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J. KEATS.

APPARATUS FOR WINDING THREAD.

No. 440,811. Patented Nov. 18, 1890.

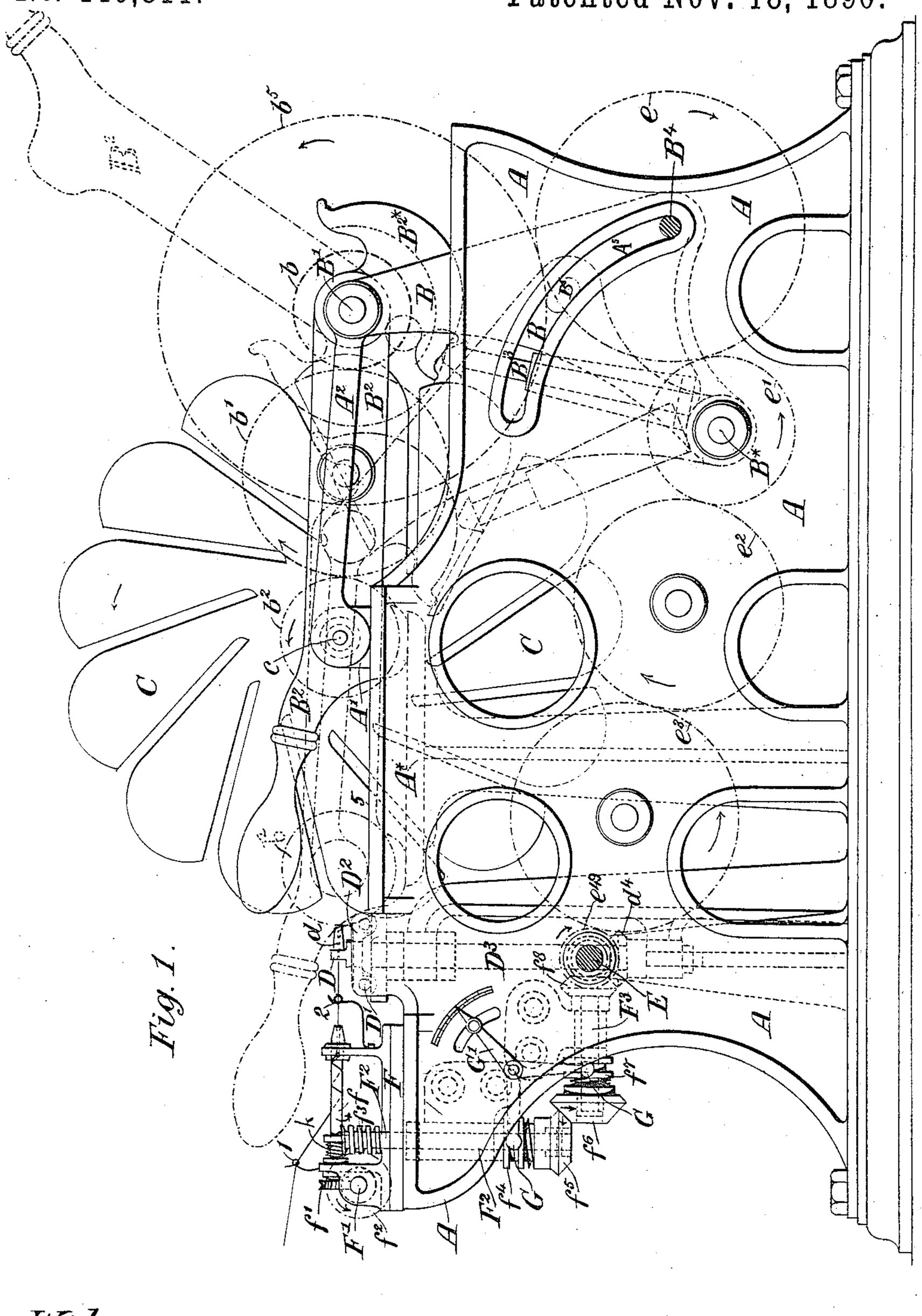

Fig. 1.

Witnesses
John Bickel
C. E. Sundgren

Inventor
John Keats
By attorneys
Brown & Gridley

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J. KEATS.

