(No Model.)

4 Sheets—Sheet 1.

C. S. TAINTER.

MACHINE FOR MAKING PAPER TUBES.

No. 388,462. Patented Aug. 28, 1888.

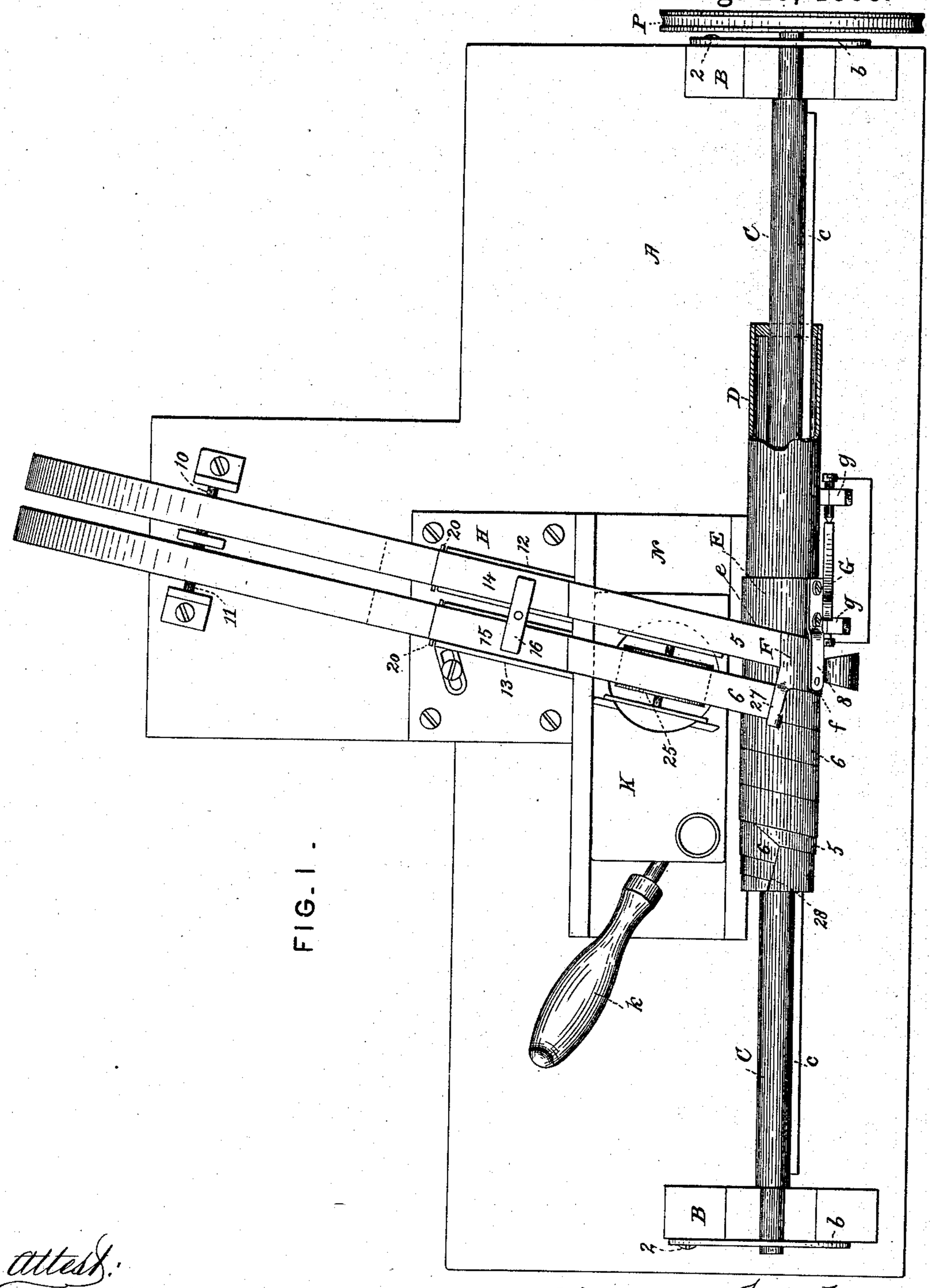

FIG. 1.

