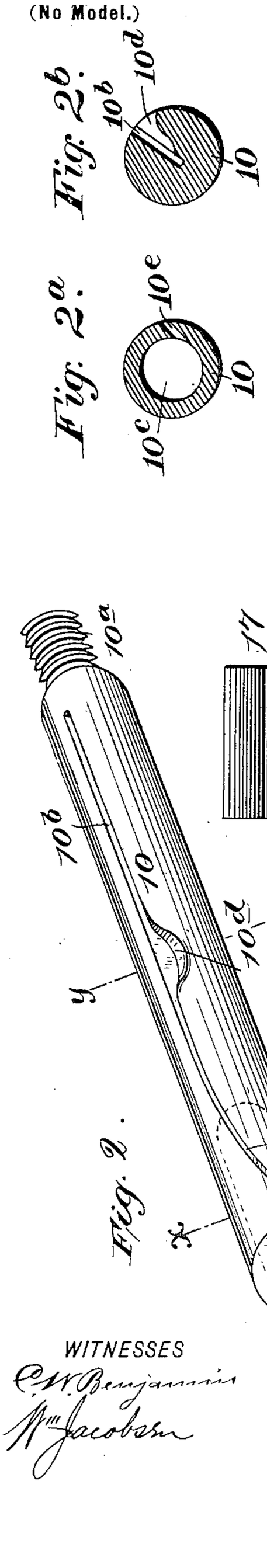
No. 657,647. Patented Sept. 11, 1900.

C. L. CURTIS.

TUBE ROLLING MACHINE.

(Application filed May 27, 1898.)

(No Model.) 4 Sheets—Sheet 1.



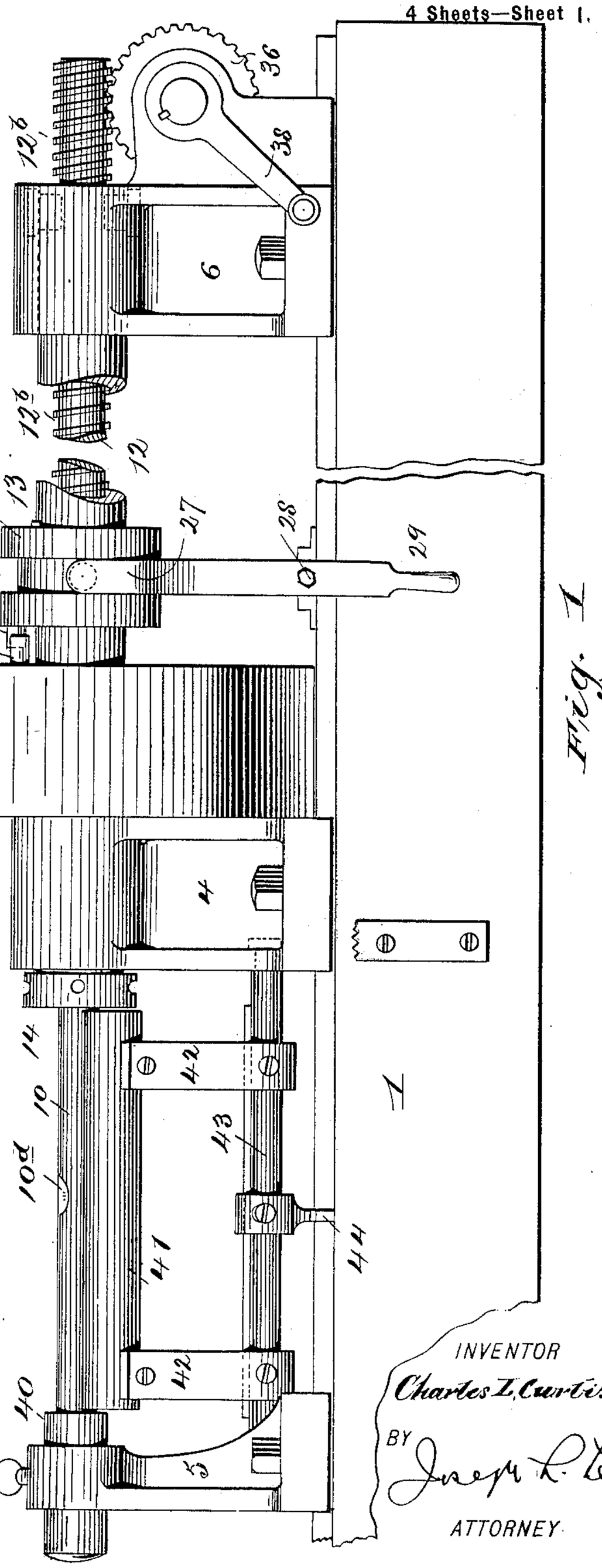


Fig. 1.