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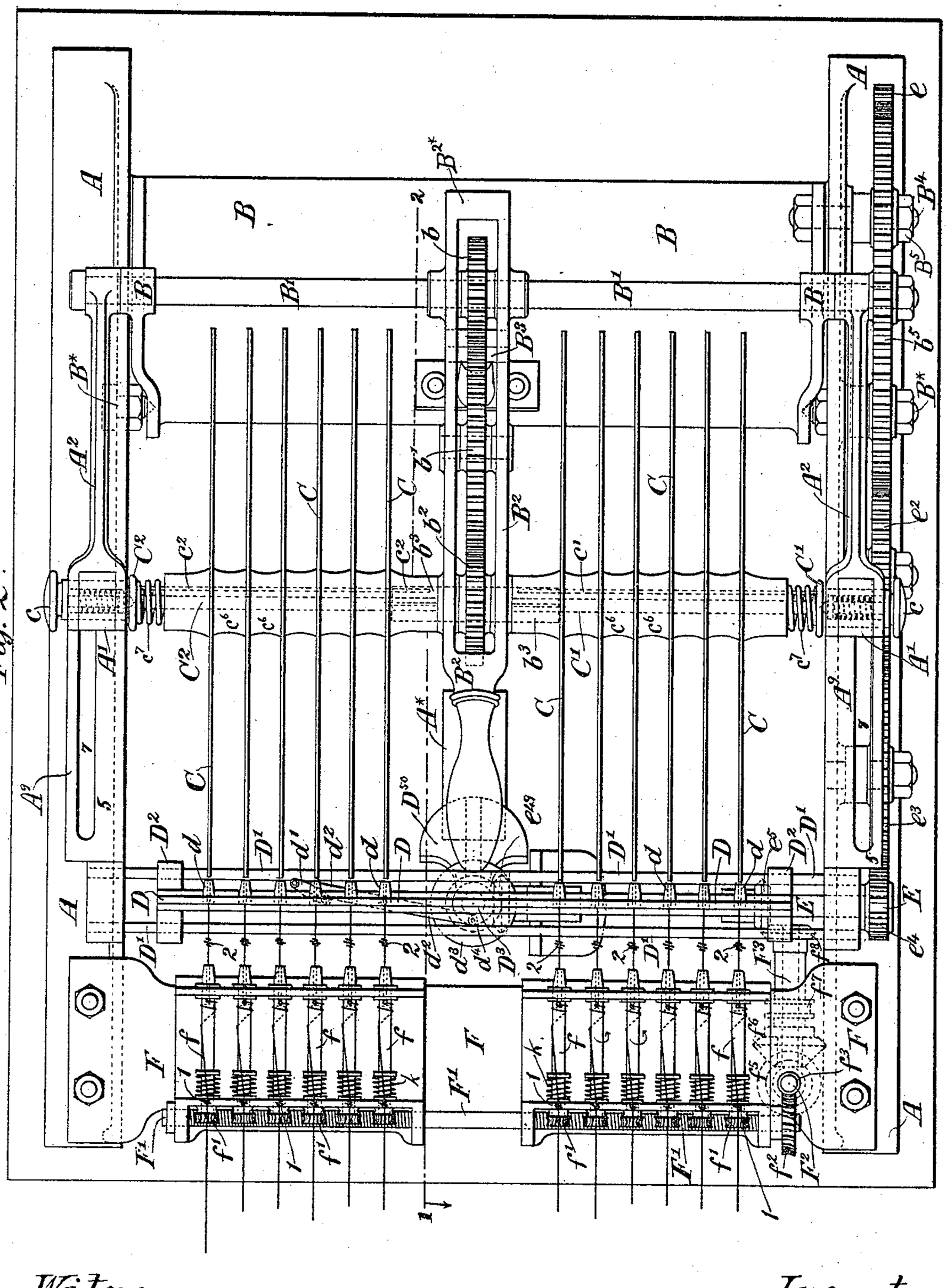
Fig. 2.



Witnesses
John Bickel
C. L. Sundgren

Inventor
John Keats
by attorneys
Brown & Prindle

(No Model.) 3 Sheets—Sheet 3.