Attest:
Geo. T. Smallwood.
Philip Barnes.

Inventor:
Charles Sumner Tainter, by
A. Pollok.
his Attorney.

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C. S. TAINTER.

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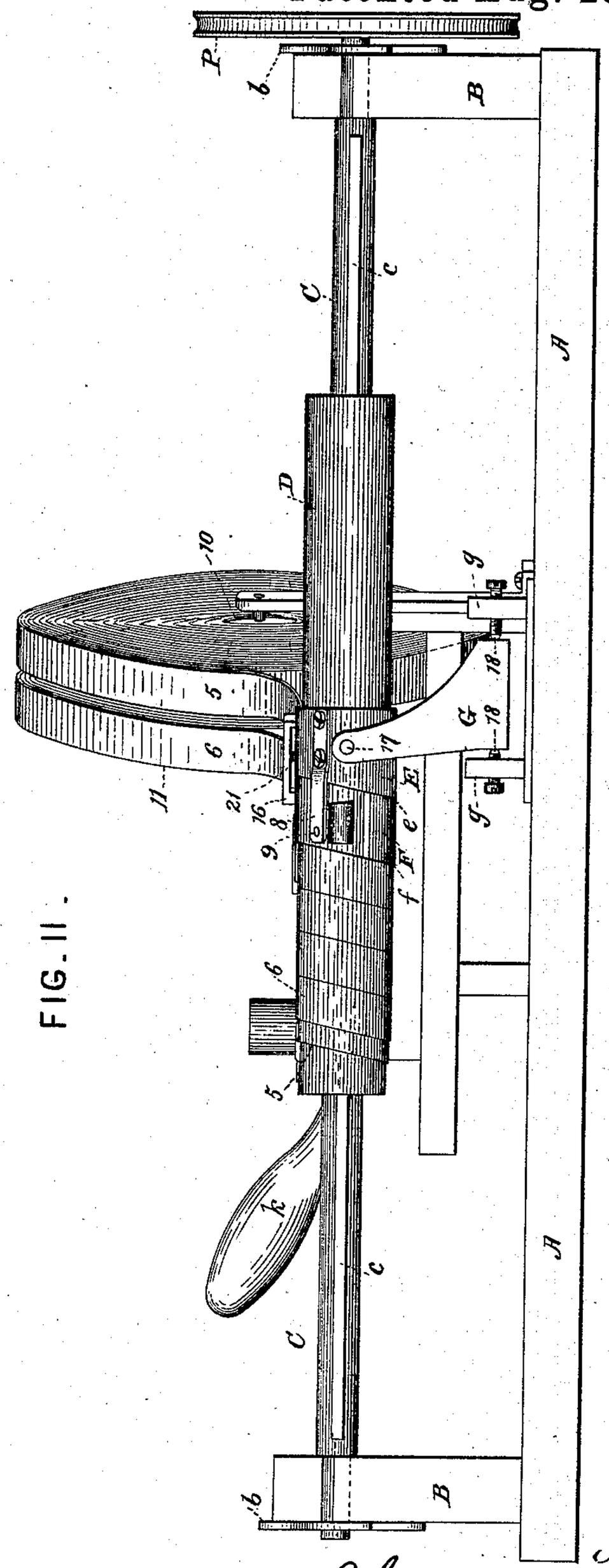
FIG. II.



Attest:
Geo. T. Smallwood.
Thos. Jno. Mauro.

Inventor:
Charles Sumner Tainter
by A. Pollok.
his attorney.

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C. S. TAINTER.