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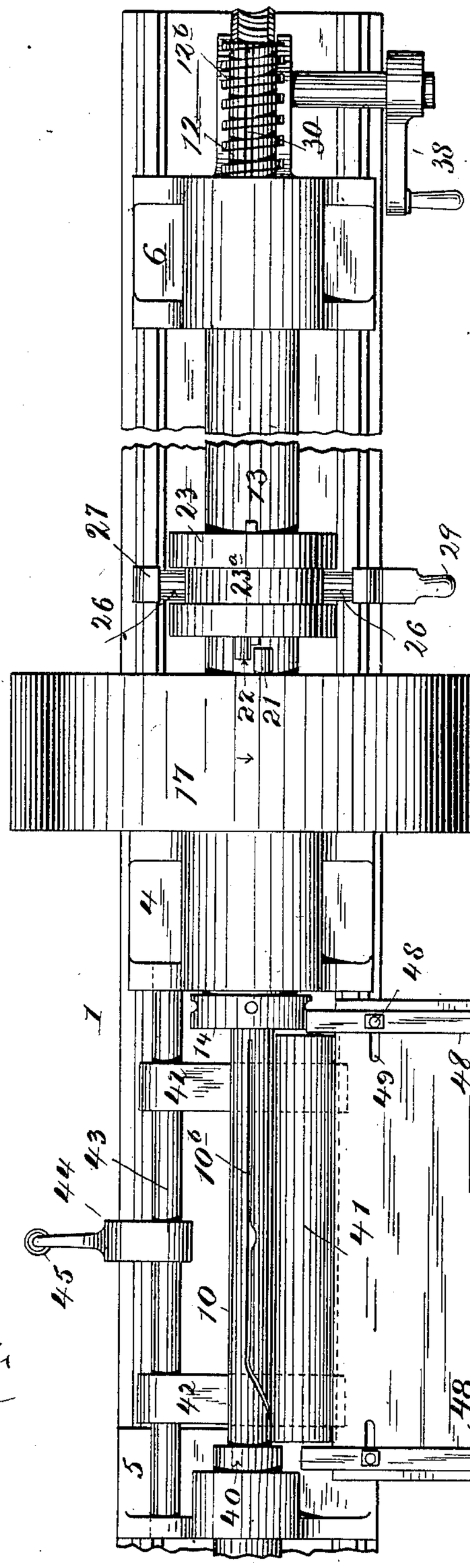

Fig. 3.

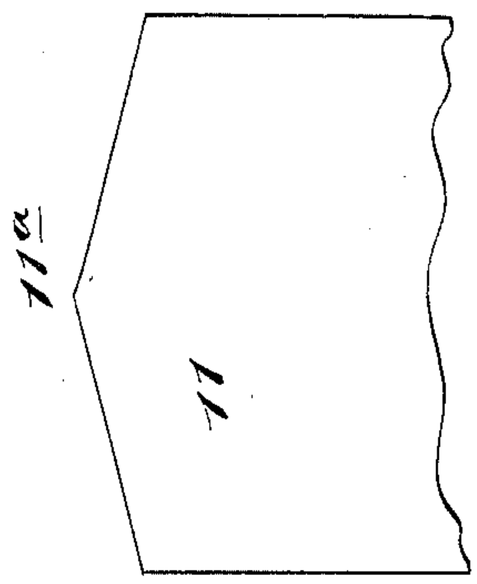

Fig 3a.

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TUBE ROLLING MACHINE.

(Application filed May 27, 1898.)

(No Model.) 4 Sheets—Sheet 3.

