

(No Model.)

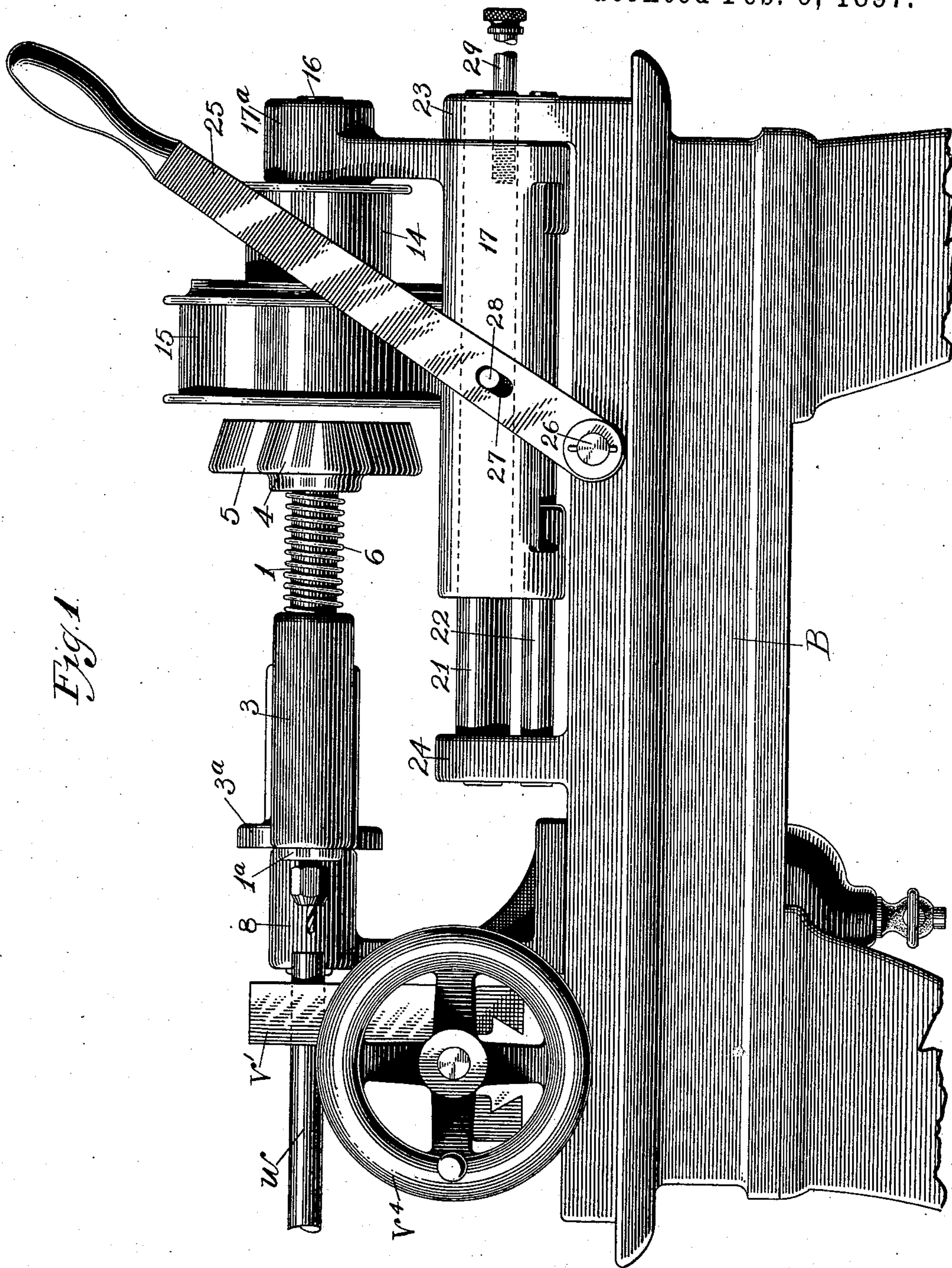
5 Sheets—Sheet 1.

B. S. WOODWARD.
MULTIPLE SPINDLED DRIVING DEVICE.

No. 576,988.

Patented Feb. 9, 1897.

Fig. 1



Witnesses
L. S. Storer
Jennie Nellis

Inventor
B. S. Woodward
By his Attorney
W. H. Honiss

(No Model.)

5 Sheets—Sheet 2.

B. S. WOODWARD.
MULTIPLE SPINDLED DRIVING DEVICE.

No. 576,988.

Patented Feb. 9, 1897.

Fig. 2.