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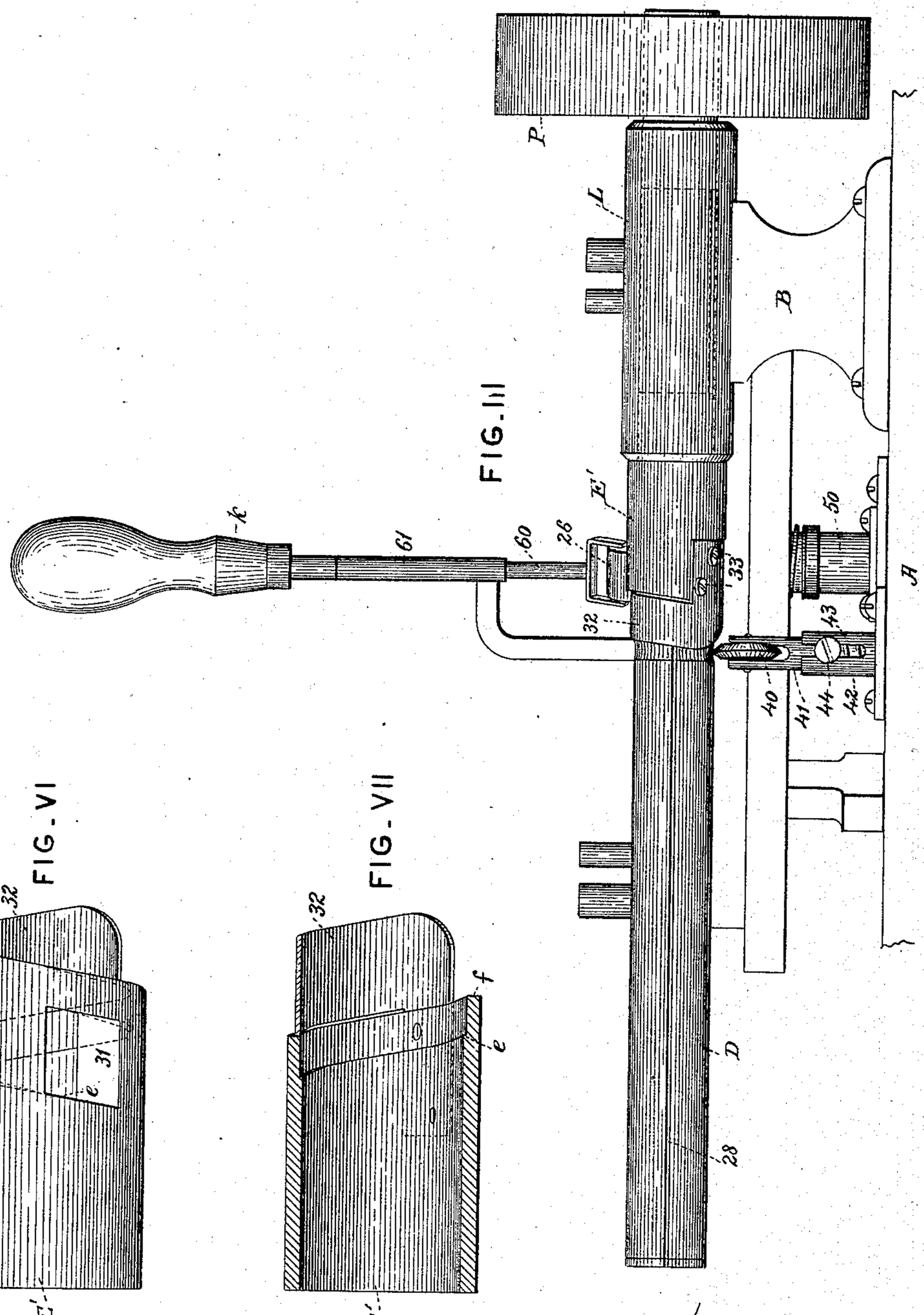

FIG. III

FIG. VI

FIG. VII

Attest:
Geo. T. Smallwood.
Philip Hanno.

