

No. 621,735.

Patented Mar. 21. 1899.

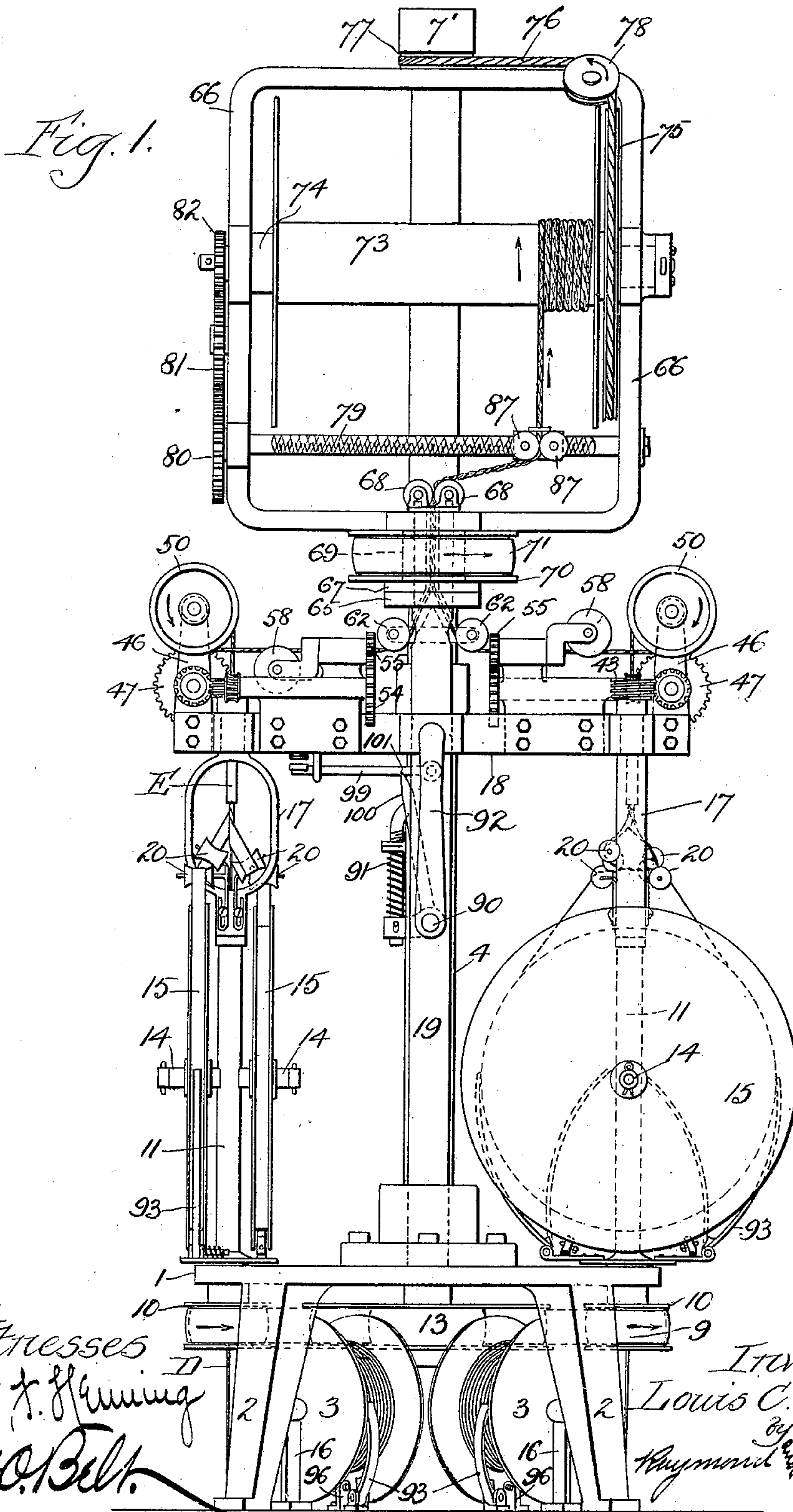
L. C. ARNOLD.

MACHINE FOR APPLYING PAPER OR SIMILAR INSULATING MATERIAL TO WIRE.

(Application filed Oct. 18, 1897.)

(No Model.)

6 Sheets—Sheet 1.



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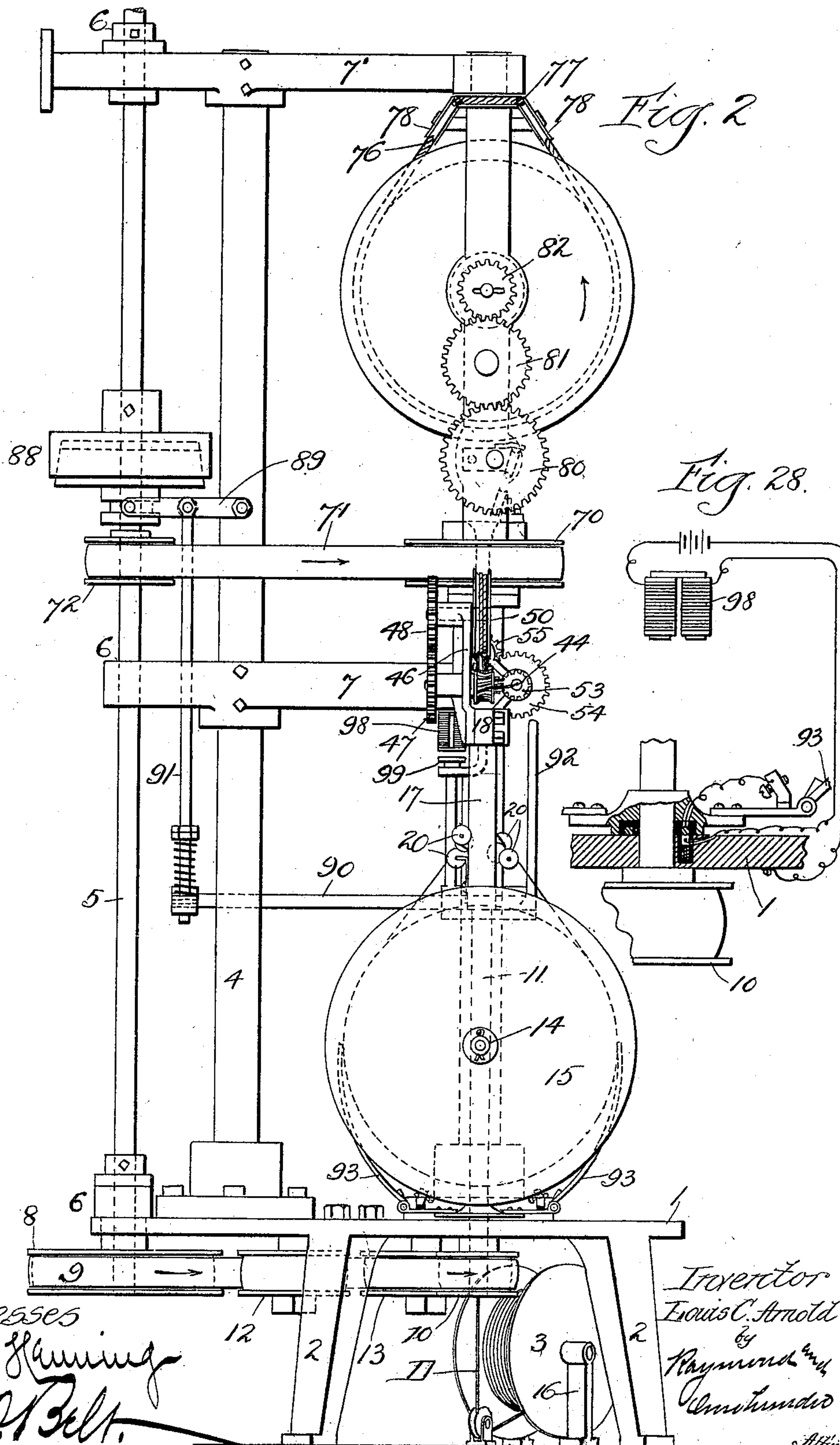
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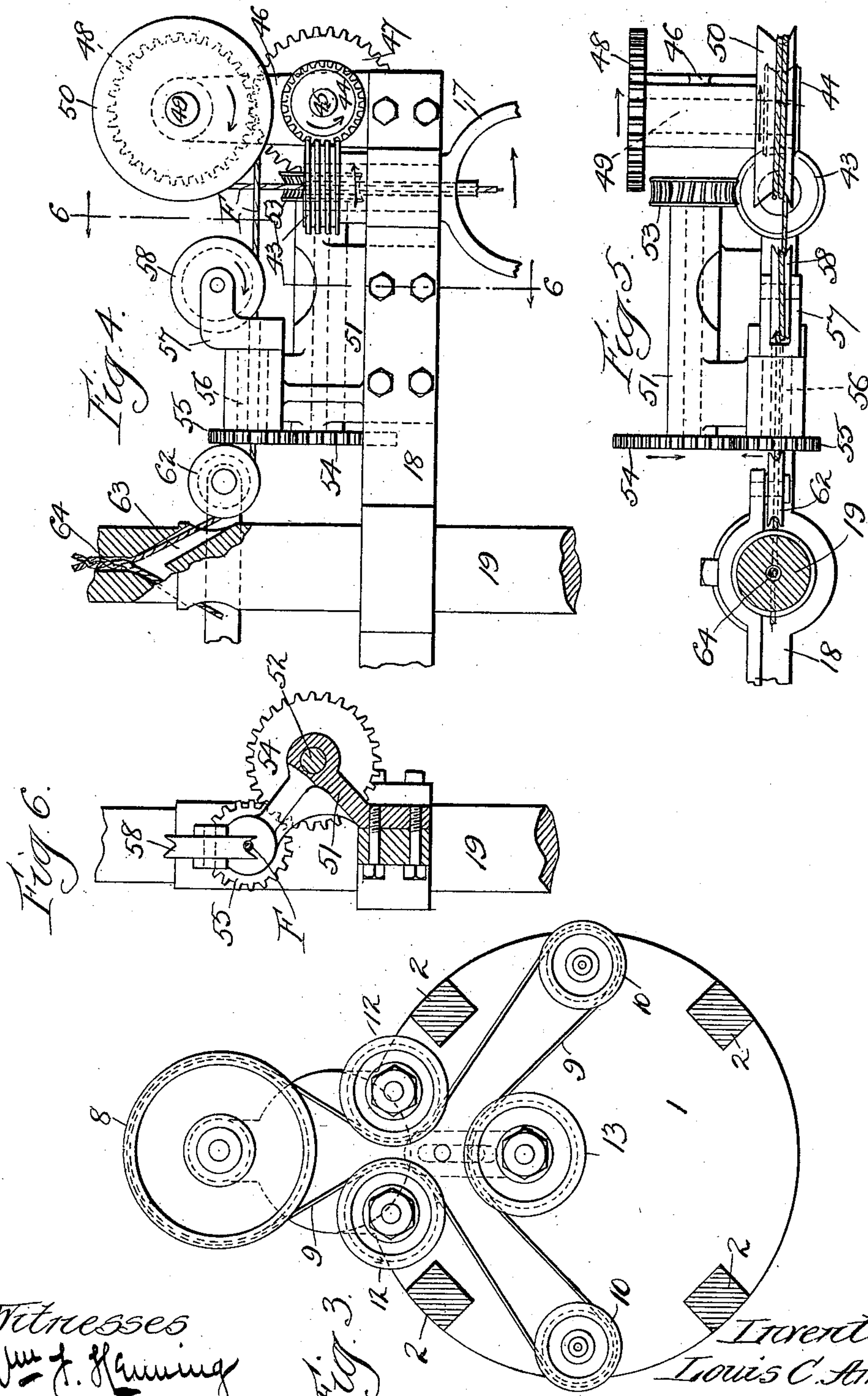
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6 Sheets—Sheet 3.