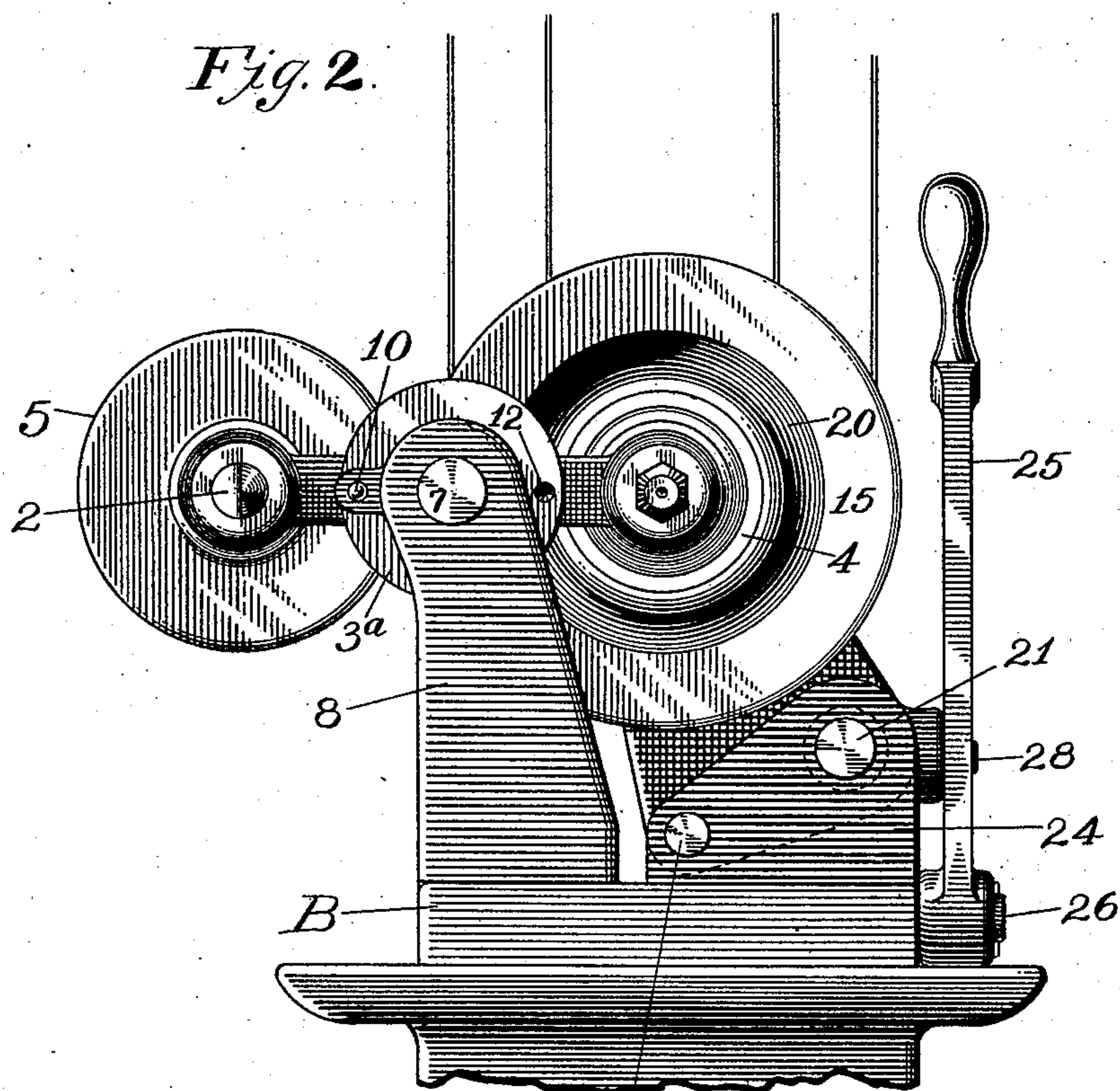
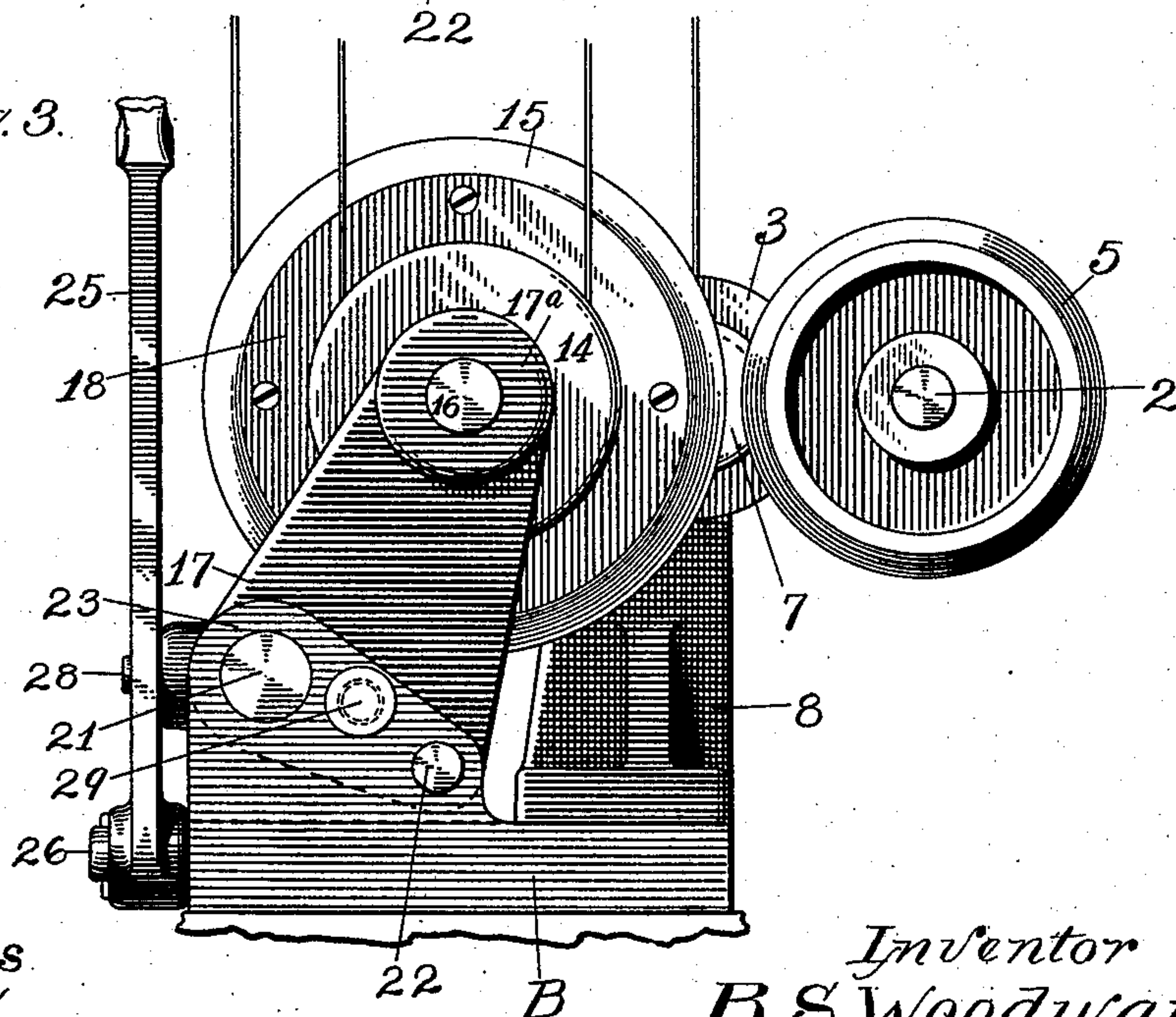