Inventor.
Charles Sumner Tainter.
by A. Pollok.
his attorney.

(No Model.) 4 Sheets—Sheet 4.

C. S. TAINTER.

MACHINE FOR MAKING PAPER TUBES.

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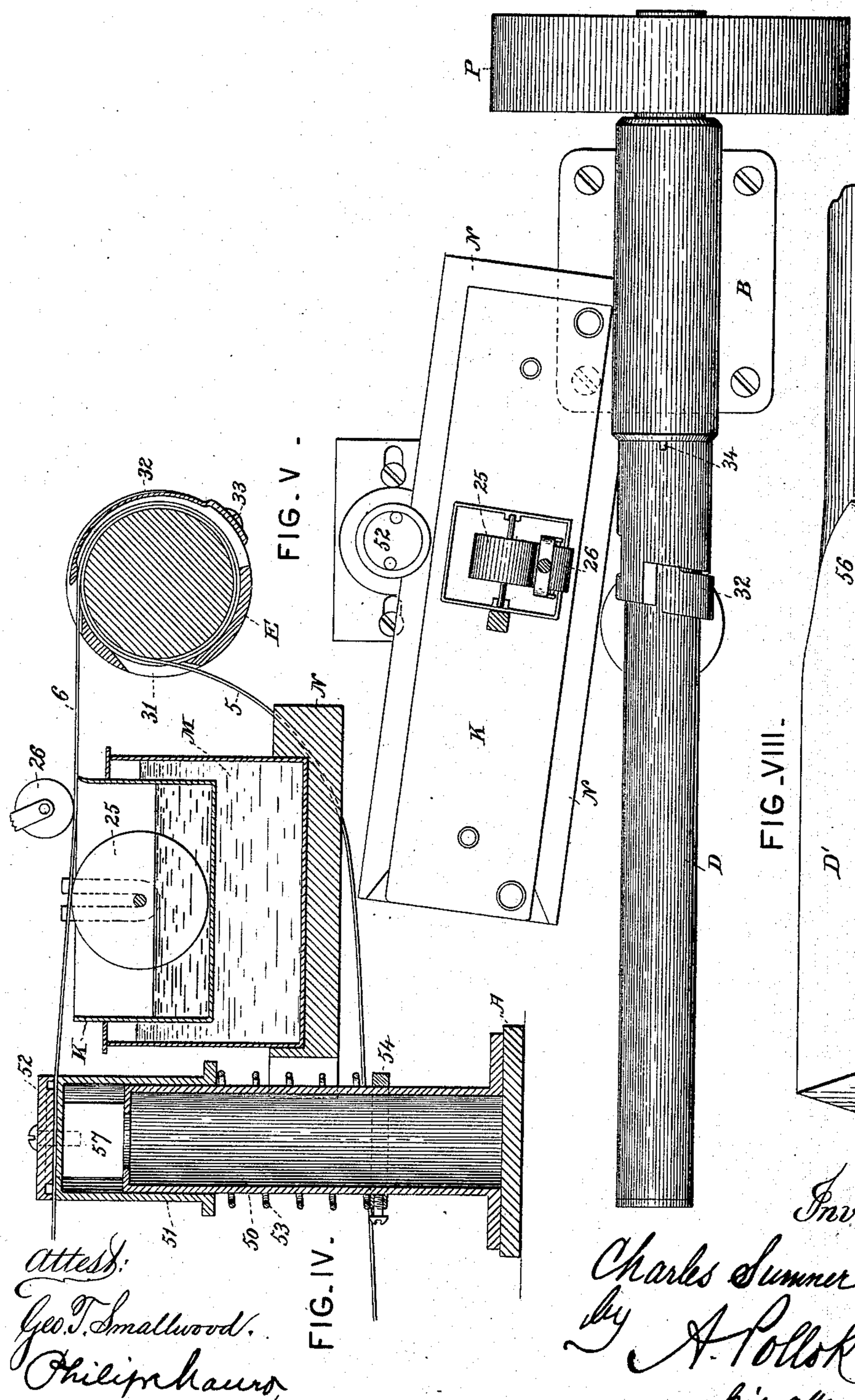

FIG. V.