J. KEATS.

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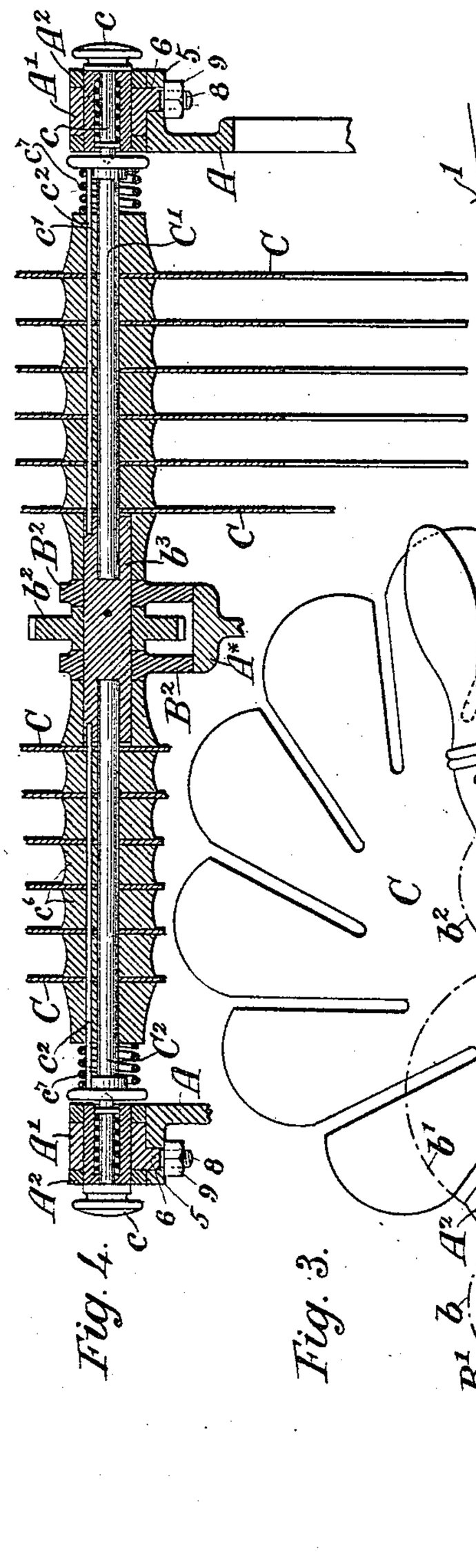

Fig. 4.

