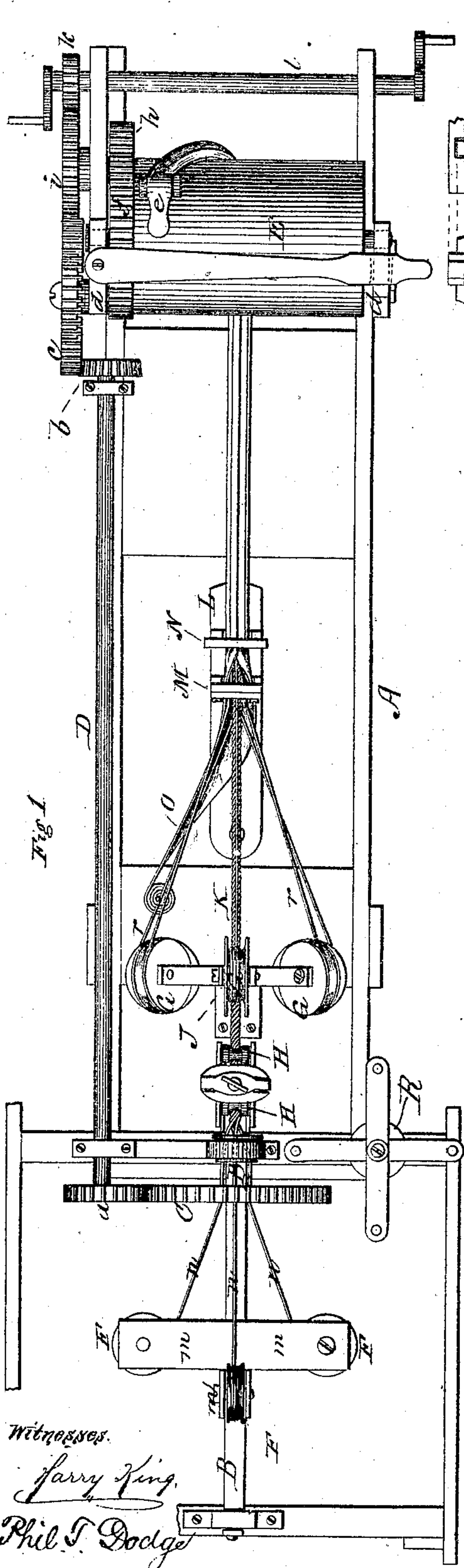
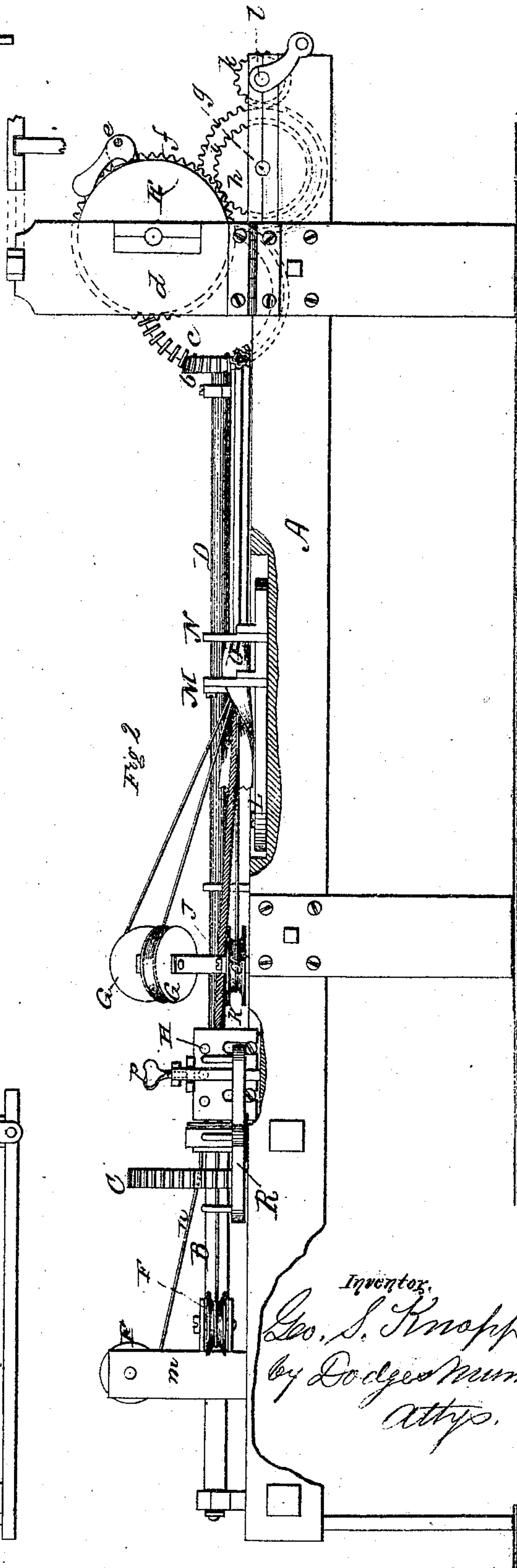