FIG. VIII.

FIG. IV.

Attest:
Geo. T. Smallwood.
Philip Hauss.

Inventor.
Charles Sumner Tainter.
by A. Pollok.
his attorney.

UNITED STATES PATENT OFFICE.

CHARLES SUMNER TAINTER, OF WASHINGTON, DISTRICT OF COLUMBIA.

MACHINE FOR MAKING PAPER TUBES.

SPECIFICATION forming part of Letters Patent No. 388,462, dated August 28, 1888.

Application filed December 6, 1887. Serial No. 257,129. (No model.)

To all whom it may concern:

Be it known that I, CHARLES SUMNER TAINTER, of Washington, in the District of Columbia, have invented a new and useful Improvement in Machines for Making Paper Tubes, which improvement is fully set forth in the following specification.

This invention has reference to machines for making tubes of paper, though it could be used for making tubes of other material—such as metal, for example.

Heretofore paper and pasteboard tubes have usually been made from a flat sheet. Common tubes for boxes and the like have been made by folding the sheet around a mandrel, forming either a lap or a butt joint, and fastening the edges with an adhesive substance. Where better or stronger tubes are desired, a thin sheet is commonly folded a number of times around the mandrel until the desired thickness is obtained, and then cut off and its edge secured. Other modes of making paper tubes have been employed or proposed, which it is not necessary to describe here.

By the operation of the machine which constitutes the present invention the tubes are made of long narrow continuous strips of paper wound helically one upon the other, so as to break joints, the adjacent surfaces of the strips being fastened together by means of glue or other adhesive substance applied while the strips are being wound. Paper tubes of this character are described in Letters Patent No. 374,133 granted to me November 29, 1887, for use as the foundation of a tablet for recording speech or other words in a graphophone. The tubes, however, are not by any means limited to such use, but are adapted to a great variety of purposes. The characteristics of such tubes are great rigidity and stiffness, combined with lightness, and obtained with the most economical use of material and labor. They are, moreover, self-sustaining, and have no tendency to lose their true cylindrical shape, as common with tubes made in the ordinary way.

The object of the present invention is to produce these tubes by machinery in a rapid and cheap manner, and in continuous pieces of any desired length.

The machine comprises, principally, a core or mandrel of the proper diameter to produce a tube of the desired size, which core or mandrel is mounted in bearings so as to rotate freely, and upon which the strips are helically wound, feeding devices for pushing the tube longitudinally as fast as it is formed, suitable reels for holding the paper strips, and means for applying the glue to one side of one or more of the strips as they are fed into the machine.

The core or mandrel may be mounted upon the arbor and connected therewith by a spline and groove, so as to have a lengthwise movement independently of the arbor, as well as a rotatory movement in common therewith. In this form of machine the feeding devices, acting on the edges of the strips, feed them along as they are wound, and as the strips are attached to the mandrel they carry the latter along with them. In the preferred form of machine, however, the mandrel has no endwise motion, and the tube as formed is pushed off the same by the action of the feeding devices, thus enabling tubes of any desired length (within reasonable limits) to be formed and rendering the operation of the machine continuous.

For ordinary purposes two thicknesses of paper are sufficient in the manufacture of a tube; but the machine may be adapted to wind three strips or any greater number without changing it in principle or mode of operation.

The feeding devices employed consist of stationary cams, one for each strip, and having helical acting faces. The pitch of each cam-face is so proportioned relatively to the width of the paper strips and the diameter of the mandrel that as the strip is wound and fed forward the edges of its adjacent convolutions will just meet, neither overlapping nor leaving any gap between. At each revolution of the core the tube formed will be advanced a distance equal to the pitch of the cams. The second cam is similar in construction to the first; but it is placed to the right or left thereof, so that the two strips of paper, when wound, will break joints. A third cam may be used if a three-ply tube is desired.