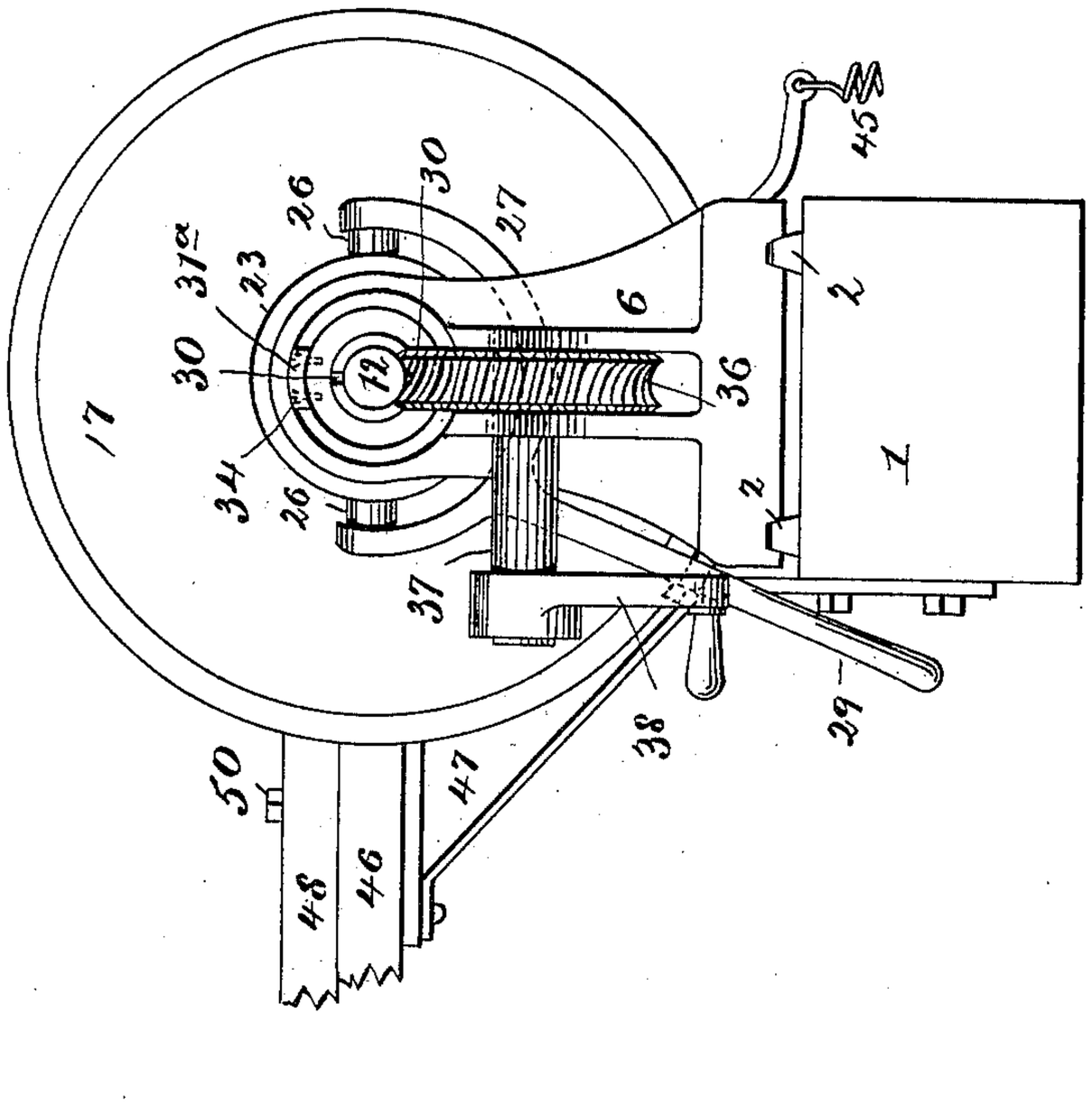

Fig. 5.

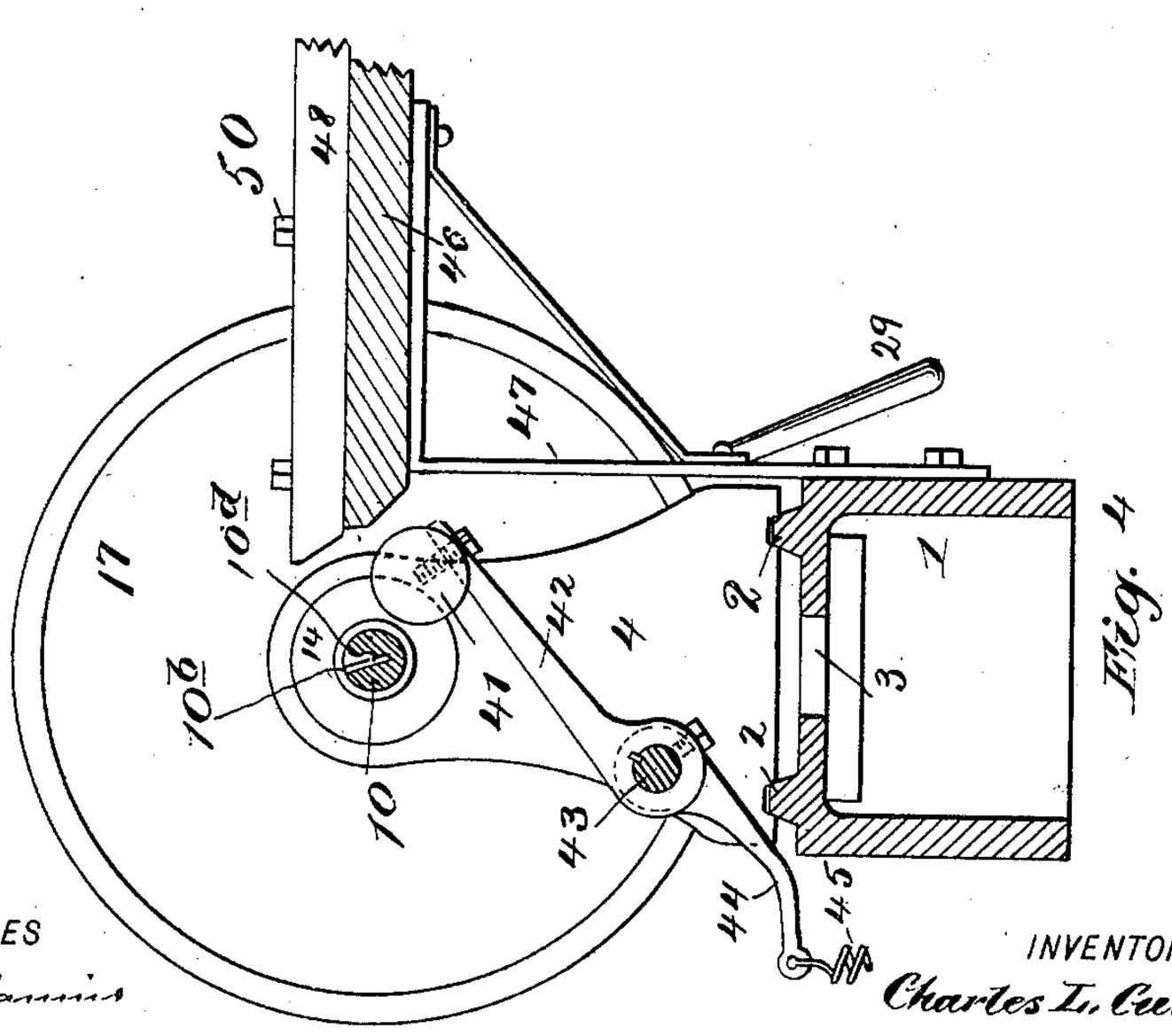

Fig. 4.

