provide in the base A two grooves 26, 26 arranged parallel to each other. The standards 16, 16, in which the screw threaded shafts 15, 15 are mounted, are arranged to slide in these grooves and are held therein in their adjusted positions in any suitable manner. As shown in dotted lines in Fig. 1 when the carriage and its operating mechanism are adjusted in the grooves 26, the telescoping rod 23 is accordingly lengthened or shortened as the case may be, the universal joints connecting it with the shafts 15 and 22 and permitting it to accommodate itself to any position of the feeding and guiding mechanism.

When the end of the wire that is to be wound on the form or core C is attached thereto it is desirable to feed the wire to the core at an angle relatively to its axis of rotation during the winding of the first layer. In order that the coil may be properly started and to prevent the wire from piling up I prefer to adjust the core C on the face plate 5 into an angular position relatively to the axis of rotation of the shaft 2. I provide the face 5 with screws 5^b the inner ends of which bear against the inner face of the core. When one of the screws 5^b is turned the core is forced outward on that side, the slots *c* being elongated as shown in Fig. 3 to permit this adjustment of the core. When the screw 5^b is turned back, the spring 5' bearing against the head of the bolt 5 and the outer face of the core C forces the latter into its normal position against the face plate 5. I prefer to provide the face plate with two or more adjusting screws so that the core may be adjusted from either side according to the side of the core to which the end of the wire is attached.

It is often necessary to wind forms or cores rectangular or irregular in cross section. With a core of this description a short or narrow side will take off less wire from the reel than will a long side, and as the core swings or rotates exposing first one side and then the other there is an alternate tendency to slack the wire and then to jerk it. In order to keep the wire under these circumstances at a substantially uniform tension I provide between the wire reel E and the carriage 14 a tension device which is indicated as an entirety by D. It consists of a suspension bracket 27 to which is pivotally connected a swinging arm 28, carrying at its free end a roller 29 over which the wire to be wound is carried.

30 is a spring secured at its lower end to the free end of the arm 28 and at its upper end to some stationary support above the arm. It is adapted to normally pull the

arm upward. This spring will tend to compensate for the uneven feed of the cable maintaining a tension on the cable substantially uniform. A brake band 31 may also be adjusted on the reel and set for feeding the wire at relatively slow speed, and when this is done the brake will have less effect upon the reel when it is rotated at high speed than at low speed, which under the circumstances is desirable and insures that the tension of the wire will remain practically the same.

In operation a core to be wound is placed upon the bolts 5^a, 5^a on the core carrying plate 5 and the wire to be wound upon the core is led from the reel E over the roller 29 between the rolls 18^a, 18^a, on the carriage 14 and thence to the core C, its end being inserted through one side wall of the core, or secured to the core in any suitable manner. The hand wheel 24^a is then operated to set the friction pulley 21 at the desired point of engagement with the friction face of the wheel 6 to give as indicated by the index 25^a the proper ratio of speed reduction between the core C and the threaded carriage feed shafts 15, 15 for the size of wire to be wound upon the core. If the wire is either over or under the standard size, indicated by the index at 25′, for which the machine is adjusted, a slight turn of the hand wheel 24^a in the required direction will correct the machine to the wire being used. If, however, the wire varies, first being larger and then smaller in diameter, and so on for short intervals, these irregularities can be compensated for on each layer of wire wound upon the core by independent adjustment of the block 18 by means of the thumb screw 19. Again, when winding very fine wire, the rollers 18^a 18^a on the carriage 14 may not direct the wire in an exact line to its desired position on the form, thereby making it pile up or not lay up close, and this too may be remedied by adjusting the thumb screw 19 either right or left, which will change the position of the wire relative to the carriage the amount necessary to give the proper result. When winding onto the core the first layer of wire, it is desirable to lay it on at an angle to the axis of the core in order to prevent its piling up along one side of the core instead of being spread over the same in a layer of uniform thickness and uniformity. To start the winding of a core, and also to prevent piling up of the wire at the sides of the core, the core may be bodily adjusted by means of the set screws 5^b, 5^b. For example if one of these set screws is turned to push the form away from the face plate against the pressure of the spring 5′ substantially opposite thereto, it tends to throw out the core as indicated in dotted lines in Fig. 1. Both sides of the core may be thus thrown out the necessary degree, preferably about half the width of the wire or a little more, and the machine is started and a layer of wire wound on at the given angle. Then when the carriage 14 starts back in the opposite direction to feed the wire for the next layer, the set screw 5^b which has been used to throw out the core may be adjusted to its normal position and the core thrown out to another angle by adjusting the other set screw 5^b as desired.

It will thus be seen that I have provided a mechanism capable of a wide range of adjustments to suit it for the winding of various sizes and shapes of cores and different sizes of wire, and one furthermore which may be quickly and readily adjusted to accommodate it to the winding of wire either over or above size and also capable of quick adjustment to vary the angle at which each layer of wire is laid up relative to the axis of the core.