GEORGE S. KNAPP.  
Improvement in Machines for making Lightning Rods.  
No. 119,987. Patented Oct. 17, 1871.



Witnesses.  
Harry King.  
Phil. S. Dodge



Inventor.  
Geo. S. Knapp.  
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Atty.

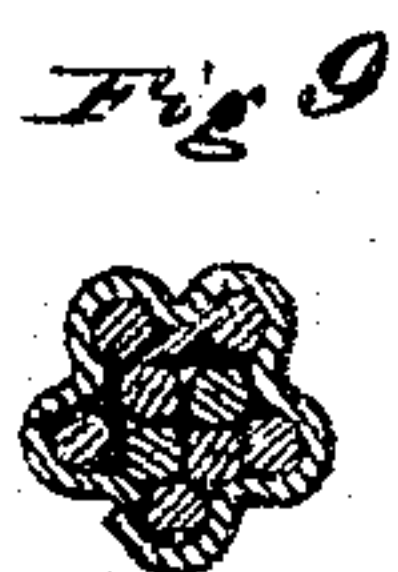
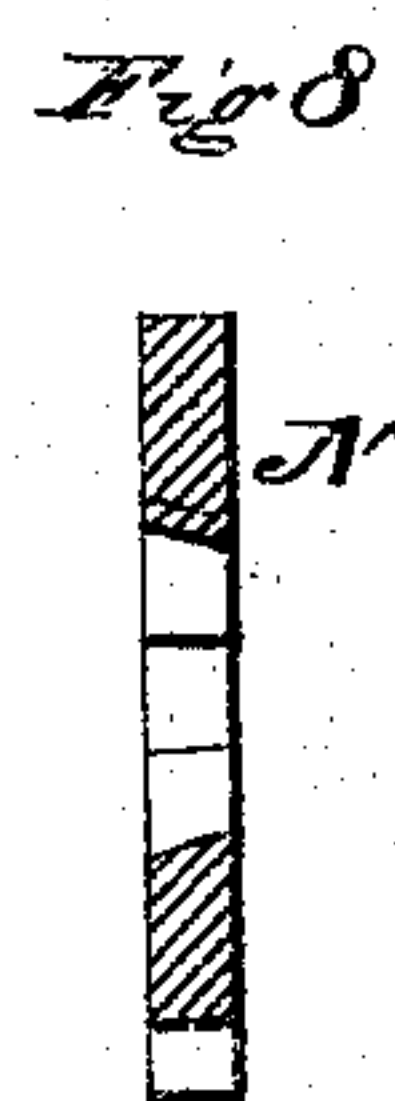