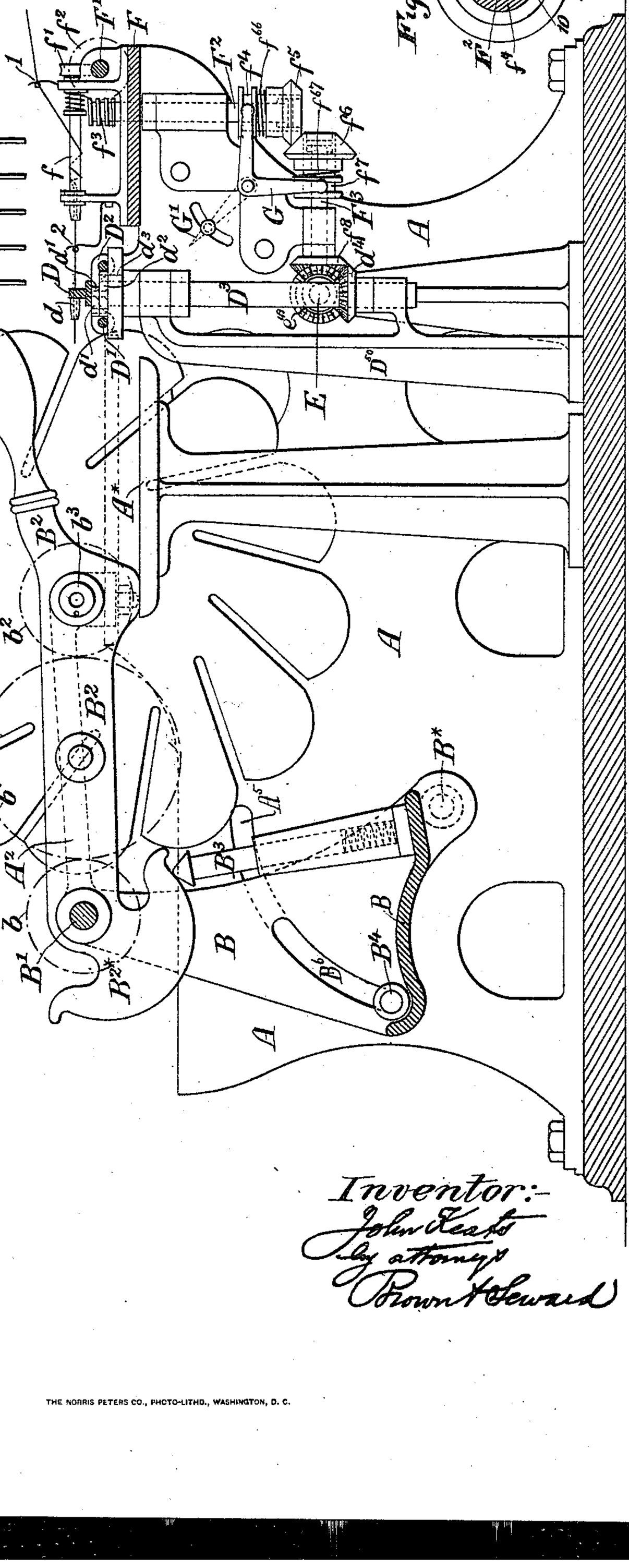

Fig. 3.

Fig. 4*.

Witnesses:-
Fred't Haynes
D. H. Hayward

Inventor:-
John Keats
by attorneys
Brown & Seward

UNITED STATES PATENT OFFICE.

JOHN KEATS, OF BAGNALL, NEAR STOKE-UPON-TRENT, ENGLAND.

APPARATUS FOR WINDING THREAD.

SPECIFICATION forming part of Letters Patent No. 440,811, dated November 18, 1890.

Application filed November 15, 1888. Serial No. 290,875. (No model.) Patented in England January 12, 1887, No. 518; in France April 8, 1887, No. 182,743; in Germany April 24, 1887, No. 42,246, and in Austria-Hungary October 16, 1887, No. 17,986 and No. 37/2,093.

To all whom it may concern:

Be it known that I, JOHN KEATS, of Bagnall, near Stoke-upon-Trent, in the county of Stafford, England, have invented a new and useful Improvement in Apparatus for Winding Thread, (for which I have obtained patents in Great Britain, No. 518, dated January 12, 1887; in France, No. 182,743, dated April 8, 1887; in Germany, No. 42,246, dated April 24, 1887, and in Austria-Hungary, Nos. 17,986, 37/2,093, dated October 16, 1887,) of which the following is a specification, reference being had to the accompanying drawings.

The object of this invention is to provide a machine which will, with the use of a special construction of holder, wind silk and other thread in such a manner that it will give off from its holder with greater regularity than heretofore, and always be in or about the same plane. These results are, I find, of great moment in sewing-machines where slackness of the thread and uneven tension are certain to produce inferior work. The holders for receiving the silk, worsted, or other thread are not included in the present application, but are the subject-matter of my application, Serial No. 343,620, dated March 12, 1890. The said holders have somewhat the character of star-shaped disks with an odd number of arms or spurs, and to them I give a rotary motion in front of a reciprocating thread-guide bar, and I thereby wind the silk or other thread onto the holders, laying it alternately on opposite sides of the projecting arms.

In the accompanying drawings, Figure 1 is a side elevation of my improved apparatus for winding thread onto star-shaped disks or holders, part of said holders being removed to prevent their confusion with other parts of the machine. Fig. 2 is a plan view of the same. Fig. 3 is a longitudinal section of the winding apparatus taken in the line 1 2 of Fig. 2, looking in the direction of the arrow, and omitting all of the thread-holders in front of said line. Fig. 4 is a vertical section in the line of the axis of the spindle which carries the holders, showing, also, the means for supporting the spindle in position. Fig. 4* is a sectional detail view, to be hereinafter explained, on a larger scale than the other figures.

A A is the main framing of the winding apparatus which I employ for winding thread onto holders according to my invention. Within the framing A is mounted an adjustable frame B, pivoted at B* to the sides of the framing. This frame B is intended to carry a series of thread-holders C C C, and to present them to the thread-guides *d* of a guide-bar D, which extends from side to side of the machine, room being left, however, for a short reciprocation of the bar.