What I claim is:—

1. In a machine of the class described, the combination of a form on which wire is to be wound, means for rotating said form, means for directing wire onto the said form, in layers, and means for adjusting the form angularly relative to the axis about which it rotates.

2. The combination of a shaft, a form mounted thereon, non-reciprocating standards adjustable toward and from the form, a feeding mechanism mounted upon said non-reciprocating standards, and means for driving the shaft.

3. The combination of a shaft, a form mounted thereon, non-reciprocating standards adjustable toward and from the form, a reciprocating feeding mechanism mounted upon the said non-reciprocating standards, and means for driving the shaft.

4. The combination with the base, of a shaft supported thereby and means for driving the shaft, a form mounted on the shaft, a feeding device arranged to reciprocate relatively to the form, and non-reciprocating guides in the said base in which the feeding device may be adjusted toward and from the said form.

5. The combination with the base, provided with bearings suitably supported thereon, of a rotating shaft mounted in said bearings, a form secured to the shaft, brackets supported in the base, screw threaded shafts mounted in said brackets provided with gears and arranged to be driven in opposite directions, connections with said rotating shaft for driving the said screw threaded shafts, a reciprocating carriage mounted on said screw threaded shafts, feed rollers mounted on the reciprocating carriage, and means for adjusting the feed rollers longitudinally of the said carriage.

6. The combination of a rotating shaft, a form secured thereto, a reciprocating feeding device for the wire, guides in which the feeding device may be adjusted toward and from the form, and extensible connections between the rotating shaft and the feeding device for causing the latter to reciprocate.

7. The combination of a rotating shaft, a form to be wound mounted thereon, a friction wheel secured to the rotating shaft, another shaft provided with a friction wheel pinion arranged to engage the first named friction wheel and be driven thereby, a pair of screw threaded shafts geared together, and adjustable toward and from the form, a carriage mounted thereon and arranged to be reciprocated thereby, and a telescoping shaft between the driven shaft and one of the screw threaded shafts for causing the latter to rotate.

8. The combination of a rotating shaft, of a form to be wound mounted thereon, a reciprocating carriage for feeding the wire to the form, connections between the rotating shaft and the carriage for causing the latter to reciprocate, and means for adjusting the form relatively to the axis of the shaft.

9. The combination of a rotating shaft provided with a face plate, of a form to be wound secured thereto, a reciprocating carriage for feeding the wire to the form, connections between the rotating shaft and the carriage for causing the latter to reciprocate, and means mounted in the face plate for adjusting the form relatively to the axis of the rotating shaft.

10. The combination of a rotating shaft, of a form non-circular in cross-section secured thereto, a reciprocating carriage provided with feed rollers for guiding and feeding the wire to the form, and a spring actuated tension device for the wire.

11. The combination of a rotating shaft, of a form non-circular in cross-section secured thereto, a guiding mechanism adapted to direct wire onto the form, a friction controlled supply spool for the wire, and a spring actuated tension device between the guiding mechanism and the supply spool.

12. The combination of a rotating shaft, of a form non-circular in cross-section secured thereto, a guiding mechanism for directing wire onto said form, a friction controlled supply spool for the wire, and means between the guiding mechanism and the supply spool for maintaining a substantially constant tension in the wire.

13. The combination of a driven shaft, the form mounted thereon, a feeding device therefor and a train of power transmitting gearing between the driven shaft and the feeding device for causing the latter to reciprocate relatively to the form, one element of said gearing being adjustable with reference to another engaging element to give a varying speed ratio, an index finger carried by said adjustable element, and a graduated scale mounted in a position parallel to the direction of adjustment.

14. In a coil-winding machine, the combination of a rotary shaft, a form to be wound mounted thereon, a guiding device for directing wire onto the form, a carriage for said guiding device, two parallel screw-threaded shafts upon which the carriage is mounted, means for rotating the shafts in opposite directions, means whereby the screw threaded shafts may alternately engage the guiding device to reciprocate it, and means whereby the guiding device may be adjusted on the carriage in the direction of reciprocation thereof, substantially as set forth.

15. In a coil-winding machine, the combination of a rotating shaft, a form to be wound mounted thereon, a feeding device, a reciprocating carriage upon which the feeding device is mounted, and means whereby the feeding device may be adjusted on the carriage in a direction parallel to the axis of the form, substantially as set forth.

16. In a coil-winding machine, the combination of a rotating shaft, a form to be wound mounted thereon, a feeding device, a carriage on which the feeding device is mounted, means for adjusting the feeding device on the carriage in a direction parallel to the axis of the form, means for reciprocating the carriage relatively to the form, and means for varying the frequency of reciprocation, substantially as set forth.

In testimony whereof I affix my signature, in presence of two witnesses.

CHARLES E. FETHEROLF.

Witnesses:
S. J. WHITE,
FRANK H. CHURCH.