WITNESSES

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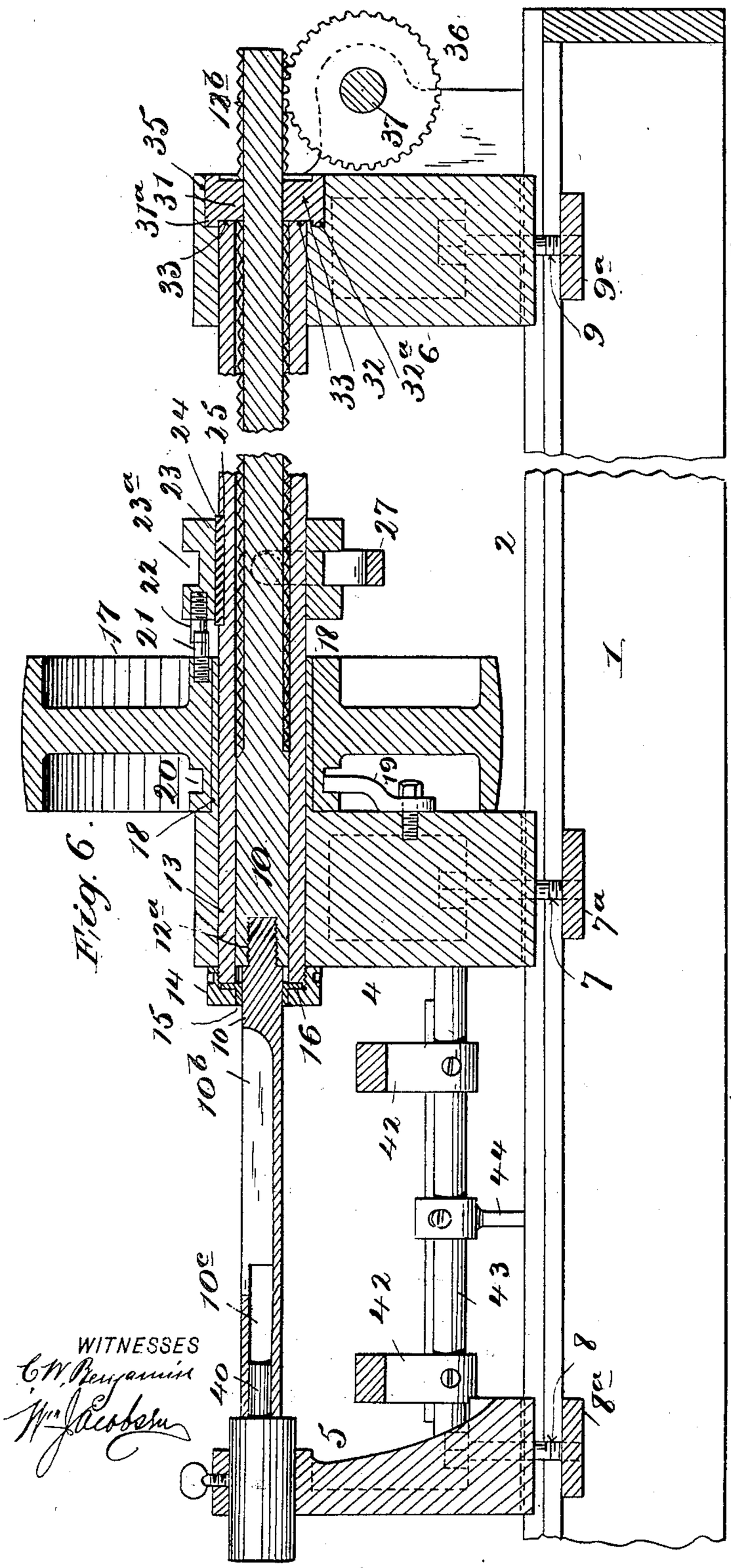

Fig. 6.