I am aware that heretofore a machine has been devised for making tubes of metal of continuous helically-wound strips one upon the other by giving the core or mandrel a

longitudinal as well as a rotatory motion. The length of the tubes that can be made on such a machine is limited to the length of the core and its endwise movement. Moreover, on the completion of each tube the machine must be stopped, the strips cut off, the core set back to the starting-point, and the ends of the strips again inserted for making a new tube.

In the preferred form of apparatus herein described, the tubes, being continually pushed off the core, can be made in any desired lengths and can be cut off automatically, and there is no necessity of interrupting the operation of the machine until the reels are exhausted, and even this may be avoided by attaching the last end of one coil of paper to the first end of the other. In the machine referred to the endwise movement of the arbor or core is obtained by means of gearing, whereas in the present machine the longitudinal travel of the paper tube (and of the mandrel also in the first form referred to) is effected by the action of stationary cams acting on the edges of the strips themselves. The tube when formed is of course cylindrical; but means are adapted, as hereinafter described, for changing them into tubes of square, hexagonal, or other form of tube having flat sides.

Having now indicated the general nature of the invention, I will describe the best mode contemplated of carrying the same into effect, reference being had to the accompanying drawings, which form part of this specification, and in which—

Figure I is a plan view of one form of machine; Fig. II, a front elevation thereof; Fig. III, a front elevation of another form of machine; Fig. IV, a cross-section, and Fig. V a top view, thereof; Figs. VI and VII, detail views of the feed-cams, and Fig. VIII a partial perspective view of another form of core or mandrel.

The form of machine shown in Figs. I and II will first be described.

The frame consists of the standards B, fixed on the bed-plate A. Standards B are notched at their upper ends to form bearings for the arbor C, which is removably supported therein, being held in place by the notched latches *b*, which are pivoted at 2, so that they can be raised to permit of the removal of arbor C. Arbor C carries a pulley, P, by which it may be driven, though obviously it could be driven by hand, if desired. The core or mandrel D surrounds the arbor C, being connected therewith by a spline, *c*, on said arbor taking into a groove in the core D. The latter, therefore, rotates with the arbor, but is free to move lengthwise thereof.

E and F are the feeding-cams. The part E is tubular and surrounds the core D, and the part F, which is a segment of a tube, is connected with the tube E by a spring locking-finger, 8, having a pin, 9, which passes through a hole in part F. The cams can be made in one piece, as hereinafter described. The two cams have helical acting faces *e f*. The former acts upon the inner strip of paper, 5, and the latter on the outer strip, 6. The pitch of each cam is equal to the width of the paper strips, and cam *f* is placed to the left of cam *e* a distance equal to one and one-half time the width of said strips, so that the outer strips will overlap the joints between the successive convolutions of the inner strip; in other words, the strips breaking joints. The part F, moreover, is so placed as to leave just sufficient space between it and the core D for the passage of one thickness of paper. The cam-tube E has a projection or pin, 17, which is engaged by the locking-arm G, the latter being pivoted at 18 in standards *g*, supported on the bed-plate A, and can be moved forward to disengage the cams when it is desired to move the arbor for the purpose of removing a finished tube. The paper strips 5 6 are supplied from reels 10 11, passing on their way to the core D through guides 12 13, which are disposed on a support, H, obliquely to the axis of arbor C at the proper angle. The guides 12 13 are in the form of flat strips of metal turned up at the sides to form guiding-edges. On top of the strips 5 6 are placed plates 14 15, which serve both to hold the strips in the guides and to exert a proper amount of tension thereon. The pressure of the tension-plates is effected by a cross-bar, 16, on the end of a shank, 21, which passes through a hole in support H. The cross-bar may be pressed against plates 14 15 by a spring or by gravity.