Witnesses  
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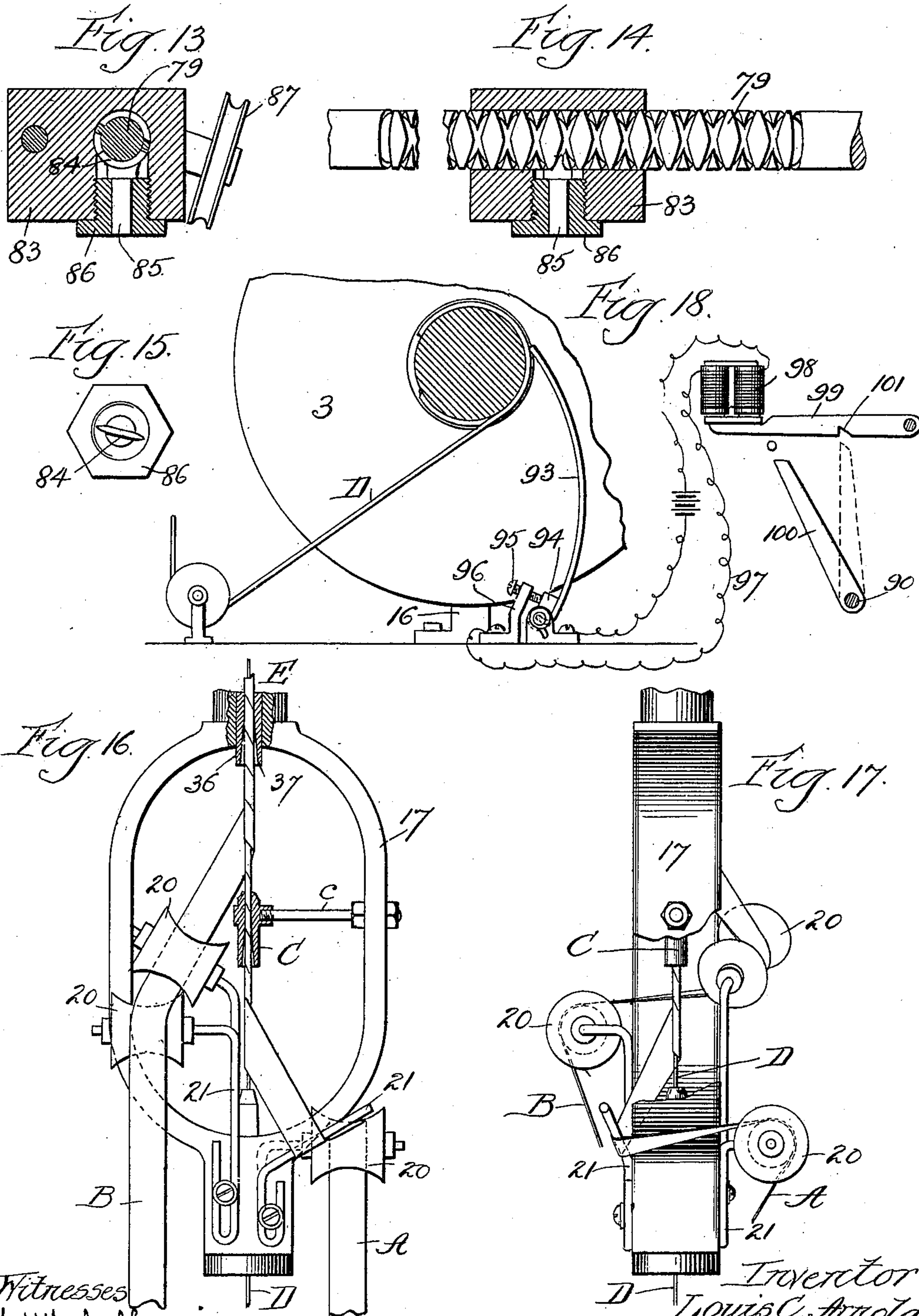
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8 Sheets—Sheet 5.