D′ D′ are a pair of horizontal guide-rods made fast at their opposite ends to the framing A, and upon them slide two cross-heads D^2, which carry the guide-bar D. Pivoted to the under side of this guide-bar D is a link *d′*, which is connected by a rod d^2 with a crank d^3, carried by a vertical shaft D^3, mounted in a bracket-bearing D^{50}, standing up from the bed-plate of the machine. This device for transmitting the motion of the crank to the thread-guide bar is designed to equalize the pauses of the bar at the opposite ends of its stroke. Keyed to the shaft D^3 is a bevel-pinion d^4, which gears into a bevel-pinion e^{49}, keyed to the inner end of a horizontal shaft E, which is the main shaft of the machine and turns in suitable bearings provided for it.

Mounted in bearings in the frame B is a transverse shaft B′, which forms the fulcrum for a central radius-arm B^2, mounted loosely thereon. This arm is cast with a longitudinal slot to receive a train of spur-gearing *b b′* b^2. The outer end of this radius-arm takes the form of a handle, which facilitates the arm being turned on its axis, and the inner end of the arm is cast with a cam-piece B^{2*}, on which are formed shoulders to receive the end of a spring-actuated bolt B^3, which serves to retain the arm in one or the other of the two positions shown in Fig. 1.

I will now explain the means for giving a rapid rotary motion to the holders, which motion is made variable to suit the various forms or constructions of holders employed.

The spur-wheel *b* is keyed to the shaft B′, and geared into this wheel is an idle-wheel

b', which has its bearings in the slotted arm B^2. The third wheel b^2 is keyed to the short shaft b^3, mounted in bearings in the arm B^2, and formed with socketed ends projecting through opposite sides of the arm B^2.

C′ C^2 are spindles which interlock with the short shaft b^3 and form therewith a compound shaft or spindle. These spindles C′ C^2 are intended to receive the thread-holders C C. The sockets of the short shaft b^3 are bored to receive the inner ends of the spindles, and the opposite ends of the spindles are each formed with a head, in the center of which a coned hole is drilled to receive an adjustable spring-center *c*. There are two of these, each of which is fitted in a sliding block A′, supported on a slotted flange A^9 on the upper part of each of the end frames A. These blocks have on their bottoms projections 6, which enter slots 7 in the said flanges, and on these projections are screws 8, which project through the flanges and are fitted with nuts 9 to clamp them to the flanges at suitable distances from the thread-guides *d*. The said blocks are connected by links A^2 with the adjustable frame B, and therefore if the said blocks are set free by unscrewing their nuts the shifting of that frame will cause the blocks A′ to be moved forward or backward in their slotted flange-supports, carrying with them the divided spindle charged with the holders, so as to place them in the proper position (according to their diameter) relatively to the thread-guides.

Underlying the radius-bar B^2 is a table A*, carried by a support standing up from the bed-plate. This table serves to act as a stop for the radius-arm B^2 and its fittings when they are depressed from their raised position, and thereby to insure the spring-centers *c*, springing into the cupped ends of the spindles C′ C^2. The holders C are locked in position on the compound spindle C′ C^2 by being strung onto rods c' c^2, which stand parallel to the compound spindle and are made fast at their outer ends to the heads of the spindles. Socket-holes are made in the ends of the short shaft b^3 to receive the free ends of the rods c' c^2 and hold them firmly in position. When placing the holders upon their spindles tubular spacing-pieces c^6 are applied. These spacing-pieces are drilled longitudinally, with holes corresponding to the holes in the holders, that they may fit both the spindle and the locking-rod. By placing these holders and spacing-pieces alternately on a spindle, having first applied a coiled spring c^7 to the head of the spindle and by then inserting the spindles in place, the interlocking of the parts will be secured, the spring serving to press the holders and spacing-pieces toward the socket of the short shaft b^3, which shaft now acts as a stop for maintaining the holders in position.