Fig. 3.



Witnesses
L. S. Storer.
Jennie Nellis.

Inventor
B. S. Woodward
By his Attorney
W. H. Honiss.

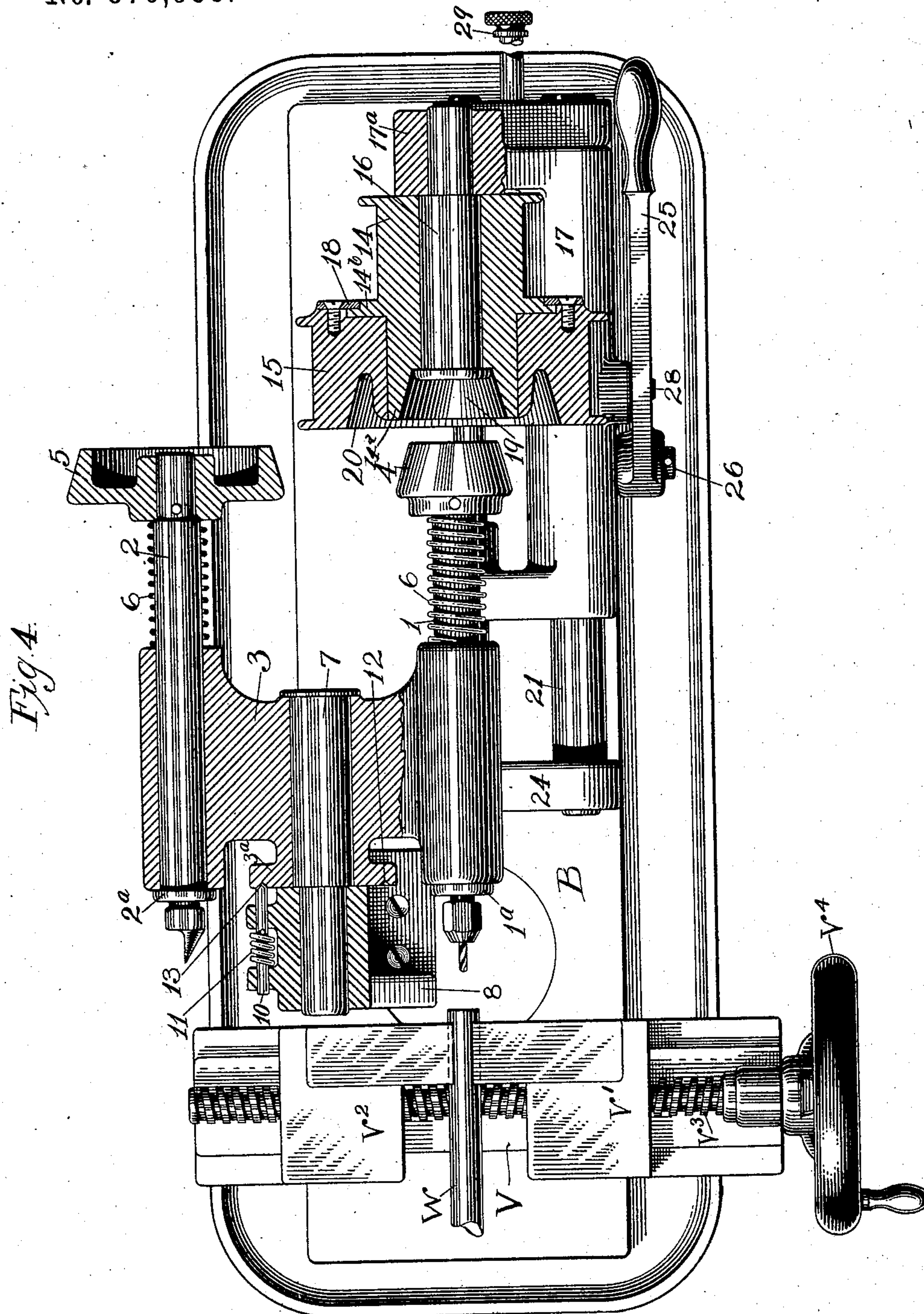
(No Model.)

5 Sheets—Sheet 3.

B. S. WOODWARD.
MULTIPLE SPINDLED DRIVING DEVICE.

No. 576,988.

Patented Feb. 9, 1897.



Witnesses
L. St. Forner
James Kellis.

Inventor
B. S. Woodward
By his Attorney
W. H. Honiss.

(No Model.)