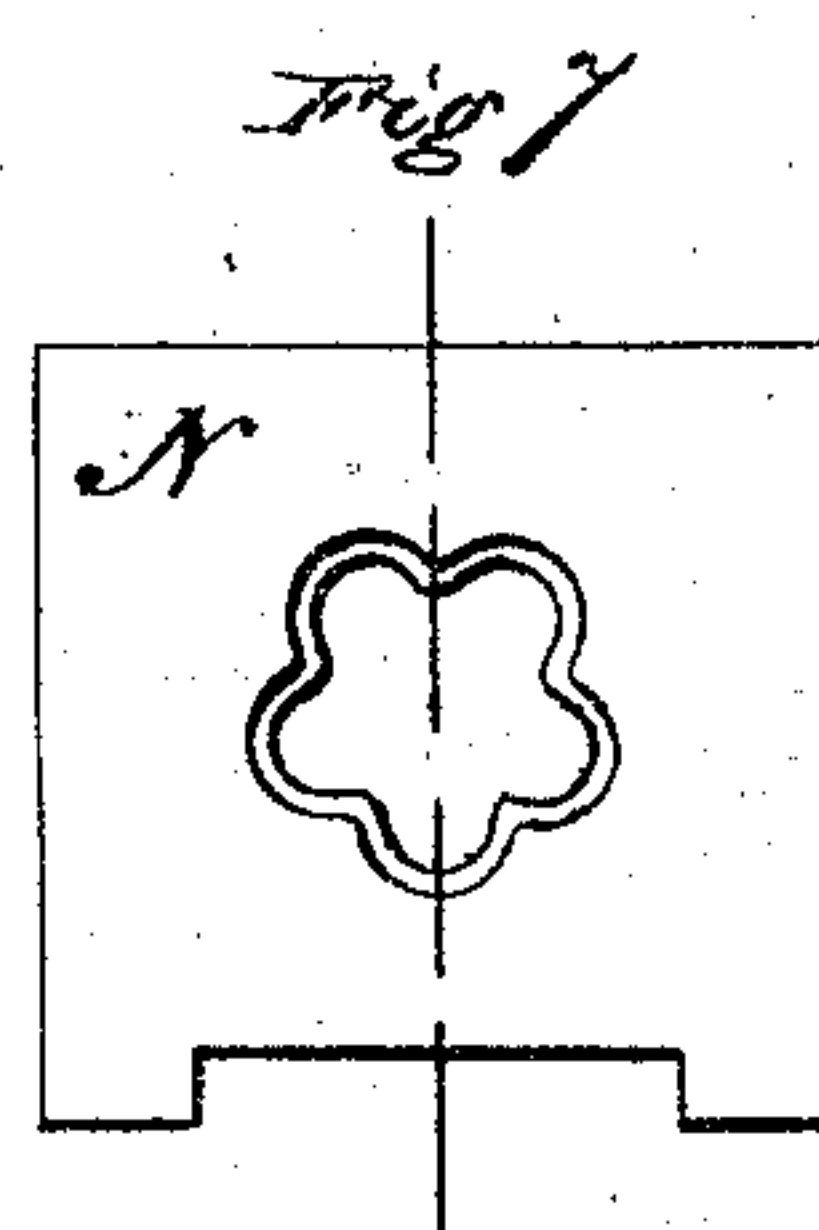
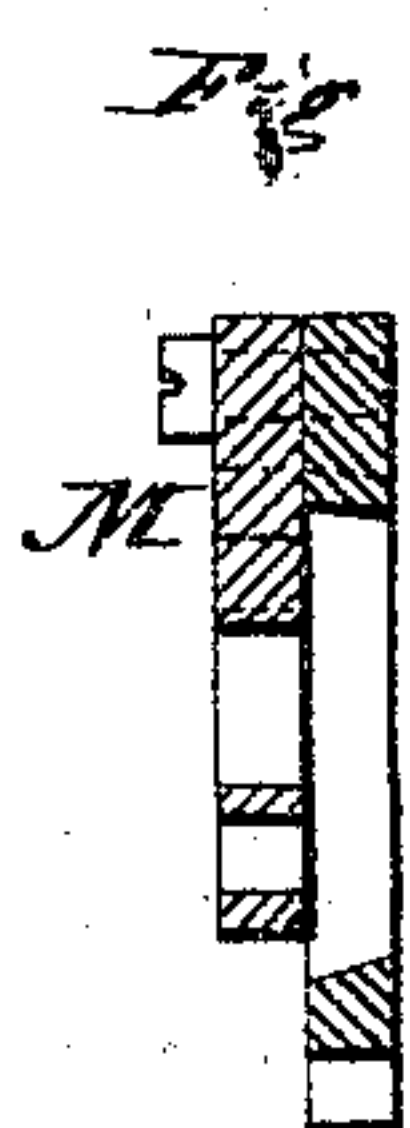
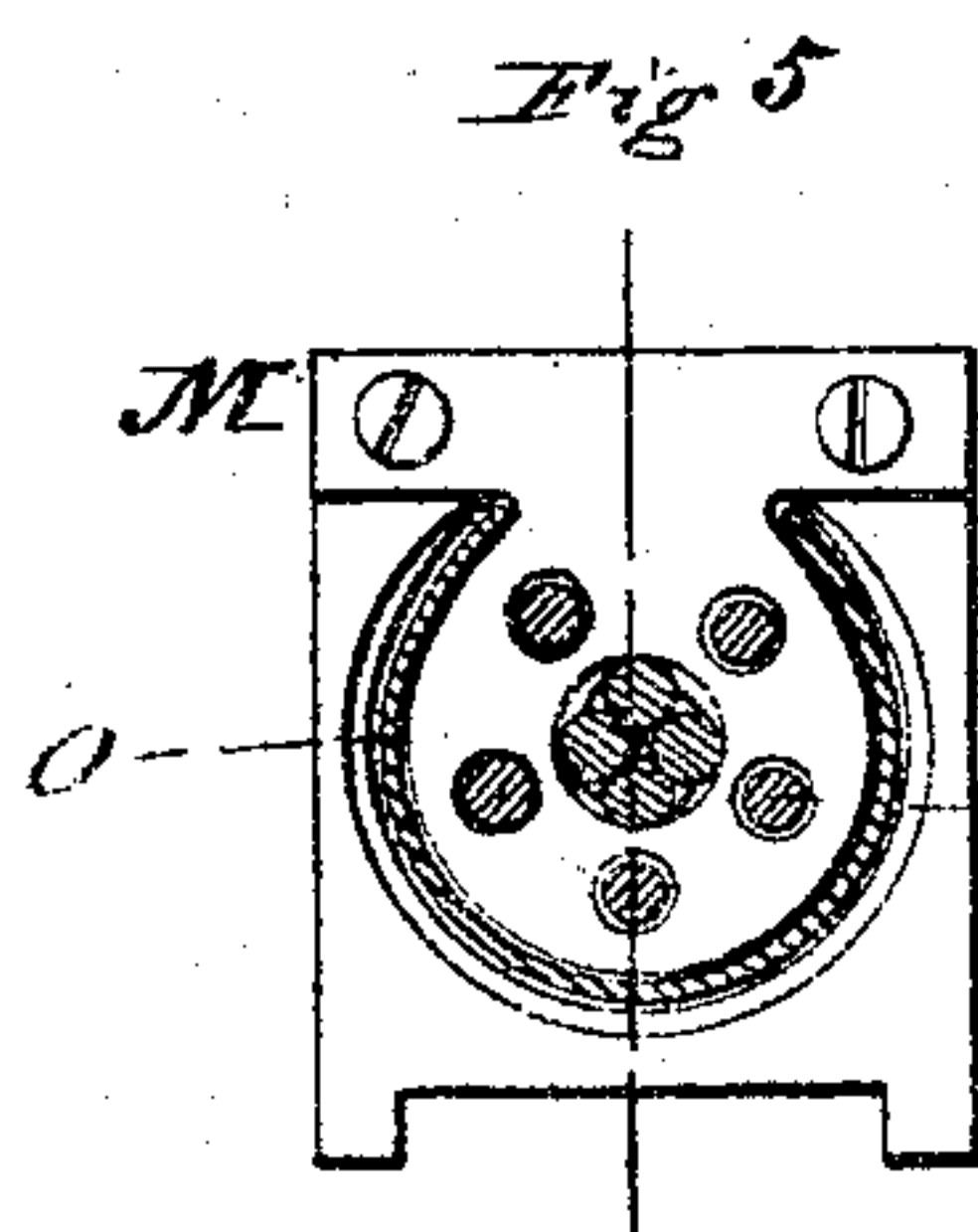