The bar 16 can be turned a quarter-turn to permit removal of tension-plates 14 15 and the insertion of new strips. Stop-pins 20 on plates 14 15 engage the ends of the guides 12 13 and prevent the tension-plates being drawn out of place by the movement of the paper strips.

Upon a support, N, between the core D and guides 12 13 is placed the glue-vessel K, provided with a handle, *k*, for convenience in removing and replacing it. A small roller, 25, turns on the glue-vessel, and the strip 6 as it is drawn forward by the rotation of the core turns this roller and receives from it a coating of glue, whereby the inner strip, 5, and outer strip, 6, are glued together. The cam-piece F carries a spring-finger, 27, which bears at its end upon the meeting edges of two adjacent convolutions of strips 6 to prevent buckling.

The operation of the machine is as follows: The inner strip, 5, is passed through its guide and its end is bent and inserted in the slit 28 in core D, its right-hand edge being in contact with the oblique face *e* of cam E, and this edge is continuously acted upon by this cam as long as the machine operates. The arbor is then turned around twice, and the end of strip 6 is now inserted in the slit 28, said strip overlying the joint between the two convolutions of the first strip, and the right-hand edge of said strip 6 being in contact with the acting face of cam F. The arbor C is now ro-

tated, and as each coil is formed the partially-completed paper tube is fed forward by the cams *e f* a distance equal to the pitch of said cams at each revolution, carrying with it the core or mandrel D.

It will be observed that the longitudinal travel of the core and paper tube is effected solely by the action of cams *e f* on the edges of strips 5 and 6. When the core D has reached the limits of its longitudinal movement, the machine is stopped, the strips 5 and 6 cut off close to the tube, the locking-arm G thrown down, and the latches *b* lifted. The arbor C, with the core D, can be lifted out of the machine and the finished tube removed. Core D is then moved back to the starting-point and the operation repeated.

In the operation of the machine above described considerable time is necessarily lost in removing a tube, replacing the core, and inserting the ends of the strips again. This objection is overcome and the operation rendered continuous by the construction illustrated in Figs. III to VII, which will now be described. In this machine the core D has no endwise motion. It is supported and turns in a long tubular bearing, L, supported by upright standard B, the left end of the core being unsupported, so that the paper tube so formed can be pushed off. The core D is adapted to be driven by driving-pulley P.

The feeding-cams are formed in a single metal tube, E′, the contruction being best shown in Figs. VI and VII. The inner diameter of the tube E′ for the greater part of its length is just great enough to enable it to slip over the core D. The acting edge *e* of the cam for the inner strip is formed by turning out the interior of the tube until the radius is enlarged to an extent equal to the thickness of the paper strip, the edge *e* being helical, as before. The second cam, *f*, is formed by the edge of tube E′.

It will be seen that cams *e* and *f* have the same pitch and are separated a distance less than (preferably one-half of) the width of the strip to be wound, so that the outer strip will overlap the line formed by the meeting edge of the inner strip. Tube E′ has a slot or opening, 31, for the introduction of the inner strip, 5. A spring, 32, is secured to the tube E′ by screws 33 and bears at its free end upon the outer strip just as it begins to wind itself upon the core. This spring presses the outer strip against the inner strip and insures that the entering edge will press against and not ride over the edge of the adjacent coil, so that the tube being formed is properly fed forward.

Cam-tube E′ can be slipped on or off D. It is held stationary in operation by a pin, 34, projecting from the bearing L into a notch, 35, in said tube. Core D has a slit, 28, as before, for insertion of the ends of strips 5 and 6. The glue-vessel K rests removably on a support, N, and to keep the glue in a fluid state the glue-compartment is surrounded by a hot-water bath, M. (See Fig. IV.) The roller 25 turns in the glue and coats the under side of strip 6, as before. A co-operating pressure-roller, 26, rests by gravity upon said strip, its shank 60 passing loosely into the hollow shank of handle *k*.