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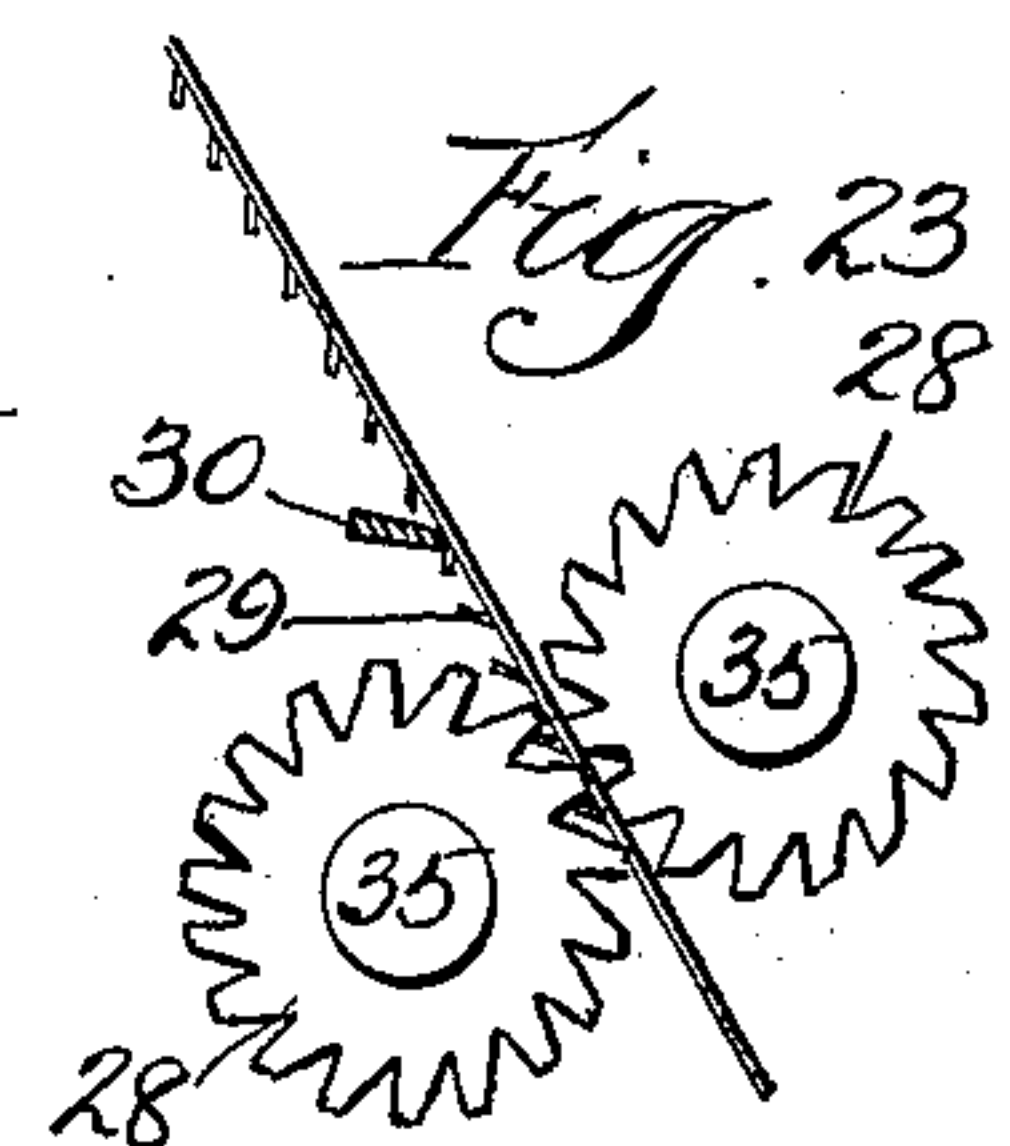
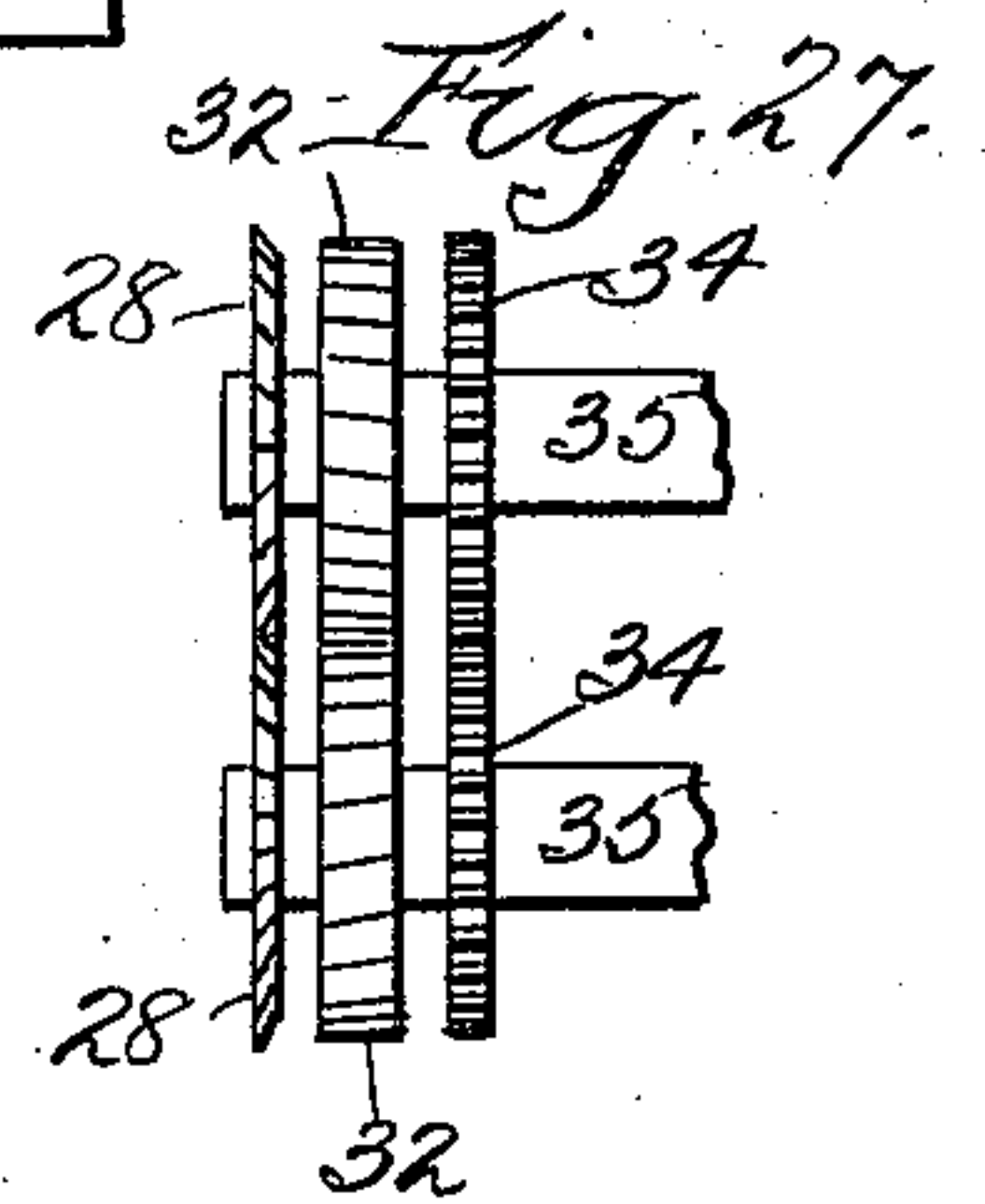
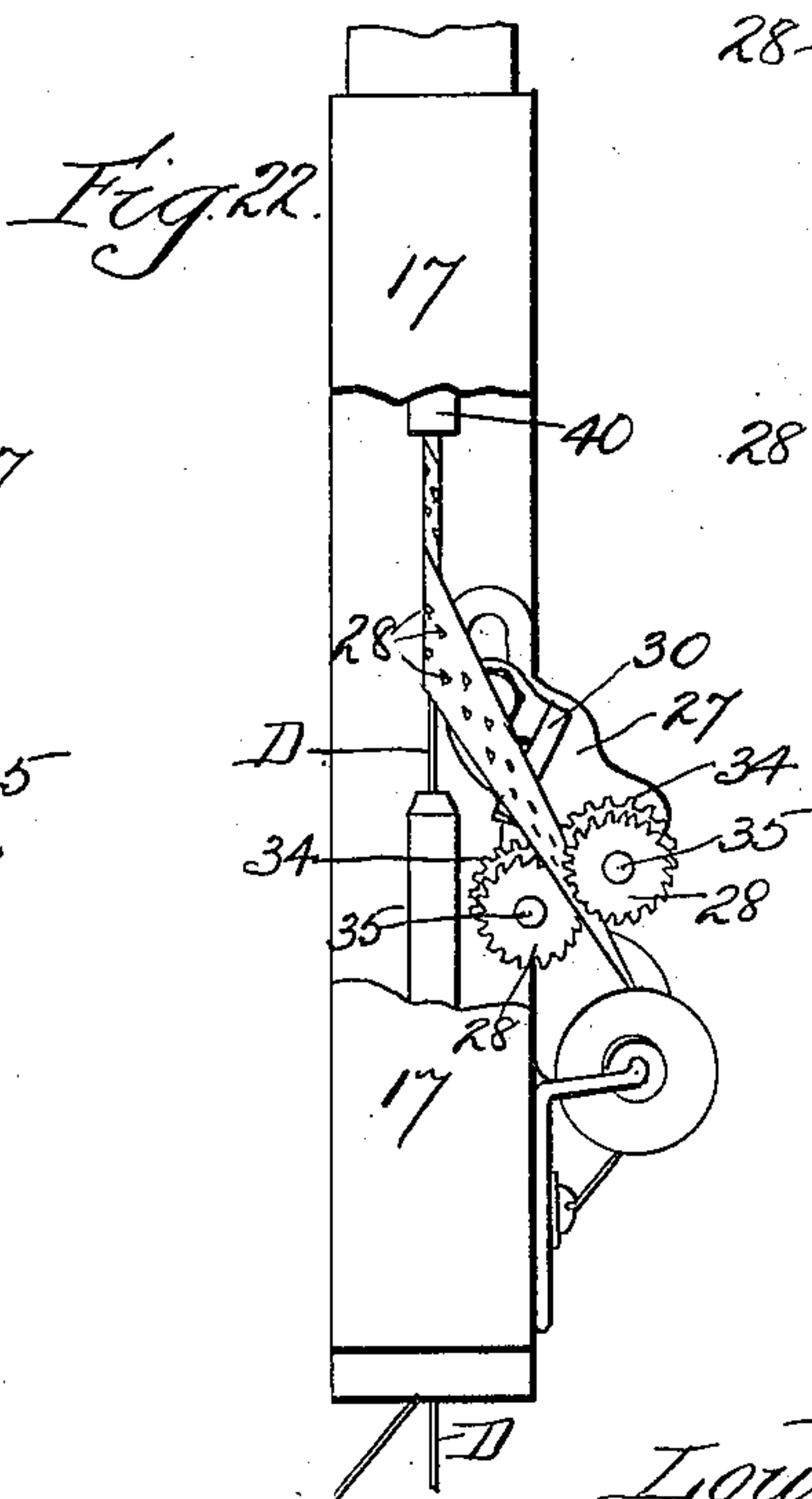
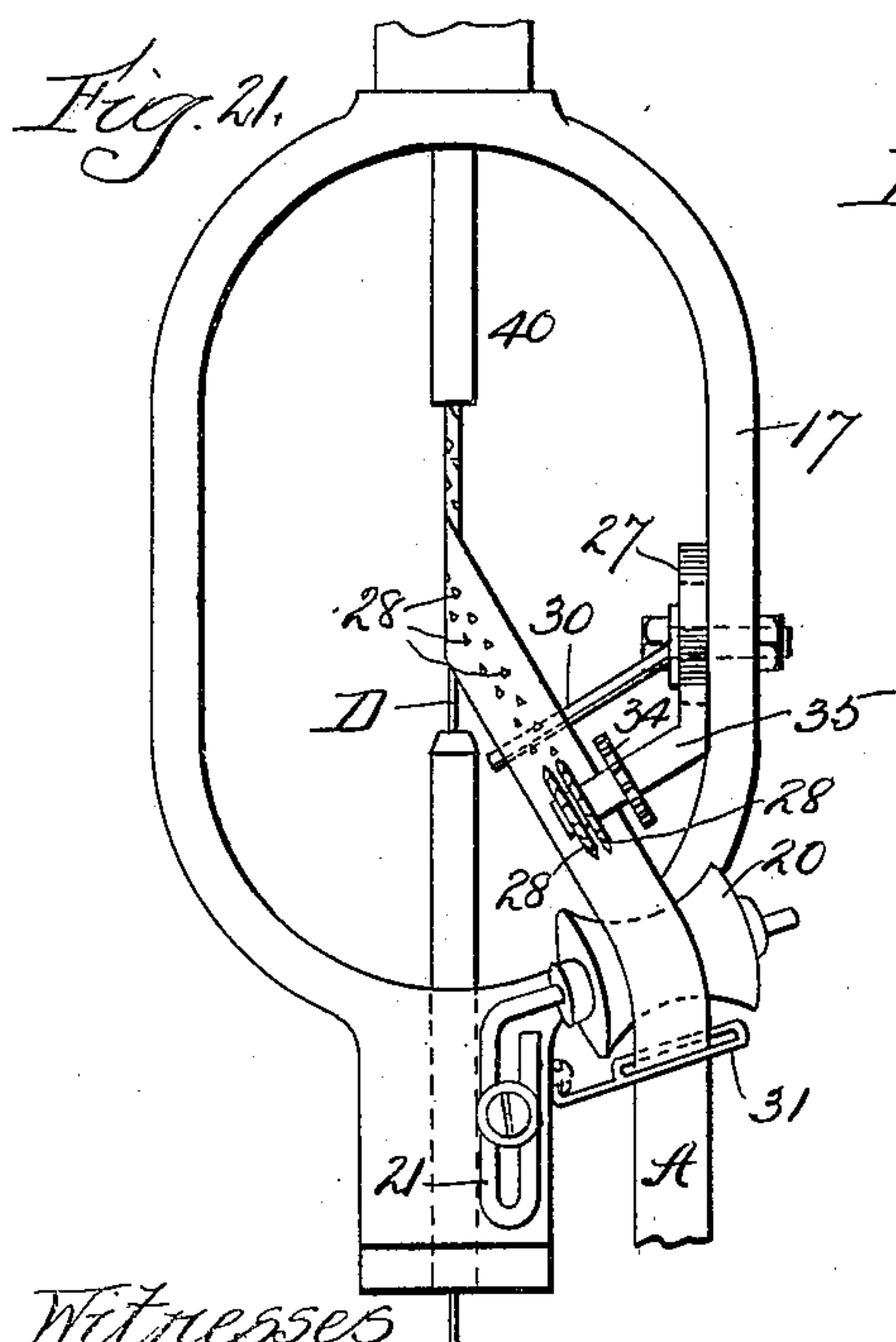