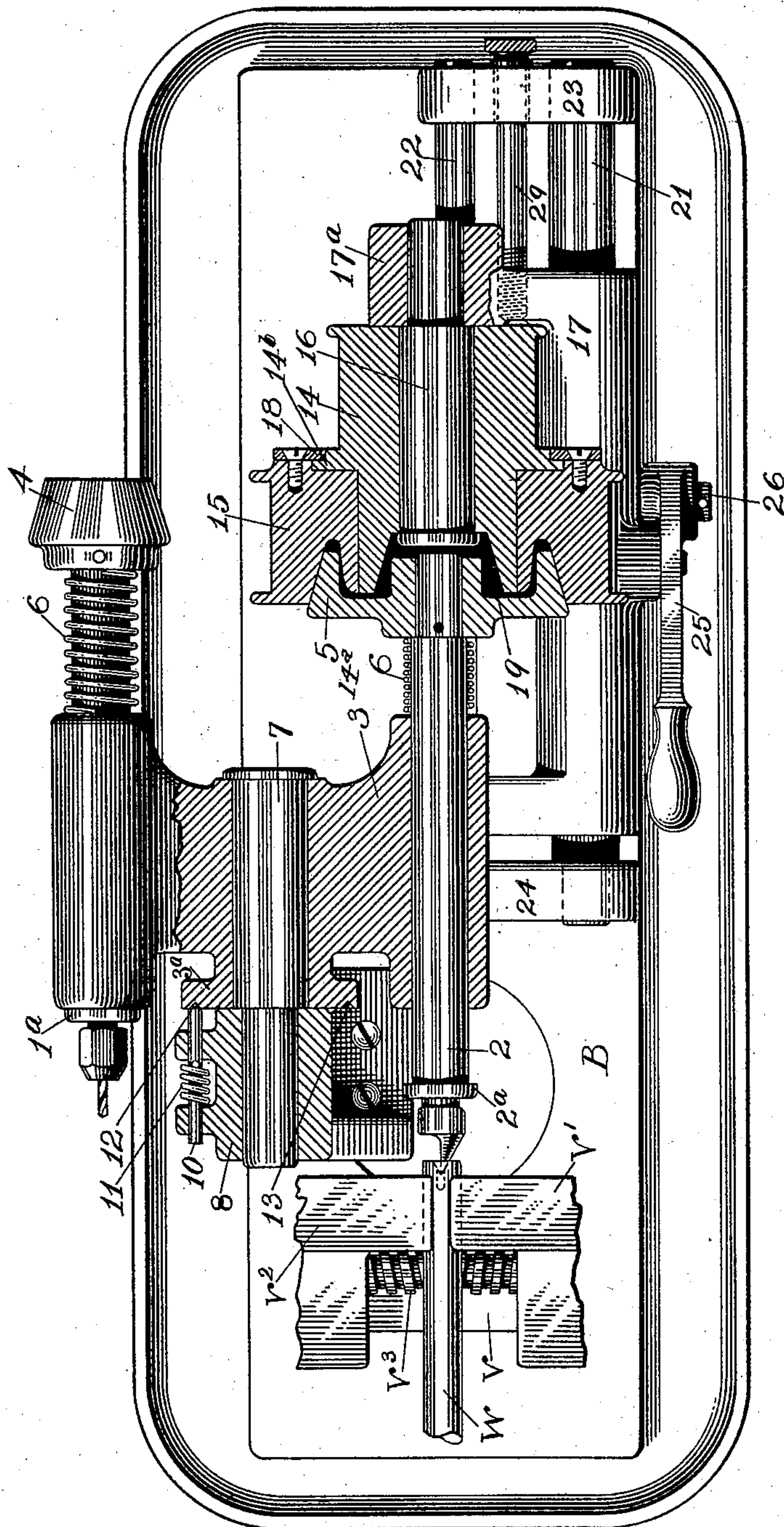
5 Sheets—Sheet 4.

B. S. WOODWARD.
MULTIPLE SPINDLED DRIVING DEVICE.

No. 576,988.

Patented Feb. 9, 1897.

Fig. 5.



Witnesses
L. S. Storer
Jenne Kellis.

Inventor
B. S. Woodward
By his Attorney
W. H. Honiss.