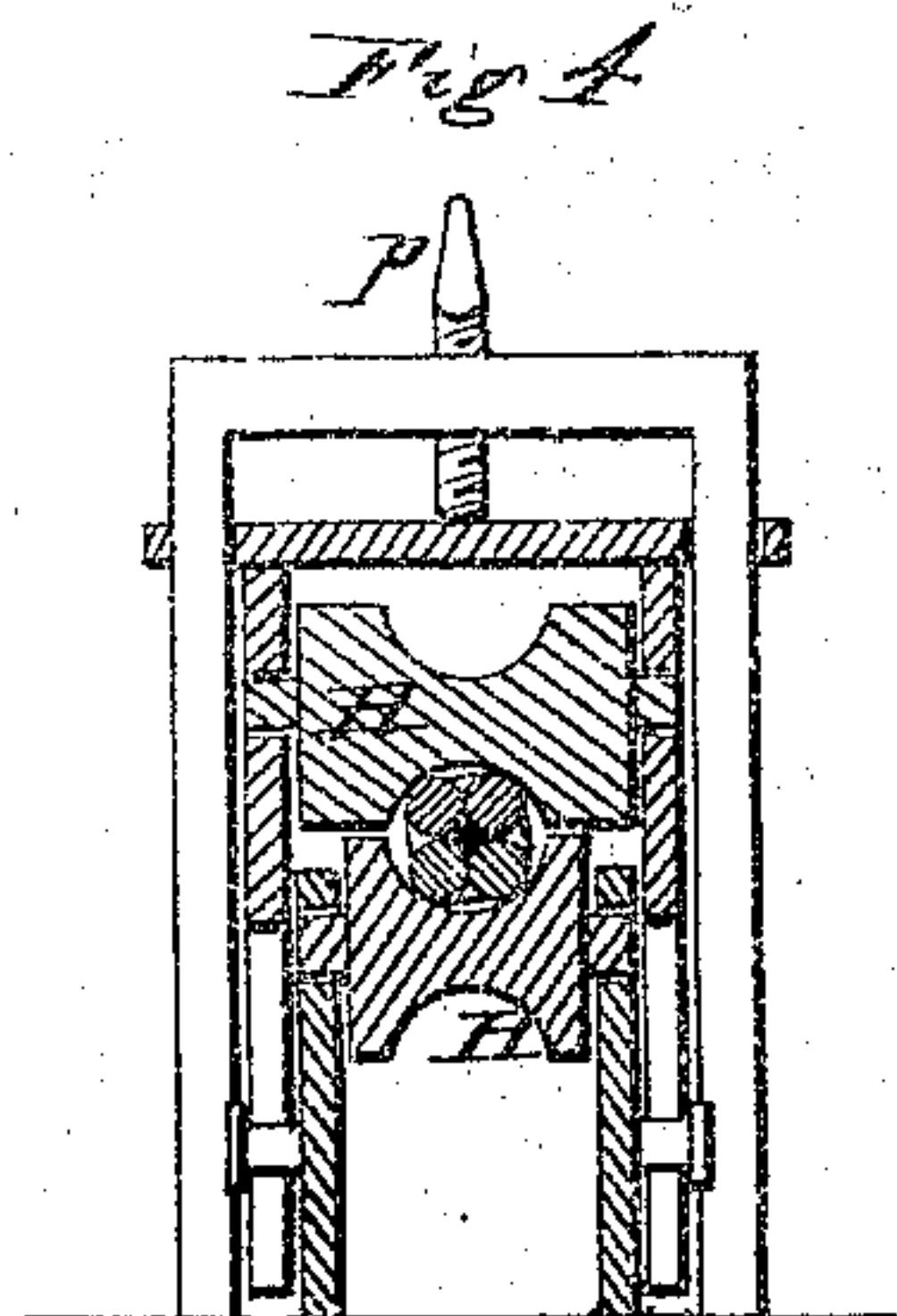
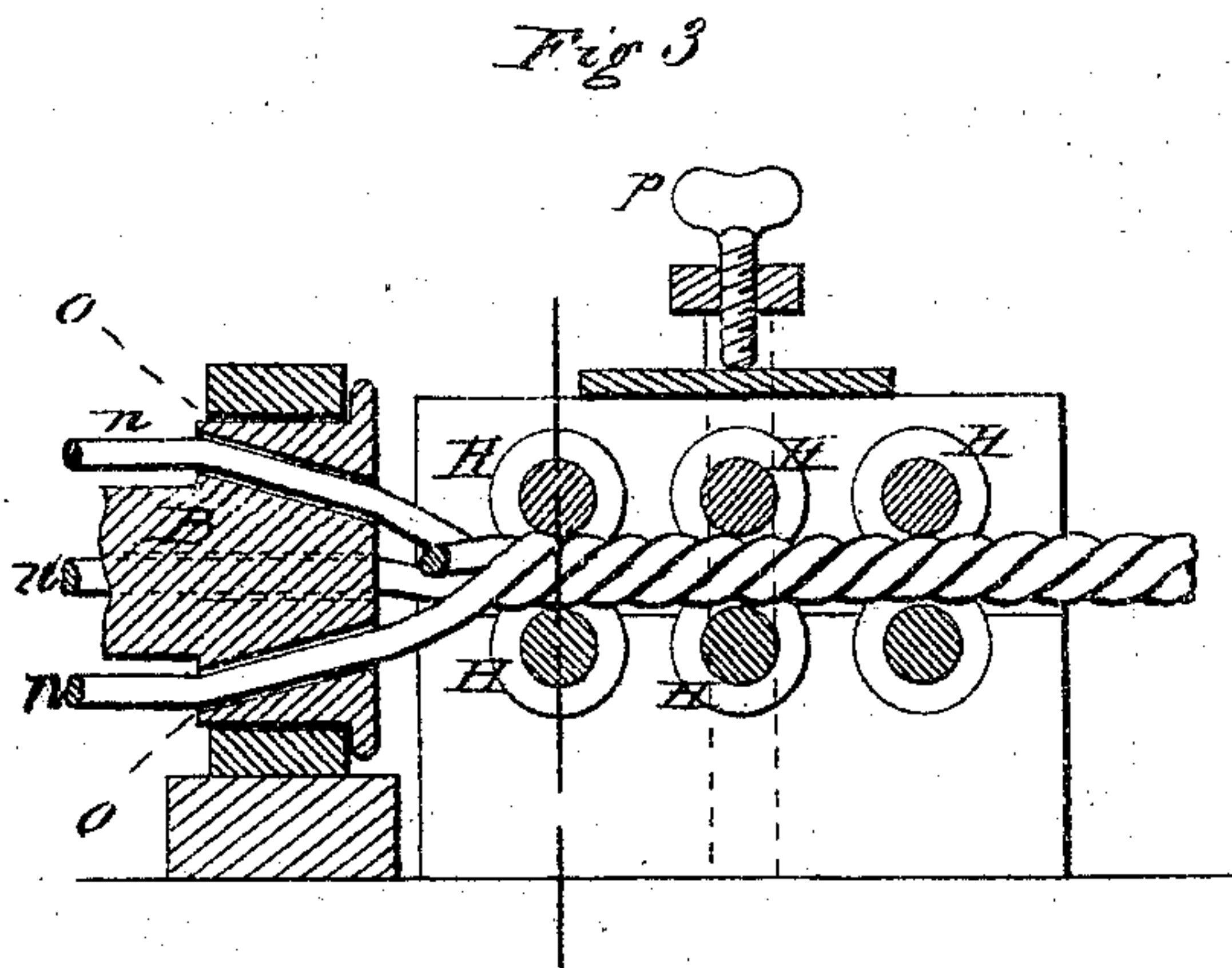
GEORGE S. KNAPP.