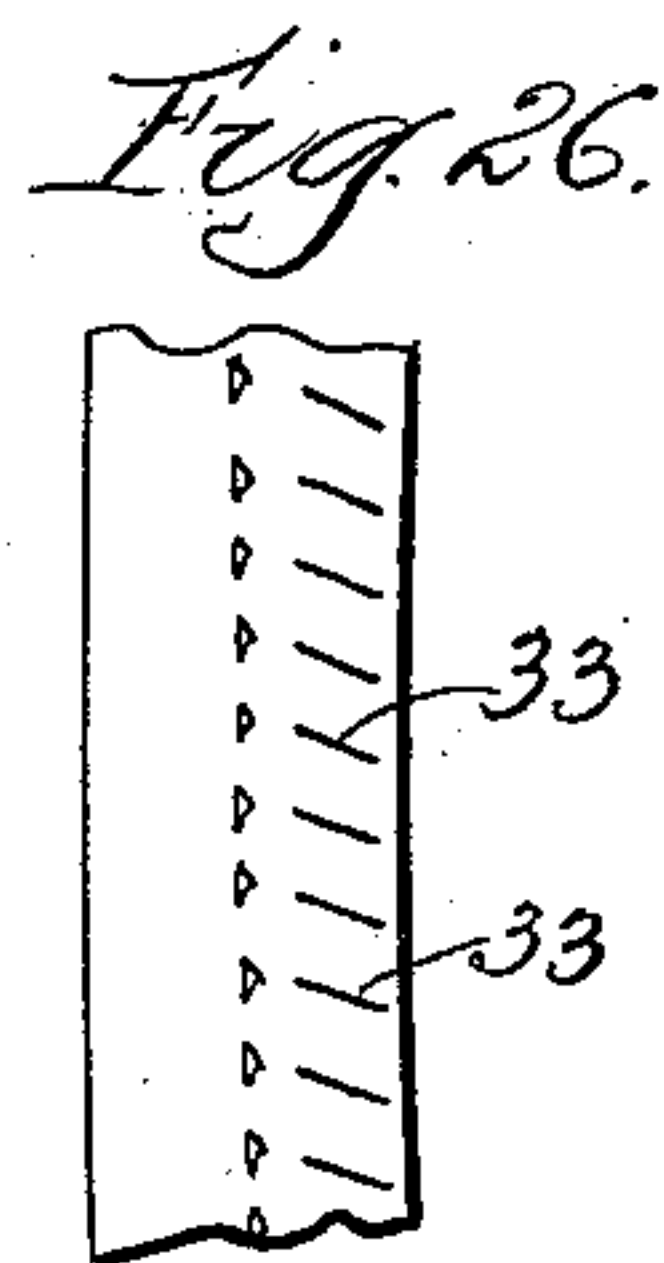
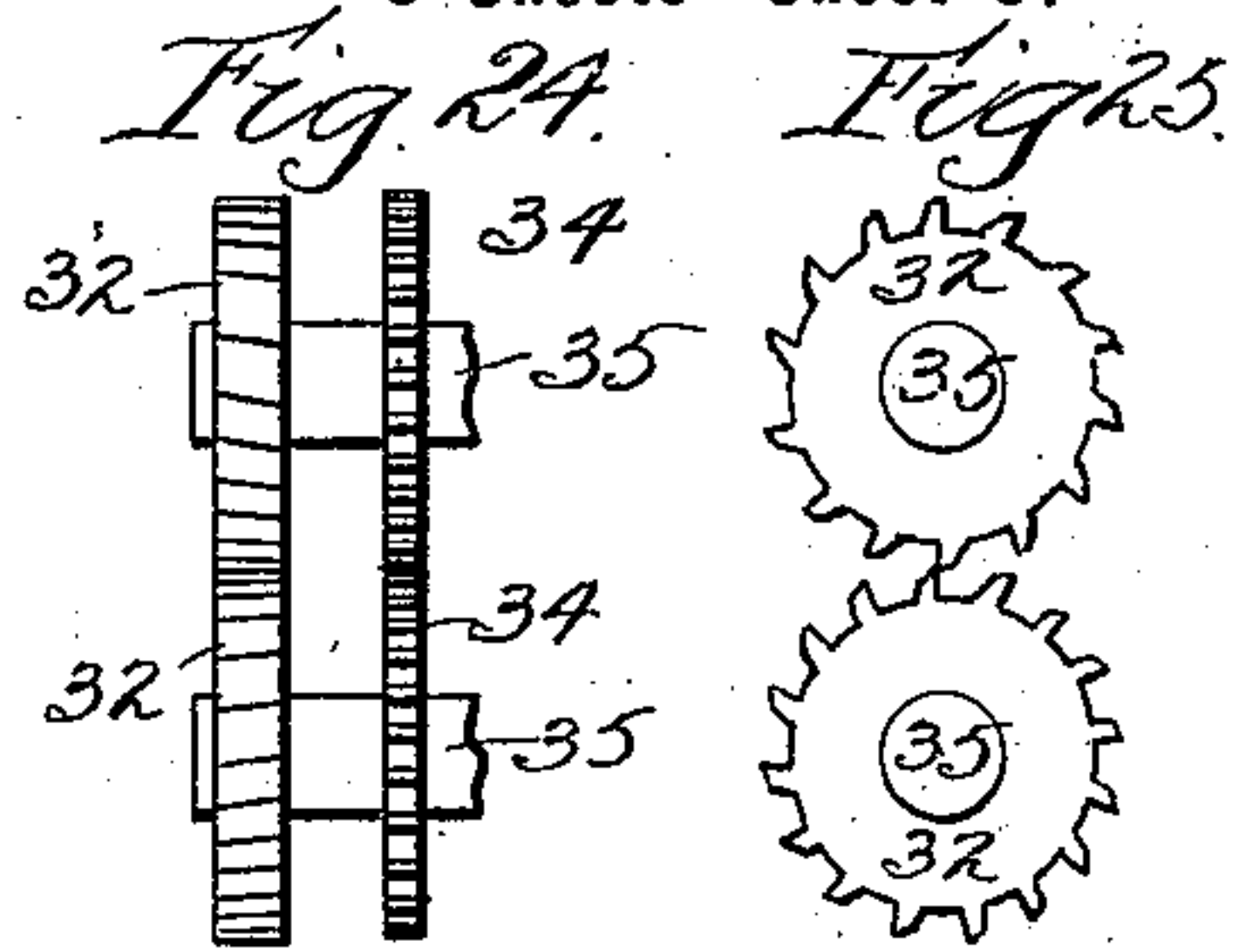
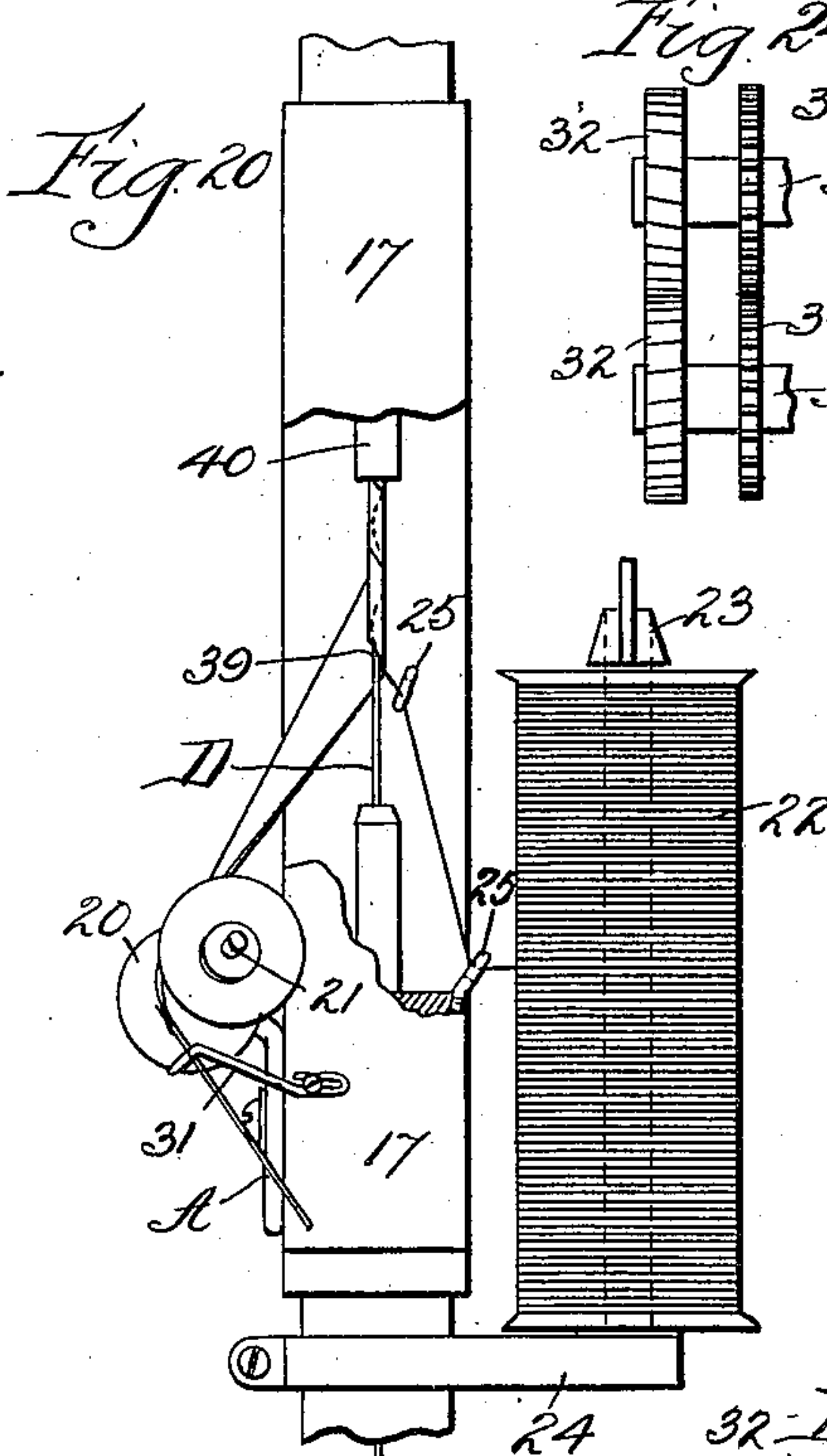
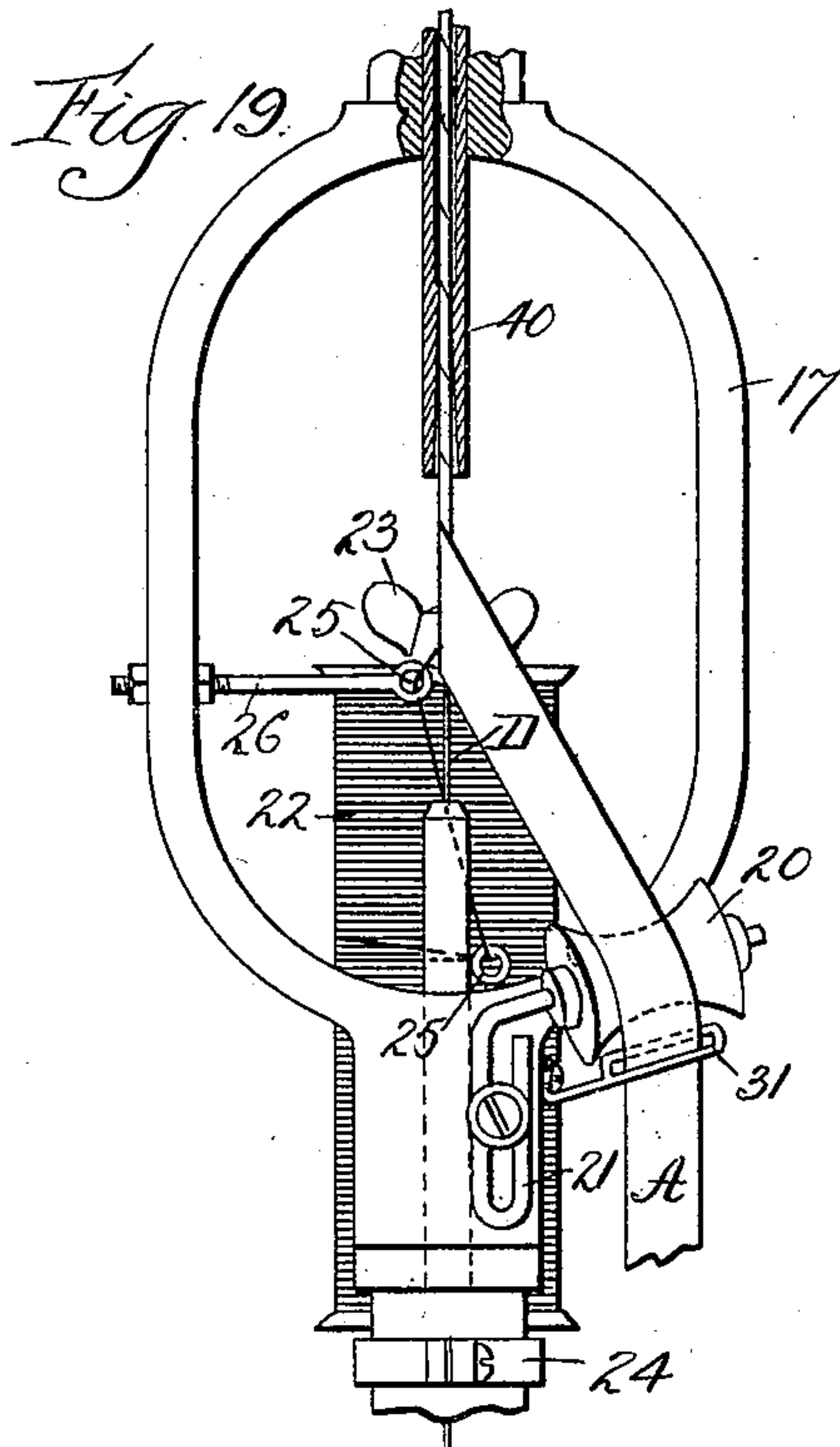
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(Application filed Oct. 18, 1897.)