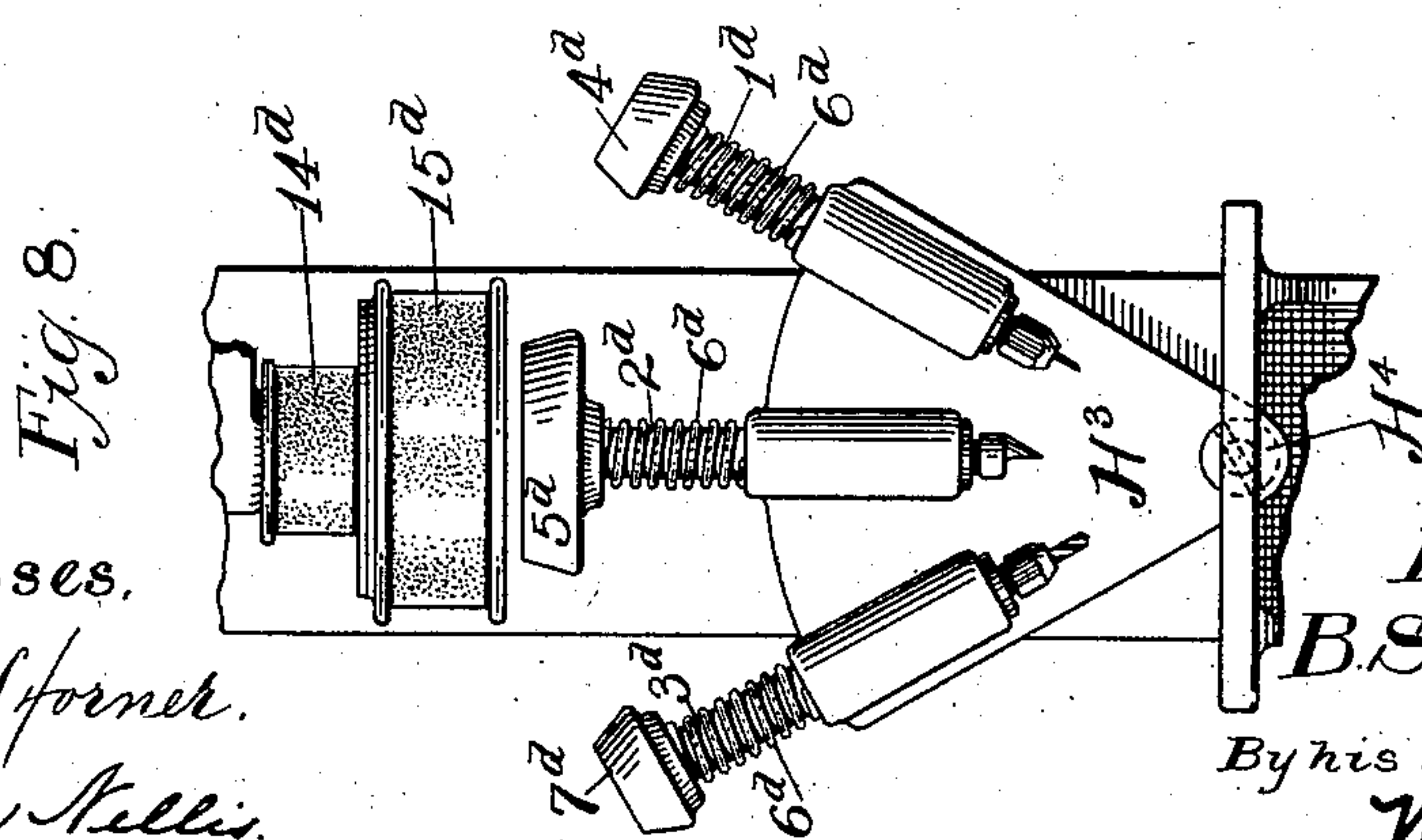
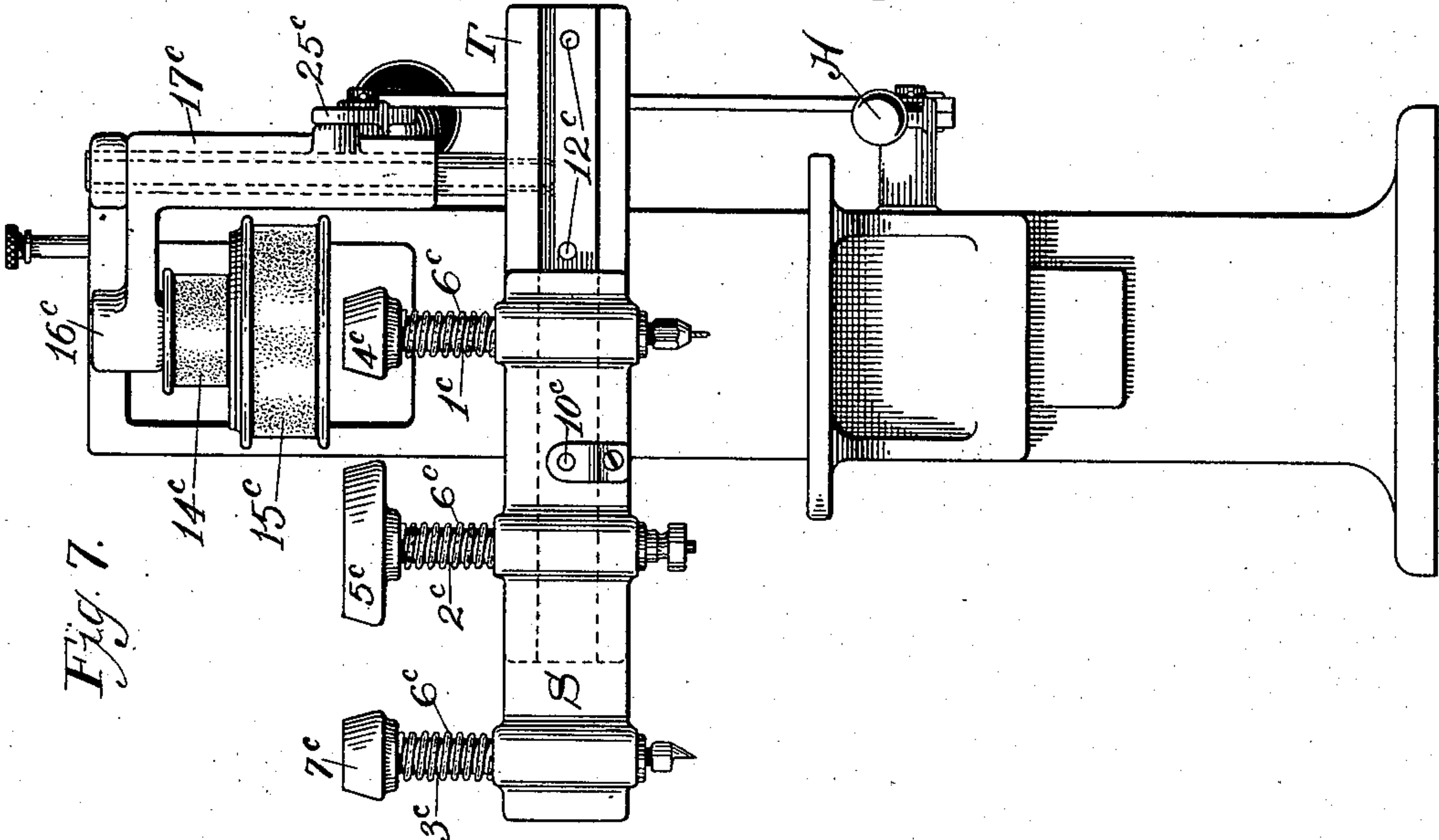