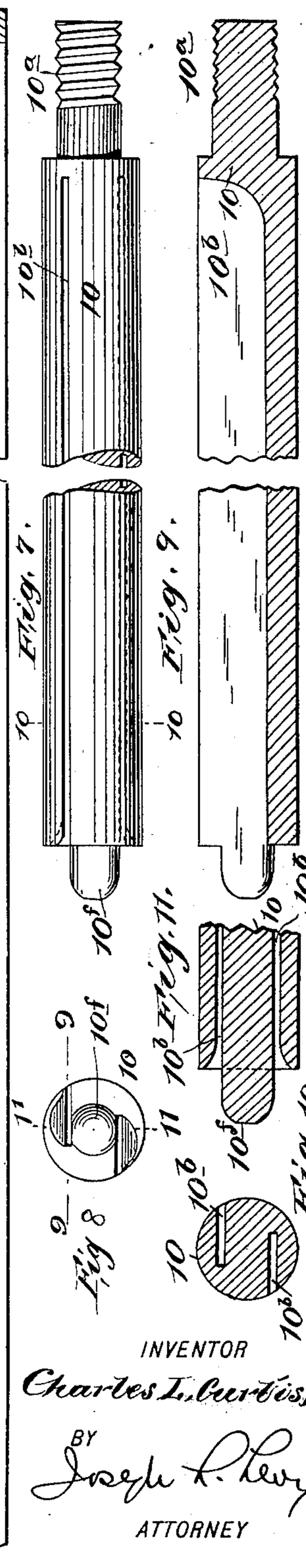

Fig. 7.

Fig. 9.

Fig. 8

Fig. 10.

Fig. 11.

WITNESSES

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UNITED STATES PATENT OFFICE.

CHARLES L. CURTIS, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE NORDLINGER-CHARLTON FIREWORKS COMPANY, OF SAME PLACE.

TUBE-ROLLING MACHINE.

SPECIFICATION forming part of Letters Patent No. 657,647, dated September 11, 1900.

Application filed May 27, 1898. Serial No. 681,856. (No model.)

To all whom it may concern:

Be it known that I, CHARLES L. CURTIS, a citizen of the United States, residing at New York, (Brooklyn,) in the county of Kings and State of New York, have invented certain new and useful Improvements in Tube-Forming Machines, of which the following is a specification.

The object of my invention is to provide an improved machine for rolling strips of material, such as paper, into convolutions to form a body having a bore, such as a tube, one of the purposes for which such body or tube may be used being for the body of a firecracker, firework, or similar article.

The invention consists in a tube-forming machine comprising a mandrel having a slot adapted to receive the edge of a strip while rotating and means for supporting and rotating said mandrel.

The invention also consists in a tube-forming machine comprising a mandrel having means adapted to hold a strip while rolling it, a support for the mandrel, and means to cause said mandrel to move longitudinally to remove the rolled body from the same.

The invention also consists in a tube-forming machine comprising a mandrel adapted to hold a strip while rolling the same, a longitudinally-movable rod carrying the mandrel and having a worm or threads, means to cause said worm or threads to move the rod longitudinally, and means for rotating said rod.

The invention further consists in the novel details of improvement and the combination of parts that will be more fully hereinafter set forth and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming part hereof, wherein—

Figure 1 is a side elevation, partly broken, of a tube-forming machine embodying my invention. Fig. 2 is a perspective view of the mandrel. Fig. 2^a is a transverse section taken through the mandrel on the line $x\,x$ in Fig. 2. Fig. 2^b is a similar section taken on the line $y\,y$ in Fig 2. Fig. 3 is a plan view of the machine, partly broken. Fig. 3^a is a detail view of the strip to be wound upon the mandrel shown in Fig. 2. Fig. 4 is a cross-section of the machine through the mandrel. Fig. 5 is an elevation looking from the right in Fig. 1. Fig. 6 is a vertical longitudinal section of the machine. Fig. 7 is a view, partly broken, of a modified form of the mandrel. Fig. 8 is an end view thereof. Fig. 9 is a longitudinal section thereof on the line 9 9 in Fig. 8. Fig. 10 is a cross-section on the line 10 10 in Fig. 7, and Fig. 11 is a cross-section on the line 11 11 in Fig. 8.

In the accompanying drawings, in which similar numerals of reference indicate corresponding parts in the several views, 1 indicates a bed or frame which may be of any suitable construction, and it is shown provided with ways 2 and a longitudinal slot 3. (See Fig. 4.) Upon the bed 1 are mounted a headstock 4 and tail-stocks 5 6. By preference the stocks 4 5 6 are adjustable lengthwise of bed 1, and for this purpose I have shown said stocks provided with bolts 7 8 9, that project through the slot 3 of bed 1 and have nuts 7^a 8^a 9^a for holding the stocks upon said bed, (see Fig. 6,) whereby said stocks may be readily adjusted. Said stocks are also shown provided with grooves at their bottoms to receive the ways 2, whereby they are properly guided and held upon the bed 1. (See Figs. 4 and 5.)

10 is a mandrel around which a strip 11, of paper or other suitable material, is adapted to be wound in convolutions, and 12 is a support in the form of a rod, to which the mandrel 10 is adapted to be attached, and said rod is shown journaled in a sleeve or hollow shaft 13, that is journaled in bearings in the headstock 4 and tail-stock 6. (See Fig. 6.) The rod 12 is shown provided with a threaded bore 12^a to receive the threaded end 10^a of mandrel 10, whereby the latter may be detachably connected with the former.