(No Model.)

6 Sheets—Sheet 6.



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# UNITED STATES PATENT OFFICE.

LOUIS C. ARNOLD, OF CHICAGO, ILLINOIS.

MACHINE FOR APPLYING PAPER OR SIMILAR INSULATING MATERIAL TO WIRE.

SPECIFICATION forming part of Letters Patent No. 621,735, dated March 21, 1899.

Application filed October 18, 1897. Serial No. 655,523. (No model.)

*To all whom it may concern:*

Be it known that I, LOUIS C. ARNOLD, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Machines for Applying Paper or Similar Insulating Material to Wire, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to certain new and useful improvements in machines for applying paper or similar insulating material to wire.

It is customary in making cables at the present time to employ a number of separate and distinct machines, one for wrapping the paper on the wire, another for twisting two or more wires together, another for twisting a number of the double wires together, another to wrap the twisted wires with cotton thread, and another for inclosing the cable so formed in an enveloping lead sleeve. These separate and distinct machines take up considerable room, require the attention of a number of operators, and much time is lost in transferring the work from one machine to another.

It is my object to provide a machine for properly wrapping one or more wires with the insulating material, such as paper, and twisting them together and reeling the same, all these operations being accomplished successively by means of one continuously-operating machine.

Another object of the invention is to construct a machine of this character in such a manner that the heads will revolve regularly and operate to wind the insulating material on the wire evenly and uniformly, thereby obviating as far as may be possible the disadvantages resulting from irregularly-operating heads, due to a large extent to unusual centrifugal force, which causes the tension on the insulating material and the direction of its movement to the wire to vary from time to time.

Another object of the invention is to provide a machine in which the insulating material may be wound upon the wire without leaving any broken or exposed places due to con-

ing or other reasons, and which are now incidental to insulated wire made on machines in which the insulating material is wound loosely on the wire.

Another object of the invention is to wind the insulating material on the wire in such a manner that a cable may be formed with said insulated wires of a desired flexibility and having the required capacity for conducting a current.

Another object of the invention is to wind an insulating material on a wire in such a manner that the wire will be entirely protected by the insulating material and a dead-air space between the wire and the insulating material.

Another important object of my invention is to provide means intermediate of the wrapping-head and the twisting-head for the purpose of loosening the insulation after it is wrapped on the wire, so that the natural tendency of the twisting operation to slightly loosen the insulation will be assisted and the insulation loosened to the desired extent, and among the other objects of my invention I may refer at this point to the great reduction in the cost of making insulated wire, due to performing a number of operations successively on a single machine, automatically operating a reel and guiding device for reeling two or more twisted insulated wires, punching the insulating material before it is wrapped on the wire, winding a thread on the wire simultaneously with the insulating material, punching and crimping the insulating material before winding the same on the wire to reduce its length on one edge, and electrically-controlled devices for automatically stopping the machine when the supply of insulating material or the supply of wire is nearly exhausted; and a still further and important object of the invention is to provide a polishing device to prevent the insulating material from coning so large and so often, as is usual in the machines now in use, by confining the insulating material within certain limits while it is being wound upon the wire and making it crumple regularly to form a tube of uniform size.