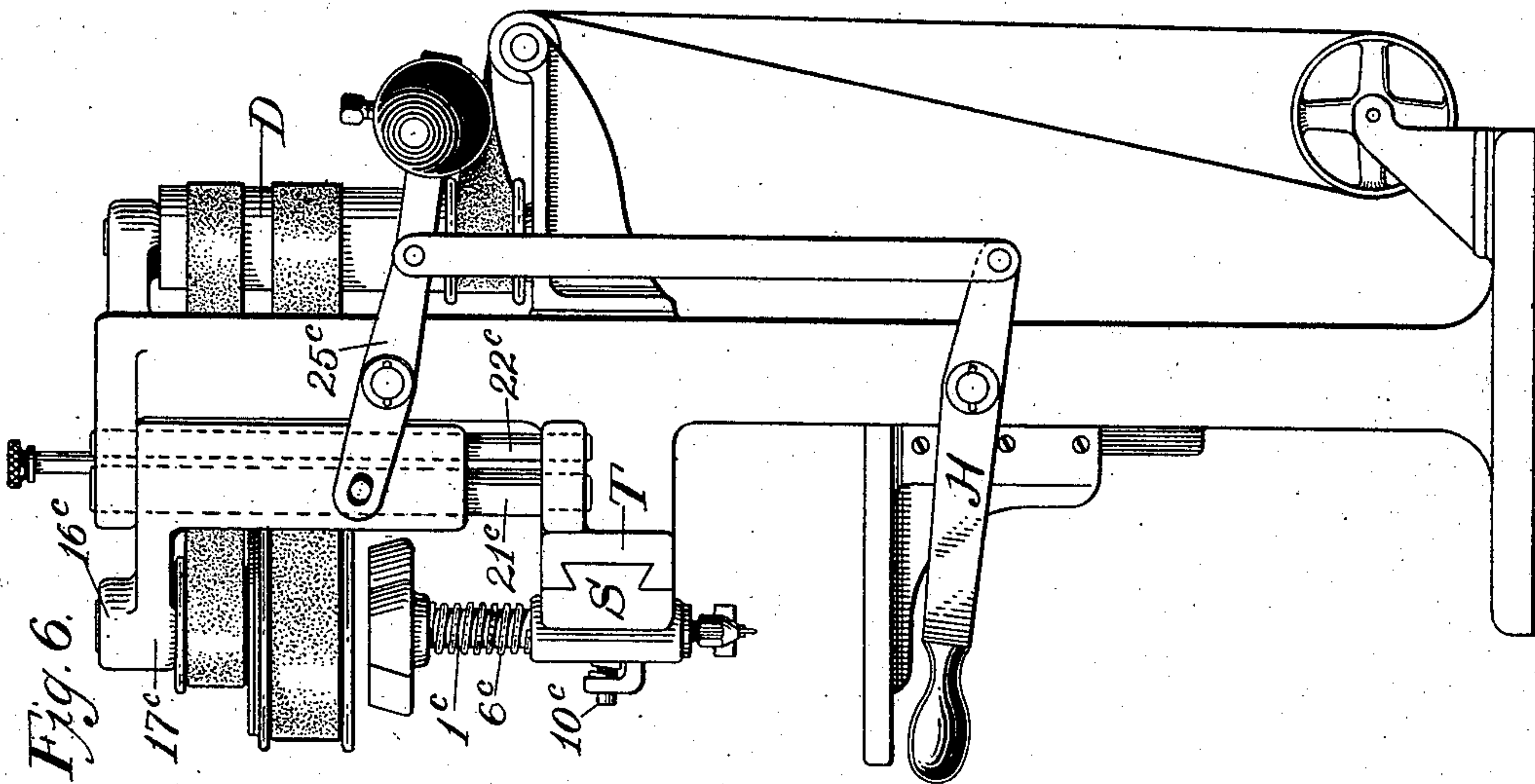
(No Model.)