The frame B is made adjustable in the framing A to provide for the introduction of different diameters of thread-holders into the machine, it being requisite to bring the arms of the holders into close proximity with the reciprocating thread-guides *d*. On one side—or it may be on both sides—of the framing A a segment-slot A^5 is formed through the framing to receive a screw-bolt B^4 for fixing, by means of a nut B^5, the frame B to its adjusted position. Such clamping-bolt B^4 also constitutes a stud-pin for the reception of an idle-wheel *e*, which transmits motion through a change-wheel b^5 to the shaft B′ and spur-gears b b' b^2, carried by the radius-arm B^2. The stud-axle B^4 of the wheel *e* passes also through a segment-slot B^6, made in the frame B, and it thus admits of adjustment indedendently of the adjustment of the frame B, for a purpose to be presently explained. Mounted loosely on the stud B*, forming the fulcrum for the frame B, is a spur-wheel e', gearing into the wheel *e*, and this wheel receives motion from the driving-shaft E through spur-gears e^2 e^3 e^4, the latter being keyed on the shaft E. Fitted on a feather of the shaft B′ is a change-wheel b^5, which gears into the wheel *e*. As therefore rotary motion is given to the main shaft E, that motion will be transmitted through the gearing above mentioned to the spindles C′ C^2, which carry the holders C.

It will be understood that the thread-holders will vary according to requirements, both in their diameter and in their number of arms, and it is to provide for these variations that means for adjusting the position of the spindle and its speed of rotation relatively to the position and movements of the thread-guide bar are introduced into the machine, it being necessary that each arm shall pass the reciprocating thread-guide after a movement to one side or the other has taken place. For this purpose I provide a series of change-wheels b^5, different ones being used, according to the nature of the holders with which the machine is for the time being fitted. When winding thread upon holders with, say, five arms, a change-wheel of sixty teeth will be used, the first-motion wheel e^4 having twenty-four teeth. For seven arms, a change-wheel of eighty-four teeth will be required. For a holder of nine arms one hundred and eight teeth, and for a holder of eleven arms one hundred and thirty-two teeth. As these change-wheels are of different diameters, the idle-wheel *e* is made capable of shifting around the fulcrum B* of the frame B, so as to maintain its connection with the gear-wheels.

From the foregoing explanation it will be understood how readily various sizes of holders may be adapted to the machine, the position of the frame B being changed to correspond thereto, and how the speed of rotation of the spindle to suit varying numbers of arms carried by the holders may be changed by employing different change-wheels.

As it is important to insure a variable adjustment of the tension of the thread, I will explain how this is effected. Stretching across

the framing A is a plate F, fitted with a series of bearings, in which are mounted tension-spindles *f*. Around these spindles it is intended to lay the threads as they come from the bobbins or hanks (which deliver them to the machine) before leading them to the holders. The inner ends of these spindles are bored out longitudinally for a short distance, and thence laterally to form a guide for the thread on its way to the guide-bar D. Each spindle is fitted at its outer end with a worm-wheel f', which wheels gear into a worm-shaft F', having its bearings on the plate F. On one end of this shaft F' is a worm-wheel f^2, which gears into a worm f^3, mounted on a short vertical shaft F^2, turning in a bracket-bearing bolted to the main framing. This shaft, it will be seen, passes through an opening in the plate F for its worm to reach the worm-wheel f^2, and it carries on its lower part a sleeve f^4, on which is fitted a coned friction-wheel f^5. Fig. 4* shows a top view of this friction-wheel and a horizontal section of the said shaft and sleeve, taken just above the said friction-wheel. In this view it will be seen that the shaft F^2 has a feather 10, on which the sleeve f^4 is capable of sliding, and that the said sleeve has a feather 11, on which the friction-wheel is capable of sliding, though both the sleeve and the friction-wheel are compelled by the two feathers to turn with the shaft. The friction-wheel f^5 works in contact with another coned friction-wheel f^6, sliding on the feather of a sleeve f^7, which slides on the feather of a horizontal shaft F^3. The last-mentioned feathers are like those on the shaft F^2 and its sleeve just described. The said shaft F^3 is also carried by a bracket bolted to one side of the framing, and on its inner end it carries a bevel-wheel f^8 in gear with a bevel-wheel e^5 of the main driving-shaft E. Surrounding the sleeves f^4 f^7 are coiled springs f^{66} f^{67}, inserted between the heads of the sleeves and the cone-wheels for the purpose of forcing forward the cone-wheels and holding them in frictional contact with each other. By this arrangement of gearing a continuous axial motion is given to the spindles *f*, whereby the coils of thread laid on the spindles, as hereinafter described, are slowly unwound. It is, however, necessary that the resistance offered to the passage of the thread shall gradually decrease as the winding proceeds. This I effect by so timing the gearing that the coils of thread around the spindles shall decrease in number with the progress of the winding. It is for the purpose of further insuring this result that the friction-wheels are introduced. These I connect together by means of a bell-crank lever G. (Shown in side view in Fig. 1, but omitted in Fig. 2 to avoid confusion.) This bell-crank lever is mounted on a pivot which carries an index-finger G', overlying a graduated sector. The arms of this bell-crank lever terminate in forks, which respectively embrace the grooved heads of the sleeves f^4 f^7, carrying their respective cone-wheels f^5 f^6. When, therefore, the bell-crank-lever is tipped, the friction-wheels will be shifted relatively to each other on their shafts, the larger diameter of the one being brought into contact with the smaller diameter of the other. In this way a nicer adjustment of the relative speeds of the spindles *f* and of the traveling threads over them is obtained when such adjustment is required.