My invention also has other objects in view, which will be set forth and described hereinafter in connection with the detail description



of the construction, in connection with the accompanying drawings, in which—

Figure 1 is a front elevation of my improved machine in operative position. Fig. 2 is a side elevation of the machine. Fig. 3 is a transverse sectional view looking upward at the base-plate and the pulleys beneath it in Fig. 1. Fig. 4 is a detail enlarged view of the mechanism for loosening the insulation immediately after it is wrapped on the wire, the twisting-head being shown in section. Fig. 5 is a top plan view, partly in section, of the loosening mechanism shown in Fig. 4. Fig. 6 is a sectional view on the line 6 6 of Fig. 4, looking in the direction of the arrows. Fig. 7 shows another form in which the loosening mechanism may be embodied. Fig. 8 is a top plan view of the loosening mechanism shown in Fig. 7. Figs. 9 and 10 show the preferred form of polishing device. Figs. 11 and 12 show another form of the polishing device. Figs. 13 and 14 are sectional views showing the guiding device on the reversing-worm, which guides the wire to the reel. Fig. 15 is a detail top plan view of the cam and its support, which operates in connection with the reversing-worm. Fig. 16 is a front view, partly in section, of the devices for guiding insulating material to a wire to form a double cover. Fig. 17 is a side elevation, partly broken away, of the device shown in Fig. 16. Fig. 18 shows the devices for automatically stopping the machine when the supply of insulating material is almost exhausted. Fig. 19 is a side elevation, partly in section, of devices for applying a single cover of insulating material and a thread to a wire. Fig. 20 is a side elevation, partly broken away and partly in section, of the devices shown in Fig. 19. Figs. 21 and 22 are respectively front and side elevations showing the manner of punching the insulating material, Fig. 22 being partly broken away. Fig. 23 shows the devices for punching the insulating material in side elevation. Figs. 24 and 25 show devices for crimping the insulating material. Fig. 26 shows a section of the insulating material punched and crimped. Fig. 27 shows the devices for punching and crimping the insulating material. Fig. 28 illustrates the electric circuit which operates the stopping mechanism.

In making cables at the present time it is customary to insulate the wires with paper applied in the form of continuous strips, and it is to this form of insulation that my present machine particularly relates, although it will be understood that I do not confine myself strictly to the use of paper as an insulation, for other kinds of insulation of substantially a similar character may be applied with my machine as well as paper. For the sake of simplicity, however, I will refer hereinafter to the use of paper as an insulation and applied to wire in connection with my machine, not confining myself, however, by any means to the exclusive use of paper.

It will be understood that when paper is

applied to a running wire, the edges of the paper overlapping, the tube formed by the paper will gradually grow larger until such time as the tension on the paper will crush the tube, after which the tube will be small and gradually grow larger again. This gradual enlargement of the tube is spoken of and known by those using machines of this character as "coning," and it is a very disagreeable feature of this form of insulation, because whenever the coning occurs, followed by a crushing of the tube, as above mentioned, the tubular character of the insulation is materially changed, the paper being crumpled and considerably disarranged, and a break or exposure in the insulation frequently occurs at this place, which may expose the wire in the subsequent operation of twisting two or more wires together in such a manner as to cause a short circuit. When the paper is wound loosely on the wire, this coning is larger than when it is wound tightly; but it does not occur so often, and when the large coning is crushed breaks or exposures in the insulation are more apt to occur when the wires are twisted together. If the paper is wound tightly around the wire, the coning occurs frequently; but by the devices and mechanism hereinafter described it is controlled in such a manner that no breaks or exposures will occur in the insulation after it is completed.

With these few general remarks as to this feature of my invention I will now proceed to a detailed description thereof.

Referring to the drawings, in which like letters and numerals of reference denote corresponding parts in all of the figures, 1 designates the base-plate of my improved machine, which may be of any desired character or construction suitable for the purpose, the same being provided with supporting-legs 2 in the drawings to provide room for the wire bobbins 3 and the pulley mechanism hereinafter described. A support 4 is mounted on the base-plate, and a counter-shaft 5 is journaled in bearings 6 in the base-plate and the cross-pieces 7 on the support, this shaft being driven by any suitable means to impart movement to the mechanism of the machine.

The lower end of the counter-shaft 5 extends beneath the base-plate and carries a pulley 8, over which a belt 9 travels and communicates motion to the wrapping mechanism, this belt operating in contact with pulleys 10 on the lower end of the spindles 11, journaled in bearings in the base-plate. The belt 9 also operates in contact with the idle-pulleys 12 12 and 13, the pulley 13 being adjustably secured beneath the base-plate, so that the tension on the belt can be adjusted as desired. (See Fig. 3.)

The spindles 11 are provided with studs 14, on which the rolls 15 of paper are supported, and these spindles constitute the carriers or supports for the paper. Although I have shown but two such supports or carriers in



the machine in the drawings, it will be understood that any number thereof may be used, as desired, and as each of them is constructed and operates like the others it will only be necessary herein to describe one of them particularly.

The bobbins 3 are suitably mounted on supports 16 beneath the base-plate, and the wire passes from the bobbin up through the hollow spindle 11 and is wrapped with the paper by means of devices mounted on the upper end of said spindle, after which it passes through a polisher, a loosening device, and two or more wires are twisted together and reeled. Drawing devices are arranged to impart movement to the wire, so that it will move regularly and evenly through these mechanisms.

*The wrapping mechanism.*—It will be understood that with a machine of this character a single cover of paper may be applied to the wire, as shown by the wrapping-heads in Figs. 19 and 20, or a double cover may be applied to the wire, as shown in Fig. 16, or a cylinder and binder may be applied to the wire, as shown and particularly described in connection with the wrapping-head forming a part of the invention described in my application, Serial No. 632,170, filed April 14, 1897. The wrapping-head comprises a frame 17, which is rigidly secured on the upper end of the spindle, the upper end of said frame passing through and being journaled in bearings in a cross-bar 18, supported on the upper end of a spindle 19, mounted on the base-plate. Guide-spools 20 are mounted on arms 21, adjustably secured on the frame 17, and these spools are adjusted with such relation to each other and to the wire that the paper from the supply-rolls 15 will pass to the wire in such a manner that it will be wrapped on the wire in the form desired, as a double cover, a cylinder and binder, or as a single cover, in the latter case only one roll of paper and the proper guide-spools being necessary.

It will be unnecessary in this specification to describe at length the manner and means of applying paper to the wire in the form of a cylinder and binder, as this is fully set forth in my above-mentioned prior application; but I will now proceed to describe the manner in which a double cover may be applied to the wire. This is shown in Fig. 16, in which the guiding-spools for the paper A from one roll are so arranged that this paper will be wound on the wire in the lower part of the frame 17, while the guiding-spools for the paper B from the other supply-roll are arranged to direct the paper to the upper part of the frame, where it is wrapped on top of the wrapping A, so that the insulation is in the form of two separate and distinct cylinders or covers. In order that the first wrapping with the paper A may be regular and uniform and in perfect cylindrical shape, a primary polisher C, of the form hereinafter described or some other suitable form, is supported on an arm c, secured to the frame and arranged to operate on the first

cover applied to the wire. This primary polisher C is used in addition to the regular polisher, which operates upon both covers of paper on the wire and which will be hereinafter described in detail.

In Figs. 19 and 20 I have shown the arrangement of parts for applying a single cover of paper to the wire and in addition thereto a thread from the bobbin 22, which is mounted on a spindle 23, supported on an arm 24, secured to the frame or to the carrying-spindle 11. For the purpose of securing the best insulation and the best capacity for the wire it is desirable that the insulation should contact with the wire as little as possible, and to this end a thread may be wound upon the wire simultaneously with the paper. In these views, Figs. 19 and 20, I have shown how a thread may be wound on the wire with a single cover of paper, the paper passing over the guide-spool 20 to the wire and the thread being guided in the eyes 25 on the arms 26, adjustably secured in the frame. The thread-guiding devices are located and arranged in such a manner that the thread will be wound on the wire under that edge of the paper which would normally contact with the wire, for it will be observed that one portion or edge of the paper engages and contacts with the previous turn of the paper, while the other edge is in position to contact with the wire and forms a support for the succeeding turn.

The thread devices may be combined with wrapping-heads for applying double covers or other forms of insulation to the wire by adapting these thread devices to the heads employed for that purpose, this adaptation requiring only the skill of a mechanic and being within the scope of my invention. In order that the paper may crumple to make a tube or cylinder insulation which contacts with the wire only at intervals, it has been customary to perforate the paper at its middle, so that when it is applied to the wire and smoothed down in the polishing device the paper will crumple on the lines of the perforations and engage the wire, the remaining portion of the insulation being to a large extent supported by the crumpled perforated portions which extend down to engage the wire. In Figs. 21 to 25, inclusive, I have shown devices arranged on the wrapping-head which may be employed for the purpose of perforating the paper or punching the same, or crimping, or punching and crimping. Referring to Fig. 21; a bracket 27 is secured to the side of the frame 17, and it carries the punching-wheels 28, said wheels being provided with teeth to engage the paper and force out lips 29 in the manner illustrated in Fig. 23, which shows one set of the punching-wheels. An arm 30 is also secured to the frame 17, and it is arranged to engage the under side of the paper between the wire and the punching-wheels to force the lips from a forwardly-projecting direction to a rearwardly-projecting direction, as illustrated in



Fig. 23, so that these lips will serve to form a support for the paper upon the wire D. By changing the direction of the lips and forcing them back in the manner mentioned against the paper they are prevented from returning to the holes out of which they are punched. In guiding the paper from the supply-roll to the wire it is desirable to employ a guide-arm 31, which is secured to the frame, and this guide-arm may be provided wherever the paper first passes from the supply-roll to a guiding-spool.