5 Sheets—Sheet 5.

B. S. WOODWARD.
MULTIPLE SPINDLED DRIVING DEVICE.

No. 576,988.

Patented Feb. 9, 1897.



Witnesses.
L. H. Spomer.
Jimmie Nellis.

Inventor
B. S. Woodward
By his Attorney
W. H. Boniss.

UNITED STATES PATENT OFFICE.

BENJAMIN S. WOODWARD, OF HARTFORD, CONNECTICUT, ASSIGNOR
OF ONE-HALF TO WILLIAM W. ROGERS, OF WEST HARTFORD, CON-
NECTICUT.

MULTIPLE-SPINDLED DRIVING DEVICE.

SPECIFICATION forming part of Letters Patent No. 576,988, dated February 9, 1897.

Application filed June 19, 1896. Serial No. 596,208. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN S. WOODWARD, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Multiple-Spindled Driving Devices, of which the following is a full, clear, and exact specification.

This invention relates to improved means for driving a series of spindles either at the same rate or at differing rates of speed, as may be desired. It is applicable to machinery of various kinds employing multiple spindles, which by the use of this invention may be brought in any desired sequence to a given operative position in order to operate upon a fixed piece of work.

My invention is herein shown in its application to multiple-spindled drilling-machines, which may be of the horizontal type shown in the first figures of the drawings or of the vertical type shown in the later figures thereof.

Figures 1 to 5 of the drawings represent this invention as embodied in a machine to be employed in the drilling and countersinking of the center holes of shafts, studs, and other objects which have subsequently to be mounted upon centers. Fig. 1 is a front elevation of the upper portion of this machine, the legs being broken away to allow of drawing the mechanism to a conveniently large scale. Fig. 2 is a left-hand view of the machine of Fig. 1 with the work-holding chuck or vise removed in order to enable the position and arrangement of the spindles to be more clearly shown. Fig. 3 is a right-hand end view of what is shown in Fig. 1. Fig. 4 is a plan view in section taken through the longitudinal centers of the several spindles, showing the drill-spindle in operative relation to the work, but not engaged by its driving means. Fig. 5 is a plan view, partly in section, taken on the line 4 4 of Fig. 1, showing the countersinking-spindle in engagement with its driving-head and carried into operative relation to its work. Fig. 6 is a side elevation, and Fig. 7 a front elevation, of a vertical drilling-machine embodying my invention, the series of spindles being in this case mounted upon a slide by means of which

they are moved transversely to their operative position with relation to the work and to the driving means. Fig. 8 is a front elevation showing a modified arrangement of the series of spindles, in which they are mounted upon a swinging plate in radial relation thereto, so that each spindle may be brought by a suitable oscillatory movement of the plate into operative position.

The numeral 1 represents a driving-spindle which may be fitted with a chuck in the usual manner, so as to enable it to hold drills of differing diameters, while the numeral 2 represents a similar spindle, which in the drawings is shown to be provided with a countersinking-tool, but which may obviously be fitted with a drill, counterbore, reamer, tap, or any other tool which it may be desired to employ. These spindles are fitted to rotate in the head 3, as best shown in Figs. 4 and 5, being provided with collars 1^a and 2^a, respectively, at their left-hand ends. The right-hand ends of these spindles 1 and 2 are provided with friction-cones 4 and 5, which are keyed or otherwise firmly secured upon the ends of their respective spindles. These spindles have coiled upon them the springs 6, located between the bearings and the cones 4 and 5, the tension of the springs being in a direction to hold the spindles toward the right away from the work, as shown in Fig. 4, further movement in that direction being prevented by the collars 1^a and 2^a of the spindles.

The spindle-head 3 is rotatably mounted upon the stud 7, and that stud is fixed in the bracket 8, secured to and projecting upwardly from the bed B of the machine. The bracket is also preferably provided with lugs into which is fitted the index-pin 10, as shown in Fig. 4. The right-hand end of the pin is preferably beveled or tapered and is forced by means of the spring 11 toward the right into engagement with corresponding index-recesses 12 and 13 in the flange 3^a of the spindle-head, these recesses agreeing in number with and being located in suitable relative position to the spindles contained in the head.

The driving-clutches 14 and 15 are mounted concentrically with each other and with the operative position of the spindles contained

in the head. The clutch 14 is fitted to rotate upon the stud 16, which is fixed in an arm 17^a of the slide 17 and is provided with a head for retaining the clutch 14 endwise in its relation to the slide 17. The clutch 15 is mounted so as to rotate freely upon a sleeve 14^a of the clutch 14, being held in longitudinal position upon that sleeve by means of the ring 18, which is screwed to the right-hand face of the clutch 15 and bears against a flange 14^b of the clutch 14, as best shown in Figs. 4 and 5. As a means of rotating these clutches, they are herein shown as being adapted as pulleys to receive belts by means of which they are independently driven from any convenient counter-shaft or drum.

The clutch 14 is provided on its left-hand end with a tapering recess 19, which is fitted to receive the cone 4 of the drilling-spindle 1, the taper of the cone and of the recess being such as to cause them to grip together firmly when they are pressed into contact during the drilling operation. The clutch 15 is also provided with a similar recess 20, fitting the cone 5 of the spindle 2. Thus it will be seen that the spindle 1, when in the position shown in Fig. 4, will be driven by the clutch 14, and the spindle 2, when moved to the same position, as shown in Fig. 5, will be driven by the clutch 15, and that the direction and speed of these clutches, being driven by means of independent belts, may, independently of each other, be adapted to the requirements of their respective spindles. The slide 17, on which these driving-clutches are mounted, is fitted to slide longitudinally of the bed of the machine and in a direction parallel with the spindles by being mounted upon the rods 21 and 22, which are fixed at their ends in the lugs 23 and 24 of the bed B of the machine. The slide is capable of movement upon its rods to the extent required by the desired longitudinal travel of the spindles. It is so moved thereon by the operator by means of the lever 25, which is pivotally mounted at 26 on the bed B, and is provided with a slot 27, engaging with a pin 28 on the slide 17, by means of which the latter with its rotating clutches may be moved forward into driving engagement with whichever one of the spindles may be in position therefor and, continuing the movement, carry the tool which is mounted upon that spindle into contact with its work.

As a means of gaging the depth of the operations performed by the spindles, the slide 17 is provided with an adjustable stop-screw 29, which is threaded in the slide and extends through the lug 23 of the bed, having on its outer end a knurled head by means of which it may be adjusted to its required position.