14 is a keeper or cap shown threaded upon the end of sleeve 13 and having an aperture to receive the mandrel 10, and 15 is a supplemental guide in the form of a bushing or short tube having a flange 16, which bushing or tube rests in the bore of keeper 14, and the flange 16 is held against the end of a sleeve 13 by said keeper, (see Fig. 6,) whereby the mandrel 10 may be guided as it is drawn into

sleeve 13. By providing bushings 15, having different-sized bores, mandrels of various sizes may be accommodated. The keeper 14 is shown bearing against the head-stock 4, and thus assists in keeping the sleeve 13 in its bearings in head-stock 4. It is evident, however, that other means may be provided for guiding the mandrel 10.

The rod 12 is adapted to be rotated by the sleeve 13 and also to have longitudinal movement within said sleeve. For this purpose I have shown the following arrangement:

17 is a pulley shown encircling sleeve 13 and journaled upon a bearing 18, which projects from head-stock 4 and has a bore that receives sleeve 13. (See Fig. 6.)

19 is a finger secured to head-stock 4 and entering an annular groove 20 in pulley 17, whereby said pulley is guided and held upon the bearing 18.

21 is a stud or pin projecting from pulley 17, and it is adapted to engage a corresponding stud or pin 22, that is carried by a sleeve 23, mounted upon the sleeve 13 and keyed thereto, as by a spline and feather 24 25, so that it may have longitudinal movement upon sleeve 13 to engage and disengage studs 21 22, said studs thereby forming a clutch.

The sleeve 23 is shown provided with an annular groove 23^a, adapted to receive pins 26 from a shifting fork 27, that is pivoted at 28 to bed 1 and has a handle portion 29, by which it may be shifted. The rod 12 has opposed longitudinally-disposed grooves 30, in which feathers 31 32 are adapted to fit. (See Fig. 5.) These feathers are shown in the form of narrow blocks 31^a 32^a and pass through opposed slots 33 in the sleeve 13 near its outer end, and thus enter the grooves 30, which heads 31^a 32^a may be secured to said sleeve by screws 34. (See Fig. 5.) Thus the feathers 31 32 lock the rod 12 to the sleeve 13, so as to rotate the former by the latter and yet to permit said rod to slide longitudinally within the sleeve 13. The feathers 31 32 are shown journaled in an annular recess 35 in the outer face of tail-stock 6. (See Fig. 6.) The keeper 14 and the feathers 31 32 thus serve to retain the sleeve 13 in the stocks 4 6, while permitting the same to rotate freely.

The means I have shown for causing the rod 12 to move longitudinally is as follows: The rod 12 is provided with an external worm or screw-threads 12^b, that normally project beyond the tail-stock 6 and mesh with a worm-wheel 36, secured upon a shaft 37, journaled in bearings carried by the tail-stock 6, and 38 is a handle secured to shaft 37, whereby the same may be rotated, and whereby also the wheel 36 can be stopped from the rotation caused by the worm 12^b. Thus when studs 21 22 are in engagement pulley 17 will cause sleeve 13, rod 12, and mandrel 10 to rotate, and during the rotation of said rod the worm 12^b will cause wheel 36 to rotate, and thus rod 12 will not have longitudinal movement. When it is desired to cause rod 12 to move longitudinally outwardly, the rotation of wheel 36 is stopped, as by taking hold of handle 38, whereupon the worm 12^b, working upon wheel 36, will cause rod 12 to move longitudinally, and thereby to draw mandrel 10 into sleeve 13. When it is desired to return rod 12 and mandrel 10 to their normal operative positions, the wheel 36 will be rotated by hand, and thus push rod 12 inwardly.

The mandrel is adapted, as before stated, to receive and wind upon itself a strip 11, and one of the objects of my invention is to cause the mandrel to grasp and wind said strip without stopping its rotation. For this purpose I have provided a mandrel which is constructed as follows: Referring to Figs. 1, 2, 3, 4, and 6, the mandrel 10 is provided with a longitudinally-disposed slot 10^b, which slot enters said mandrel tangentially. At the free end of said mandrel is a bore 10^c, that is adapted to receive a centering-stud 40, carried by tail-stock 5, whereby said mandrel is supported and guided at its free end. At one side of slot 10^b in the surface of mandrel 10 is cut a depression 10^d, which is adapted to receive a pointed end 11^a of the strip 11, (see Fig. 3^a,) whereby said strip can readily enter the slot 10^b, and as the mandrel continues to rotate the metal at the sides of said slot will grip said strip to wind it on the mandrel. In this case the end 11^a of strip 11, after the latter is wound upon the mandrel, will be bent inwardly across the bore of the body or tube made upon the mandrel, and in order to straighten out the same to cause it to follow the inner wall of the bore of the body or tube the slot 10^b from the point where it meets the bore 10^c is cut on a curve at 10^e, that leads to the end of the mandrel. (See Fig. 2.) By this means as the body or tube that is formed on the mandrel is drawn from the same the curved portion 10^e of slot 10^b will cause the projecting portion 11^a of strip 11 to wind or be pressed outwardly, so as to lie against the inner wall of the bore of said body or tube. In some cases, however, I prefer that the strip 11 should have a straight edge where it meets the mandrel, and for this purpose the slot 10^b may be made parallel throughout, as shown in Figs. 7, 8, 9, 10, and 11, and said slot is shown arranged tangentially, and by preference two of such slots are used, as shown in said figures.