Sheet 2. (2 Sheets)

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# UNITED STATES PATENT OFFICE.

GEORGE S. KNAPP, OF WINONA, MINNESOTA.

## IMPROVEMENT IN MACHINES FOR MAKING LIGHTNING-RODS.

Specification forming part of Letters Patent No. 119,987, dated October 17, 1871.

*To all whom it may concern:*

Be it known that I, GEORGE S. KNAPP, of Winona, in the county of Winona and State of Minnesota, have invented certain Improvements in Machines for Making Lightning-Rods and for other purposes, of which the following is a specification, reference being had to the accompanying drawing.

My invention relates to a machine for manufacturing the lightning-rod for which Letters Patent were granted to Foot & Knapp on the 24th day of March, 1871, numbered 113,154, and also for making a modified form of said rod, in which a central core of twisted wires is used in place of the solid core shown in the patent. The invention consists in a novel combination of devices for laying the outside wires around the core for drawing the sheet-copper covering over the outside, and for coiling up the rod as it is produced in a continuous length, and also in combination therewith of devices for forming the twisted-wire core, when such is used, and for straightening the core.

Figure 1 is a top-plan view of my machine in operation. Fig. 2 is a side elevation of the same, portions being broken away from the frame to expose other parts. Figs. 3 and 4 are, respectively, a longitudinal section and a cross-section of the devices for twisting the wire cord. Figs. 5 and 6 are, respectively, a face view and a vertical section of the guide and former for laying the wires around the core and presenting the wires, core, and covering to the die which applies the latter. Figs. 7 and 8 are a face view and a section of the die which applies the copper covering. Figs. 9 and 10 are, respectively, a cross section of a rod with a twisted core and one with a solid core.

In constructing my machine to make rods with a twisted-wire core I first provide a strong flat bed or table, A, to one end of which is connected a frame supporting a horizontal shaft, B, which lies in line with the center of the bed. On the shaft B I secure a large gear-wheel, C, and, lengthwise along one side of the bed, I mount a shaft, D, which is provided on one end with a pinion, a, gearing into wheel C, and on the other end with a pinion, b, which gears into side teeth on a wheel, c, which wheel is mounted against one side of the bed, as shown in Figs. 1 and 2. In standards d, at the opposite end of the bed from shaft B, I

mount a horizontal drum, E, having a clamp, e, attached to its face, and a gear-wheel, f, secured to its end, as shown in Fig. 1. Across the end of the frame I mount a shaft, g, provided with two pinions, h and i, the former gearing into wheel f and driving the drum E, and the latter gearing into wheel c, and thereby driving the shaft B, as shown in Figs. 1 and 2. The shaft g is driven by a pinion, k, on a shaft, l, which latter may be provided with hand-cranks, as shown, or with pulleys, through which the power for driving the machine may be applied. The shaft B I provide with four radial arms, m, carrying on their outer ends bobbins F, upon which I wind the wires n, which are to be wound together to form the core of the rod. The inner end of the shaft B is enlarged and provided with converging holes o, through which the wires n are passed so as to join each other opposite the inner end of the shaft, as shown in Figs. 1 and 3. On the bed A, opposite the inner end of shaft B, I mount three pair of transverse-grooved rollers, H, between which the four wires n are passed, as shown. The lower set of rollers are mounted in a loose frame, which is supported by a yoke and set-screw, p, as shown in Figs. 1, 2, 3, and 4, so that by turning said screw the lower rollers can be raised so as to give any desired pressure upon the wires. In this way it will be seen that the wires are held from turning over or twisting, while at the same time they may be readily drawn through between the rollers, so that when the shaft B is set in motion it twists the issuing wires together into a rope or core, K, which as fast as formed may be drawn forward between the rollers, as shown in Figs. 1 and 3. These grooved rollers not only serve to hold the core as it is formed, but also to render it perfectly straight and smooth. On the bed A, just in front of the rollers, I secure a hub, J, having at its center a hole, through which the core K passes, and having around its outside radial arms supporting spools or bobbins G, upon which are wound the outside wires r, which are to be laid upon the core. On the bed, near its middle, I pivot one end of a long bar or arm, L, and upon the free end of this bar I secure an upright guide-plate, M, and a die, N, the former being provided with a central hole for the passage of the core, several surrounding holes for the passage of the outside wires r, and a curved slit for the passage of the copper covering, as shown in Figs. 5 and 6, while