In Figs. 24 and 25 I have shown a set of crimping-wheels 32, which are provided with broad indenting edges and are adapted to operate upon the paper to make the broad indentations 33. (Shown in Fig. 26.) These indentations adjacent to one edge of the paper take up and shorten the paper along that tube more or less, so that when it is applied to the wire it will take the form of a cylindrical tube of a better and more uniform character. These crimping-wheels may be used in connection with the punching-wheels in the manner illustrated in Fig. 27, and when so arranged they will operate to mark the paper, as shown in Fig. 26.

In order that the punching-wheels and the crimping-wheels may operate in unison, gear-wheels 34 are secured on the arms 35 of the bracket, which support the punching and crimping wheels, and these gear-wheels are arranged in engagement with each other to preserve the regularity of movement of the punching and crimping wheels.

*Polishing device.*—After the paper has been wrapped on the wire it is often more or less lumpy and irregular in form, and it is desirable to smooth out these lumps and irregularities to produce a tube of uniform size by means of a polishing device E, several forms of which are shown in the drawings. This polishing device may consist of a short tube 36, as shown in section in Fig. 16, said tube being secured in the upper end of the wrapper-frame, so that the paper-wrapped wire will pass directly into it from the wrapping device. The lower end of the tube is provided with a flared mouth 37, and the bore of the tube gradually decreases in size from the mouth to the standard size desired for the insulated wire. I prefer, however, to provide an elongated tube, substantially as shown in Figs. 9 to 12, inclusive, and this tube may be made in several different forms, as shown in these figures. The preferred form is shown in Fig. 9, in which two arms 38 and 39 are secured to the lower end of a short tube 36, corresponding to the polishing device above mentioned. These arms are arranged adjacent to each other and in position to form a narrow slot, through which the paper passes from the guiding devices to the wire, the paper being wrapped upon the wire while the wire is in the elongated polishing device. One of the arms, as 39, is bent, as shown in Fig. 9, to press against the paper while it is being

wrapped on the wire to make a tighter tube and press in the "point" of the tube. I mean by "point" of the tube the lowermost portion at all times which is formed by the lower unlapped edge of the paper and which will contact with the wire, as indicated at 39 in Fig. 20.

The arms 38 and 39 may be straight, as shown in Fig. 10, or the polishing device may be formed as a continuous tube 40, as shown in Figs. 11 and 12, said tube being provided with a slot 41 and having a reduced portion to complete the operation of smoothing the insulated wire, said reduced portion corresponding to the short tube 36.

*Drawing mechanism.*—The upper end of the wrapping-frame 17 projects through an opening in the cross-piece 18 and is provided on its upper end with a worm 43, which meshes with a worm-gear 44 on a transverse shaft 45, journaled in a bracket 46 on the cross-piece 18. This shaft 45 also carries a gear 47, which meshes with a gear 48, carried on a shaft 49, also journaled in the bracket 46. On the other end of the shaft 49 is a drawing-pulley 50, over which the insulated wire F is drawn, as shown in Fig. 4. It will be observed, therefore, that movement is communicated to the drawing-pulley from the winding-head, and by regulating the intermediate gearing the speed of the drawing-pulley can be adjusted with reference to the speed of the wrapping-head.

*Loosening mechanism.*—From the drawing-pulley the insulated wire passes to the twisting-head and thence to the reel, the twisting of two or more insulated wires being accomplished in the lower end of the reeling-frame, hereinafter described.

The wrapping mechanism wraps the paper on the wire in the form of a tube, which is very tight, this tight tube being necessary in order to make the paper crumple along the line of the perforations therein; but it is not desired to have such a tight tube, and while it is true that the twisting-head turning in the same direction as the wrapping-head will tend of itself to loosen the insulation to a slight extent it is desirable to have the insulation still looser. For this purpose I provide a loosening device intermediate of the wrapping-head and the twisting-head, which is adapted to engage the insulated wire as it comes from the wrapping-head and loosen the insulation thereon, or, in other words, loosen the tube on the wire. The insulation is therefore first applied to the wire in the form of a tight tube. The tube is then loosened, and thereafter it is yet more slightly loosened during the twisting operation.

It will be understood that an air-space formed between the insulating-tube and the wire constitutes a very important part of the final insulation for the wire, and for this reason it is also important and desirable that the tube should be loose. Making the tube loose also provides for a certain amount of compression, which occurs as the insulated



tube runs through the various parts of the insulating and cabling machines, and it also makes a more flexible cable.

In the drawings I have shown two different arrangements of this loosening mechanism; either one of which can be used to accomplish the results desired. Referring first to Fig. 4, a bracket 51 is secured to the cross-piece 18, and a shaft 52 is journaled in bearings in said bracket and carries on one end a worm-gear 53, meshing with the worm 43 on the upper end of the wrapping-frame. On the other end of the shaft 52 is a gear-wheel 54, which meshes with a small gear-wheel 55 on one end of a loosening-shaft 56. On the other end of the loosening-shaft 56 is an angular loosening-arm 57, and a pulley 58 is journaled in bearings in this angular loosening-arm 57, over which the insulated wire is drawn as it comes from the drawing-pulley. By this construction the loosening-arm 57, carrying the loosening-pulley 58, is revolved on its shaft 56 by movement communicated from the wrapping-head, and it operates to loosen the paper which has been wrapped on the wire in said wrapping-head, the direction of movement of the arm 57 being in a direction opposite to the winding of the paper on the wire. The degree to which the paper is unwound or loosened by this loosening device is regulated by the gearing 54 55, and by changing this gearing the paper may be loosened more or less, as desired. In Fig. 7 I have shown this loosening mechanism arranged in a somewhat different manner.

Referring to Fig. 7, it will be observed that the shaft 45 carries a beveled gear 59, which meshes with a corresponding gear 60 on a shaft 61. This shaft 61 corresponds to the shaft 52 in the other construction of the loosening device, and it carries the gear 54, arranged to mesh with the gear 55, and the loosening-arm 57 is connected with said gear 55 and carries the loosening-pulley 58, over which the insulated wire is drawn. In this construction the loosening device is arranged between the wrapping-head and the drawing device; but it operates in the same manner and for the same purpose as hereinbefore described.

*Twisting-head and reeling device.*—The insulated wire passes from the loosening device around the idle pulley 62 and through a diagonal channel 63 into a vertical channel 64 in the upper end of the standard 19. On the upper end of the standard 19 is a bearing-plate 65, and the frame 66 of the reeling device is also provided with a hub 69, provided with an opening to receive the upper end of the standard and carrying a bearing-plate 67, which rests upon the plate 65.

Two guide-rollers 68 are journaled in suitable bearings on the lower portion of the reel-frame at the upper end of the standard 19 to receive and guide the insulated wire as it comes from the twisting-head. That portion of the standard between the inclined chan-

nels 63 and the extreme upper end constitutes the twisting-head, the wires being twisted together in the vertical channel, as shown in Figs. 1 and 4, by the revolution of the reeling device.

A pulley 70 is rigidly secured on the hub 69, and a driving-belt 71 is wound around this pulley and another pulley 72, secured on the counter-shaft 5, whereby a rotary movement is imparted to the reeling device.

The reeling device comprises a substantially rectangular frame 66, the lower portion of which is mounted on the upper end of the standard 19, as before mentioned, while the upper portion is secured to the end of the cross-piece 7'. In Fig. 1 a reel 73 is shown secured in place in the frame on a shaft 74. This shaft carries a pulley 75 adjacent to one end, and a rope 76 is drawn around this pulley and a stationary pulley 77 on the end of the cross-piece 7' and the idle pulleys 78. As the reel-frame is rotated through the medium of the belt 71 the rope 76 will be operated to turn the pulley 75 and the reel-shaft 74, thereby imparting the proper movement to the reel and causing the same to wind up the twisted wires.

In order to guide the wire properly to the reel, I provide a reversing-worm 79, which is journaled in bearings in the lower portion of the frame and is provided at one end with a gear 80, which meshes with an idle gear 81, which in turn meshes with a gear 82 on the end of the reel-shaft. Motion is thereby communicated from the reel-shaft to the worm, and a guiding device is arranged on the worm and travels back and forth to guide the wire to the reel. This guiding device is illustrated in Figs. 13 and 14, and it comprises a block 83, provided with an opening to receive the worm 79. The cam 84, Fig. 15, is arranged to operate in the thread of the reversing-worm, and this cam is carried on a stud 85, which is loosely mounted in an opening in a nut 86, which is screwed into the block 83. Guide-rollers 87 are arranged on the front of the block 83, and the wire passes from the guide-rollers 68 at the upper end of the standard to the rollers 87 and thence to the reel, the guiding device being moved along on the worm as the cam operates in the thread of said worm. The cam is loosely mounted in the nut 86 and works freely in the thread of the screw, so that when it reaches the end of the worm it follows the thread and carries the block back to the other end of the worm, the cam following the thread of the worm at all times during its revolution without interruption. The wire is therefore wound upon the reel in an even and regular manner, the movement of the wire-guiding device being regulated to secure a proper winding.