Instead of having a bore at its end the mandrel shown in Figs. 7, 8, 9, and 11 is provided with a cylindrical projection 10^f to receive the tail-stock or a support 40, having a socket. In this case as the strip 11 is fed to the mandrel while the same rotates the strip will enter the slot 10^b and the mandrel will wind the strip upon itself. In both cases it will be understood that as the slot 10^b is located at one side of the axial center of the mandrel and arranged tangentially the strip can readily enter said slot as it is pushed along, not-

withstanding that the mandrel is rotating at the time that the strip is pushed against the same.

Mandrels of different lengths can be used by adjusting the head and tail stocks along bed 1.

In order to cause the convolutions of the body or tube to be wound tightly together upon the mandrel, I provide a presser 41, that is shown in the form of a cylindrical bar lying parallel to mandrel 10. (See Figs. 1, 3, and 4.) The presser 41 is shown secured to arms 42, that are attached to a rock-shaft 43, hung in suitable bearings in the head-stock 4 and tail-stock 5, and from the shaft 43 projects an arm 44, to which is attached a spring 45, which is also suitably attached to the bed or frame 1, the tendency of which spring is to move the presser 41 toward the mandrel 10, and thus to press upon the strip as it is being wound upon the mandrel.

At 46 is a table or plate upon which the strip 11 may be placed and pushed to the mandrel by hand, the table 46 being shown carried by brackets 47, secured to bed or frame 1. (See Figs. 4 and 5.) At opposite sides of the table or plate 46 are located guides 48, which serve to guide the sides of the strip 11, so that the same shall be fed properly to mandrel 10, and by preference the guides 48 are adjustable laterally of the table 46, for which purpose I have shown said table as provided with slots that receive bolts or screws 50, which pass through the guides 48, whereby the latter may be adjusted and securely held.

The operation of forming a body or tube is as follows: The mandrel 10 is secured to rod 12 and the latter is moved to the left in Fig. 6 to bring the mandrel in the proper position. The clutch 21 22 is then adjusted into engagement and pulley 17 rotated, whereupon the rod 12 and mandrel 10 will rotate and the wheel 36 will be continuously rotated by the worm or threads upon rod 12. The strip 11 is placed upon table 46 and fed to the mandrel, and when it comes in contact with the same it will enter the slot 10^b, whereupon its edge will be bent, and the mandrel will thus grip it and will wind it upon itself, some gum or other adhesive being preferably placed on the upper outer edge of the strip, so that as said edge passes under the presser 41 it will adhere to the body or tube thus formed. As soon as the strip is properly wound the operator grasps the handle 38 to check the rotation of wheel 36, whereupon the worm or threads 12^b of rod 12 while the latter continues to rotate will cause said rod to move longitudinally outwardly, and will thus draw mandrel 10 with it, whereupon the body or tube formed on said mandrel will abut against the keeper 14, and thereby the mandrel will be withdrawn from said body or tube, which can drop away. The handle 38 is next rotated by the operator, whereupon wheel 36 will act to feed rod 12 and mandrel 10 back to their normal operative positions. Thus it will be understood that the mandrel 10 can continuously rotate, and all that the operator has to do is to feed the strips 11 to the mandrel and to cause wheel 36 to stop rotating and then to rotate the same, as may be required.

It is evident that the mandrels can be formed otherwise than as shown, and that the means for causing rod 12 to move longitudinally can be altered, if desired and I therefore do not limit my invention to the precise details of construction shown and described, as they may be varied without departing from the principles thereof.

Having now described my invention, what I claim is—

1. A tube-forming machine comprising a mandrel having a longitudinal slot open at one end and curved near its open end, and adapted to receive the edge of a strip while rotating, and means for supporting and rotating said mandrel, substantially as described.

2. A tube-forming machine comprising a mandrel having a longitudinal slot open at one end and curved near its open end, a support for said mandrel, and means to cause said mandrel to move longitudinally, to remove the formed body from the same, substantially as described.

3. A tube-forming machine comprising a mandrel having an open hollow end, a longitudinal slot in said mandrel curved near the open end of the mandrel, and adapted to receive the edge of a strip while rotating, and means for supporting and rotating said mandrel, substantially as described.

4. A tube-forming machine comprising a mandrel having a longitudinally-disposed slot that enters the same tangentially and is curved near its open end, the metal of said mandrel having a cut-away portion at the side of said slot that leads into the latter, and means for supporting and rotating said mandrel, substantially as described.

5. A tube-forming machine comprising a mandrel having a bore at one end, a longitudinally-disposed slot that is parallel to said bore at the portion in the rear of said bore and curved at the side of said bore, and means for supporting and rotating said mandrel, substantially as described.

6. A tube-forming machine comprising a mandrel having a hollow end, and a longitudinal slot entering the wall at the hollow end of the mandrel tangential to its inner circumference, and curved along the hollow portion of the mandrel, said slot being adapted to receive the edge of a strip while rotating, and means for supporting and rotating said mandrel, substantially as described.

7. A mandrel for rolling a strip upon itself comprising a bar hollow at one end, and having a longitudinally-disposed slot entering the wall at the hollow end of the bar tangential to its inner circumference and curved along the hollow portion of the mandrel, substantially as described.