Beneath core D is a roller, 40, turning in the fixed end of a support, H, which can move vertically in a tubular standard, 42, being pressed upward by a spiral spring, 43. Roller 40 is thus pressed against the meeting edges of two adjacent convolutions of strip 6, flattening out any burr that may be formed, and thus aiding in producing a perfectly smooth surface. The shank 41 may be depressed to lower the roller out of contact with the paper tube and held in that position by a clamp-screw, 44.

The tension device for the outer paper strip (see Fig. IV) is placed between the reel and the glue-vessel. It consists of standard or pillar 50, secured to the bed-plate A, and a sleeve, 51, sliding thereon and pressed upward against the head or top plate, 52, by a spring, 53. The top plate, 52, is secured to the vertical strips 57, which form guides for the edges of the paper strip. The latter passes between the top plate, 52, and sleeve 51. The pressure of spring 53 can be regulated by moving the collar 54, against which the lower end bears up or down. The inner paper strip is passed under the glue-vessel K.

The operation is substantially as before described, except that the paper tube slides over the core D and is pushed off the end thereof by the feed-cams, so that it can be formed in any desired lengths and the operation of the machine need not be interrupted. To form tubes having flat sides, either square, hexagonal, or of other polygonal form in cross-section, a core or mandrel such as shown in Fig. VIII may be employed. As therein shown, the part D of the core is cylindrical where the strips are wound upon it, but the part D′ is square in cross-section. The circumference of the cylindrical part D is equal to the sum of all the sides of the part D′. The change from circular to polygonal is gradual, the ridges 55 being raised gradually to form the edges of the latter, and the intermediate surfaces, 56, being curved inward until they merge into the flat sides D′. As the paper tube is fed slowly forward by the action of the cams, it thus gradually changes its form from circular to polygonal in section, the circumference of course remaing the same. The formation of square or other tubes can thus be accomplished while the glue is yet soft, whereas it would be a more difficult matter to change the shape after the glue had hardened.

It is obvious that modifications could be made in the construction of the machine without departing from the spirit of the invention, and that parts of the invention could, if desired, be used without the whole.

Having now fully described my said invention, what I claim is—

1. In a machine for making tubes from

strips of paper or other material, the combination, with the rotatory core, of the stationary feed-cams having oblique or helical faces for acting against the edges of the strips as they are wound upon said core, substantially as described.

2. The combination, with the rotatory core, of the stationary feed-cams having oblique or helical acting faces, said cams being in different positions relative to the length of said core, so that the strips will break joints, substantially as described.

3. The combination of the rotatory core, the feed-cams for acting on the edge of the strips as they are wound, the reels, the vessel for glue or other adhesive substance between said reel and core, and the roller for applying a coating of glue to one of said strips, substantially as described.

4. The combination of the rotatory core, the feed-cams having helical edges for acting on the strips as they are wound upon said core, and the guide and tension for said strips, substantially as described.

5. The combination of the core supported in bearings at one end only and the feed-cams for acting on the edges of the strips as they are wound upon said core and pushing the tube as formed off the free end of said core, substantially as described.

6. The combination, with the rotating core for winding strips of paper into the form of a tube, of the feed-cams comprising a sleeve or cylinder having helical acting edges formed therein, one for each strip composing the tube, substantially as described.

7. The combination of the rotatory core, the feed-cams having helical acting edges, and the spring-finger, substantially as described.

8. The combination of the rotating core, the feed-cams, the roller bearing against the meeting edges of the outer strip, and the spring for pressing said roller against the paper tube, substantially as described.

9. In a machine for forming tubes from strips of paper or other material, the combination, with feeding devices for advancing the strips as they are wound, of the core or mandrel circular in cross-section where the tube is formed and changing gradually to the form of a polygon, substantially as described.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

CHARLES SUMNER TAINTER.

Witnesses:
CHAS. E. HADLEY,
PHILIP MAURO.