As a means of holding the work in position to be operated upon by the spindles, the machine is provided with a vise V, (best shown in Figs. 1 and 4,) having jaws V¹ and V², which, by means of the right and left hand threaded screw V³ and its hand-wheel V⁴, are moved

together to clamp the work W and to hold it firmly in suitable position with relation to the operative position of the spindles, which, as herein shown, is in line with the axis of the driving-clutches.

In the modified construction shown in Figs. 6 and 7 the spindles 1^c, 2^c, and 3^c are journaled upon the slide S and are provided with springs 6^c and with cones 4^c, 5^c, and 7^c, respectively. These spindles and their appurtenant springs and cones are arranged and operate in a manner substantially similar to that of the spindles 1 and 2 of the preceding figures. The slide S is fitted upon a cross-arm T of the machine, being provided with an index-pin 10^c, adapted to coincide with index-holes 12^c in the arm T to suit the operative position of the different spindles. The clutch-pulleys 14^c and 15^c are fitted to rotate upon the stud 16^c, fixed in the slide 17^c, which is fitted to slide vertically upon the rods 21^c and 22^c, fixed at their ends to lugs of the bed or column of the machine, all in a way substantially similar to that in which the clutches 14 and 15 are shown in the preceding figures to be mounted and operated. The clutch-pulleys 14^c and 15^c are driven by means of independent belts from the drum D, which in turn may be driven as shown in the figures, or any of the numerous ways in which drilling-machine spindles are usually driven. The slide 17^c may be moved longitudinally upon its guide-rods by means of the lever 25^c, connected by means of a link to the hand-lever H or to a foot-lever, as may be thought preferable.

In Fig. 8 is shown still another modified arrangement of the spindles, whereby they may be brought in any desired sequence into their relative position. In that figure the spindles 1^d, 2^d, and 3^d are journaled upon the swinging head H³, which is pivoted at H⁴ to the bed or column of the machine. These spindles are provided with springs 6^d and with cones 4^d, 5^d, and 7^d in a manner hereinbefore described in connection with the corresponding spindles of the other figures of the drawings, and are brought into alinement with the clutches 14^d and 15^d by swinging the head H upon its pivot H⁴, the spindles being preferably mounted upon that head in radial relation to its center of oscillation.

If the nature of the work to be done permits of the driving of the several spindles at the same rotative velocity, it is only necessary to employ one driving-clutch, each of the spindles in that case being provided with a cone suitable for engaging with that driving-clutch.

The index-recesses are preferably made shallow, so that the index-pin enters but a short distance, and that pin is made beveled or tapering, so that the operator may, by turning the head, force the index-pin out of its recess, it being only necessary for the pin to locate the positions of the spindle-head, inasmuch as the clutches, when brought forward over their respective cones, serve to central-

ize the spindles and to lock the spindle-head positively during the operations of the tools upon the work.

The clutches for each of the spindles may be driven at speeds suitably related to the work to be done by the respective tools. They may be driven in the same direction or in opposite directions, as may be desired. Two or more of the spindles may be made to engage with the same clutch, as shown in Figs. 7 and 8, or additional clutches may be provided mounted one upon the other, each driven by its own independent means. The clutches may also positively engage with their respective cones by means of fingers instead of by friction, as herein shown, and in various ways which will suggest themselves to the artisan skilled in this art.

The various elements of this invention may be modified, or equivalent elements substituted therefor, without departing from the essential features thereof.

I claim as my invention—

1. A series of concentrically-journaled separate driving-clutches, and a series of rotatable spindles journaled in a movable head, whereby each spindle of the series may be brought into concentric engaging relation with its respective clutch, substantially as described.

2. A driving-clutch, its rotating means, and a series of spindles journaled in a movable head, whereby they may each be brought into concentric relation to the clutch, with means for moving the clutch longitudinally of the common axis of itself and of the spindle which is in the operative position, thereby rotating that spindle and moving it longitudinally to its work, substantially as described.

3. In combination with a series of concentrically-mounted separate rotating clutches, a series of rotatable spindles, each provided with a cone for engaging with one or the other of the clutches and with a spring for maintaining the said engagement, the series of spindles being mounted upon a movable head by means of which each may independently be brought into alinement with the series of clutches.

4. In combination with a series of concentrically-mounted driving-clutches, a series of spindles each adapted to be brought into engaging relation with one of the clutches, with means for independently rotating the clutches at suitable rates of speed, substantially as described.

5. A series of concentrically-mounted separate driving-clutches, means for holding the work in suitable relation thereto, and a series of spindles located between the plane of the work and the plane of the clutches, rotatably mounted upon a movable head, whereby each of the spindles may independently be brought into engaging relation to the work and to one of the clutches, substantially as described.

6. A series of concentrically-mounted separate driving-clutches, means for holding the work in suitable relation thereto, a series of tool-carrying spindles rotatably mounted upon a head, whereby they may independently be brought into alinement with the work and with one of the series of clutches, the latter being capable of longitudinal movement whereby it may be brought into driving engagement with the spindle, and then move the latter longitudinally to its work, substantially as described.

7. A series of concentrically-mounted rotating clutches, a slide upon which the clutches are mounted, being capable of movement longitudinally of the common axis of the clutches, with means for independently rotating the clutches, and with means for moving the slide longitudinally, substantially as described.

8. The combination of a slide, a rotating driving-clutch journaled thereon, a clutch journaled upon a sleeve of the clutch, concentrically therewith, with means for imparting rotative motion independently to each of the clutches, and with means for moving the slide upon its ways longitudinally of the common axis of the clutches.

BENJAMIN S. WOODWARD.

Witnesses:

JENNIE NELLIS,
W. H. HONISS.