8. A mandrel comprising a bar having a longitudinally-disposed slot and a bore at one end, said slot being straight in the rear of said bore and curved at the side of said bore, substantially as described.

9. A mandrel comprising a bar having a longitudinally-disposed slot and a bore at one end, said slot being straight in the rear of said bore and curved at the side of said bore, the metal of said mandrel at one side of said slot being cut away, substantially as described.

10. A tube-forming machine comprising a mandrel adapted to hold a strip while rolling it, a longitudinally-movable rod, means for detachably connecting the rod with the mandrel, means to cause said rod to move longitudinally without stopping its rotation, and means to rotate said rod, substantially as described.

11. A tube-forming machine comprising a mandrel adapted to hold a strip while rolling it, a longitudinally-movable rod adapted to carry the mandrel and having a worm or threads, means to cause said worm or threads to move the rod longitudinally, and means for rotating said rod, substantially as described.

12. A tube-forming machine comprising a mandrel to hold a strip while rolling it, a longitudinally-movable rod adapted to carry the mandrel and having a worm or threads, a toothed wheel meshing with said worm or threads, and means to check the rotation of said wheel, substantially as described.

13. A tube-forming machine comprising a mandrel adapted to hold a strip while rolling it, a longitudinally-movable rod adapted to carry the mandrel and having a worm or threads, a toothed wheel meshing with said worm or threads, and a handle connected with said wheel, whereby it may be independently rotated and its rotation by said worm or threads checked, substantially as described.

14. A tube-forming machine comprising a mandrel adapted to hold a strip while rolling it, a rod adapted to carry said mandrel, a sleeve to receive said rod, means to support and rotate said sleeve, means to lock said sleeve and rod rotatively, and means to cause said rod to move longitudinally by and during its rotation, substantially as described.

15. A tube-forming machine comprising a mandrel adapted to hold a strip while rolling it, a rod adapted to carry said mandrel, a sleeve to receive said rod, means for supporting and rotating said sleeve, means for connecting said sleeve and rod rotatively while permitting said rod to have longitudinal movement within said sleeve, and means for causing said rod to have rotation without longitudinal movement and also to have longitudinal movement without stopping its rotation, substantially as described.

16. A tube-forming machine comprising a mandrel adapted to hold a strip while rolling it, a threaded rod adapted to carry said mandrel, a sleeve adapted to receive said rod, means for supporting and rotating said sleeve, means for causing said rod to rotate without longitudinal movement and to move longitudinally while rotating said rod having one or more longitudinal grooves and one or more feathers carried by said sleeve and located in said groove, whereby said rod may be rotated by said sleeve and may have longitudinal movement within said sleeve, substantially as described.

17. A tube-forming machine comprising a mandrel adapted to hold a strip while rolling it, a threaded rod adapted to carry said mandrel, a sleeve adapted to receive said rod, means for supporting and rotating said sleeve, said sleeve having one or more slots, said rod having one or more grooves alined with said slots, one or more feathers located in the slot or slots of said sleeve and entering the groove or grooves of said rod, and means for causing the latter to rotate without longitudinal movement and also to move longitudinally while rotating, substantially as described.

18. A tube-forming machine comprising a mandrel adapted to hold a strip while rolling it, a rod adapted to carry said mandrel, a sleeve adapted to receive and rotate said rod, a pulley journaled to rotate around said sleeve, a clutch to connect said pulley and sleeve, and means to cause said rod to move longitudinally within the sleeve, substantially as described.

19. A tube-forming machine comprising a mandrel adapted to hold a strip while rolling it, a rod adapted to carry said mandrel, a sleeve to receive and rotate said rod, means for supporting said sleeve rotatively, a pulley adapted to rotate around said sleeve, said pulley having a stud or projection, a sleeve or collar keyed upon the first-mentioned sleeve, and carrying a stud or projection to engage the stud or projection of the pulley, means for shifting said sleeve or collar, and means for causing said rod to move longitudinally within the sleeve, substantially as described.

20. A tube-forming machine comprising a mandrel adapted to hold a strip while rolling it, a rod adapted to carry said mandrel, a sleeve to receive and rotate said rod, means for supporting and rotating said sleeve, a guide carried at the end of said sleeve adapted to permit the passage of said mandrel, and in position to receive the end of the body that is rolled on the mandrel and means for causing said rod to move longitudinally, substantially as described.

21. A tube-forming machine comprising a mandrel, a rod adapted to carry the mandrel, a sleeve to receive said rod, means for supporting and rotating said sleeve, an apertured keeper at the end of said sleeve, a removable bushing at the end of said sleeve to receive and guide the mandrel, and means for causing said rod to move longitudinally, substantially as described.

22. In a tube-forming machine the combination of a bed, a head-stock and tail-stocks,

with a sleeve journaled in said head and tail stocks, means for intermittently rotating said sleeve, a rod located in said sleeve and adapted to carry a mandrel, means to rotate the rod by the sleeve and means for causing said rod to move longitudinally, substantially as described.

Signed in the city, county, and State of New York this 26th day of May, 1898.

CHARLES L. CURTIS.

Witnesses:
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S. BEATRICE KUHN.