To facilitate the coiling of the thread on the tension-spindles, they are made capable of receiving an endway motion, as hereinafter described, whereby their worm-wheels are drawn clear of the worms on the shaft F', and they may then be freely turned to lay the thread in any given number of coils upon their peripheries.

Each thread before being coiled is led through a guide-eye 1, then through the end of the spindle *f*, thence through an elastic or spring eye 2 to the guide *d*, and thence to the holder, to which it is attached. When the spindle is thus threaded up, an axial motion is imparted to it by hand to lay on three or more coils, after which its worm-wheel is put into gear with its worm and the required tension at starting the winding is secured. A coiled spring *k*, surrounding the spindle and placed between its outer bearing and a collar made fast to the spindle, serves to hold the spindle in position and yet allow of its being drawn back to unship its worm-wheel. It will now be understood that if three or four coils of thread around the spindle suffice to put the requisite drag on the thread at the starting of the winding operation, and a slow unwinding motion is given to the spindles, the drag will slacken as the winding proceeds, some two or perhaps three coils being unwound during the action of the machine. If more tension is required, that result can be secured by an additional coil of the thread around the spindles, and if less tension is found desirable for the particular character of thread under treatment a less number of coils at starting will suffice. When the set speed of rotation of the spindles is found to be in excess or short of the requirements of the thread, the shifting of the friction-wheels f^5 f^6 in the proper direction will provide for the adjustment desired.

In the drawings the machine is shown as containing twelve holders, six for each detachable portion of the winding-spindle; but the machine may be constructed to contain a larger or a smaller number, the reciprocating bar D having a proportionately increased or diminished number of thread-guides. It will be understood that all the holders fitted to the machine at one time will be of the same size and character; otherwise the work of winding could not be properly carried on. The adjustment of the frame B will be made to suit the diameter of the holders, and the proper change-wheel will be selected to correspond with the arms in the holders, as above mentioned.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The winding-machine herein described, consisting of the spindle for receiving the thread-holders and rotating them, a reciprocating thread-guide bar and guides thereon for laying the thread alternately on opposite sides of the arms of the rotating holders, and means for rotating the spindle and reciprocating the thread-guide bar, having provisions for varying the speed of the rotation of the spindle relative to the reciprocations of the thread-guide bar, substantially as herein described.

2. The combination of the adjustable rocking frame and pivotal supports therefor, means for holding the said frame in adjusted position, a thread-holder spindle and bearings therefor, link connections between said rocking frame and said bearings, a thread-guide bar, and means for reciprocating said bar, all substantially as herein set forth.

3. The combination of the thread-holder spindle constructed in parts C′ C², the socket-shaft for receiving the inner ends of said parts, and the spring-actuated centers for the outer ends of said parts, substantially as herein described, whereby the unshipping of the said spindle parts C′ C² is provided for, as herein set forth.

4. The combination, with the thread-guides of a thread-winder, of a thread-tension device consisting of short spindles, one for each thread, and bearings for the said spindles in which they are free to slide endwise and independently of each other, a worm-wheel on each of said spindles, a worm-shaft gearing with said worm-wheels, and actuating-gearing for said worm-shaft, the said spindles having passages provided within them and being adapted to receive the thread in coils upon their peripheries and deliver it through said passages to the thread-guides, substantially as described.

JOHN KEATS.

Witnesses:
R. J. PRESTON,
J. L. RATHBONE.