the die is provided with a central opening of the form of the required rod, as shown in Fig. 7. By thus mounting the guide-plate M and die N on the bar or plate L, which is free to move or swing laterally, those parts are free to adjust themselves to the varying position of the cable or rod as the latter is wound in regular layers on the take-up or drum E. It is obvious that the guide M and die N may be placed in lateral grooves, so as to slide laterally, and thus adjust themselves to the position of the rod while being wound on the drum, or they may be arranged in any other manner to accomplish the object; but that shown in the drawing is preferred as being the simplest and most efficient. The wires *r* being passed through the holes in plate M, they are laid in their proper positions against the core as it is drawn forward, while the sheet-copper covering-strip O, being drawn through the curved slit, is folded or wrapped around both the core and the outside wires, as shown in Figs. 1 and 2. The covering being drawn from the plate M through the die N is pressed by the latter down firmly and smoothly around the inside wire and core, the rod being thus completed. The end of the rod from the die N is passed to the drum D, and secured thereto by clamp *e*, so that as the drum rotates it draws the rod forward through the dies, and winds the rod as fast as formed into a continuous unbroken coil.

Thus it will be seen that this core is twisted by the inner end of shaft B and straightened by the rollers; that the outside wires are laid against the core and the covering folded around the whole by plate M; that the covering is drawn down tightly in place and the rod finished by the die N; and that the rod is coiled up by the drum.

One of the standards which support the drum is hinged at its lower end, as shown in Fig. 2, so that it may be turned outward to permit the removal of the coil of rod from the drum. If desired, each of the arms *m*, instead of being provided with a bobbin, F, containing a single wire, may be provided with three bobbins containing fine wire, and with spindles for twisting the three wires into a single strand. In such case the strands will be laid around the core in the same manner as the single wires *r*.

When the machine is to be used for making a rod with a solid core the shafts B and D are removed, and the wire or rod to form the core is wound upon a reel, R, mounted on the corner of the bed, as shown in Fig. 2. The end of the core is passed from the reel through between the rollers, and forward through the guide-plate and die in the same manner as with the twisted core.

When starting or commencing a rod its end is drawn forward from the die to the drum by means of a chain having tongs at one end, the chain being connected to the drum or one of the shafts, and the tongs clasped to the end of the rod. The object of mounting the guide-plate and die on the swinging arm is to allow them to move laterally as the rod winds upon the drum from one end toward the other, and thus prevent the bending of the rod. If desired, a die may be secured on the bed for smoothing the twisted core as it comes from the rollers, and for reducing it to a perfectly-uniform size.

It is obvious that the machine may be arranged to lay any desired number of the outside wires around the central core, and that the dies and guide-plate may be made so as to produce a rod of any desired form corresponding to the number and position of the outside wires around the central core. The rollers H serve to make the core perfectly straight and true, whether a solid or a twisted core be used.

By means of my machine I am enabled to manufacture rods in a continuous piece of a length controlled only by the length of the copper covering-strip, and to make such rods of uniform size and at a very cheap price.

Having described my invention, what I claim is—

1. The combination of the rotating shaft B provided with arms for carrying a series of bobbins and with holes or guides *o* with the guide-plate M and die N, all arranged to operate substantially as and for the purpose set forth.
2. The adjustable rollers H in combination with the radially-arranged bobbins G, guide-plate M, and die N, all constructed and arranged to operate substantially as described.
3. The guide-plate M and die N, arranged to swing or move laterally on the bed, in combination with the take-up shaft or drum E, whereby they are permitted to adjust themselves to the varying position of the rod, as set forth.
4. The shaft or drum E provided with the eccentric lever *e* for holding and winding up the finished rod, as set forth.
5. The guide-plate M having a central hole for the core, with a series of holes for the surrounding wires arranged radially therefrom, and the circular slit for guiding the covering, arranged outside of the latter, as herein described.

GEORGE S. KNAPP.

Witnesses:

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J. MCKENNEY.

(50)