*Stopping mechanism.*—In order to make my machine automatic in its stopping, I have provided devices adapted to cause a stoppage of the machine whenever the supply of paper or wire on any one roll or bobbin is exhausted,



or nearly so. A clutch 88 is arranged on the counter-shaft 5, and a clutch-lever 89 is pivotally secured to the support 4 and arranged to throw the clutch. A rock-shaft 90 is journaled in bearings in the support 4 and standard 19, and it is connected with the clutch-lever 89 by means of a link 91, Fig. 2, this rock-shaft 90 being provided with a crank or handle 92 in front of the standard or in some other suitable place, whereby the rock-shaft can be operated to move the clutch-lever, and thereby engage or disengage the clutch. This apparatus can be used at any time for the purpose of throwing the clutch manually; but, as before stated, it is desirable to stop the machine automatically, and for this purpose I employ the following devices: A spring-controlled arm 93, Fig. 18, is pivotally secured to the base-plate 1, and it is arranged to bear against the roll of paper or the roll of wire, as the case may be. This arm carries near its pivot a contact-block 94, which is arranged to engage an adjusting-screw 95, mounted on a bracket 96 on the base-plate and forming another contact of an electrical circuit 97. A magnet 98 is suitably arranged on the cross-piece 18, and an armature 99 is located adjacent to said magnet and pivoted to the standard 19. An arm 100 is rigidly secured to the rock-shaft 90, and its upper end is adapted to engage a notch 101 in the armature 99, as shown in Fig. 1.

When the spring-controlled arm 93 is in engagement with the paper or wire, the contact-points 95 and 94 are separated, so that the electric circuit is broken; but the arm remains in contact with the paper or wire until the supply is almost if not entirely exhausted, and the parts are so regulated and adjusted that at this time the contact 94 will be carried into engagement with the contact 95 and the circuit closed, whereupon the armature 99 is attracted to its magnet 98 and the arm 100 disengaged from the armature, so that the weight of the arm and the link 91 and other parts rock the shaft 90 and cause the lever 89 to disengage the clutch. If the weight of the parts is not sufficient to rock the shaft 90, suitable weights may be provided for this purpose on the arm 100.

The stopping-arm 93 is preferably made of wood or other suitable non-conducting material, and to prevent the machine stopping and leaving a quantity of wire on the bobbin I prefer to provide an annular groove in the bobbin in which the winding of the wire is commenced, so that the arm 93 may be arranged to engage only with the wire in this groove. It will therefore be understood that before the machine is stopped by reason of the wire becoming exhausted all of the wire on the greater portion of the bobbin will have become exhausted, and the contacts 94 and 95 are adjusted so that they will not engage until the arm 93 has entered the groove in the bobbin.

The contact-points may be mounted on the

base-plate or they may be otherwise supported thereon, as desired. By the use of these automatic stopping devices the machine will be stopped whenever the supply on any paper-spool or wire-bobbin is exhausted.

This machine can be used for supplying any kind of insulation similar to paper to any number of wires simultaneously and then twisting such insulated wires together, it being only necessary to provide the requisite number of wrapping-heads and other devices for each wire. The operation of making a cable consisting of a number of insulated wires is therefore very materially simplified in my machine, as by it I am able to accomplish in one automatic machine, requiring very little attention, that which has heretofore required the use of several machines and a great deal of attention on the part of a number of workmen.

In connection with the machine it is desirable to measure the wire at some stage, and for this purpose I have provided the measuring device 102, Fig. 7, which is also electrically connected with the magnet 98. This measuring device is supported on the cross-piece 18, and it is actuated by a series of gear-wheels 103, 104, and 105, the gear 105 being arranged to operate in unison with the idle pulley 62. The measuring device is provided with a scale 106, and two contact-arms 107 108 are arranged to travel around over the scale, the construction of the measuring device being such that one of said arms, as 108, is set at the figure representing the number of feet of wire desired, and when the other contact-arm 107 reaches and engages the contact-arm 108 the electrical circuit is closed, the armature 99 lifted, and the machine stopped, as hereinbefore described.

As hereinbefore mentioned, I have shown in my prior application the paper adapted to be guided to the wire to secure a loose cylindrical tube and a tight binder on the tube, and the same arrangement may be used in connection with the apparatus of this application. In Fig. 1, however, I have shown the paper running over the guide-spools to form one tight cover on the wire with two strips of paper, and in forming this kind of tube the wire can be drawn through the wrapping mechanism twice as fast as when a single strip of paper is employed to form the tube, and thinner and narrower paper, which will crumple more readily, may be used.

The coning of the paper on the wire depends largely upon varying conditions, and when the paper is wound loosely the coning occurs at irregular intervals, but larger than when the paper is wound tightly. When the coning has reached its limit, subsequent winding will break down and crush the enlarged end of the cone and leave a loose space in the insulation which will open up during the subsequent operations and make an exposure of the wire at this break in the tube. Such im-



perfect insulation materially affects the capacity of the wire or cable, requiring more current and greater power.

I prefer to employ cone-pulleys in the drawing and loosening devices, so that the paper will crumple while it is being drawn tightly over the surfaces thereof. The shaft 90 is preferably provided with a crank on one end thereof, in front of the machine, to permit of the machine being started and stopped manually.

Where a number of telephone-wires are made into a cable, there has generally been more or less induction between the wires; but the insulation applied by my improved machine will prevent this by forming a tube of uniform size without breaks or openings and by twisting the wires together uniformly and systematically.

Having thus fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a machine of the character described, the combination with a base, of revoluble mechanism for wrapping insulating material on a moving wire, means for drawing the wire through the wrapping mechanism, a revoluble reeling device arranged above and connected with the wrapping mechanism adapted to twist two or more wires together and wind the same on a reel carried thereby, and suitable operating means, substantially as described.

2. In a machine of the character described, the combination with revoluble mechanism for wrapping insulating material on a moving wire, of means for drawing the wire through said mechanism, a reeling device arranged above and connected with the wrapping mechanism revolving in the same direction as the wrapping mechanism and simultaneously therewith and operating to twist two or more wires together and wind the same on a reel, and suitable operating means, substantially as described.

3. In a machine of the character described, the combination with revoluble mechanism for wrapping insulating material on a moving wire, and comprising a frame, of means connected with and operated by said frame for drawing the wire through said wrapping mechanism, and suitable operating means, substantially as described.

4. In a machine of the character described, the combination with revoluble wrapping mechanism for wrapping insulating material on a moving wire, and comprising a frame, of means connected with and operated by said frame for drawing the wire therethrough, a revoluble reeling device adapted to twist two or more insulated wires together and wind them upon a reel carried therewith, and suitable operating means, substantially as described.

5. In a machine of the character described, the combination with mechanism for wrapping insulating material on a wire and means for moving the wire through said mechanism,

of automatic devices for stopping the machine whenever the supply of wire or insulating material is exhausted comprising a clutch device, an electromagnet, an armature, and a tripping-arm engaging said armature, substantially as described.

6. In a machine of the character described, the combination with a stationary base, of a wrapping mechanism mounted on the base and adapted to apply insulating material to a moving wire and means for operating said mechanism, means connected with and operated by said wrapping mechanism for drawing the wire through the mechanism, of automatic devices connected to the supply of insulating material and the supply of wire and adapted to stop the machine whenever either supply is exhausted, comprising a clutch device, an electromagnet, an armature, and a tripping-arm normally engaged by said armature, substantially as described.

7. In a machine of the character described, the combination with mechanism for wrapping insulating material on a moving wire, and means for twisting two or more wires together, of a device arranged intermediate of the wrapping mechanism and twisting means for loosening the insulation after it is wrapped on the wire, substantially as described.

8. In a machine of the character described, the combination with mechanism for wrapping insulation material on a moving wire, means for twisting two or more wires together and means for drawing the wire through the wrapping mechanism, of a device for loosening the insulation on the wire before it reaches the twisting mechanism, substantially as described.

9. In a machine of the character described, the combination with mechanism for wrapping insulating material on a moving wire and means for twisting two or more wires together, of a device arranged intermediate of the wrapping mechanism and the twisting means and connected with and operated by the wrapping mechanism for loosening the insulation on the wire before it reaches the twisting means, substantially as described.

10. In a machine of the character described, the combination with mechanism for wrapping insulating material on a moving wire, of a device for loosening the insulating material after it is wrapped on the wire, substantially as described.

11. In a machine of the character described, the combination with mechanism for wrapping insulating material on a moving wire, of a loosening-pulley arranged to engage the insulated wire and operating to loosen the insulation thereon, substantially as described.

12. The combination with mechanism for wrapping insulating material on a moving wire, of a loosening-pulley connected with the wrapping mechanism and adapted to be operated thereby to loosen the insulating material on the wire, substantially as described.

13. In a machine of the character described,



the combination with mechanism for wrapping insulating material on a moving wire, of a loosening-pulley arranged to engage the insulated wire and loosen the insulation thereon, a loosening-arm carrying said pulley and connections between said arm and the wrapping mechanism for operating the arm and pulley, substantially as described.

14. In a machine of the character described, the combination with mechanism for wrapping insulating material on a moving wire comprising a revoluble frame and suitable guiding devices, of a worm on the upper end of said frame, a loosening-pulley arranged to engage the insulated wire and loosen the insulation thereon, an arm supporting said loosening-pulley and gearing intermediate of said arm and worm for revolving the arm and loosening-pulley, substantially as described.

15. In a machine of the character described, the combination with mechanism for wrapping insulating material on a moving wire, of means for drawing the wire through said wrapping mechanism, a device for loosening the insulation on the wire and connections intermediate of said drawing means and loosening device and wrapping mechanism, whereby the drawing means and loosening device are operated by the wrapping mechanism, substantially as described.

16. In a machine of the character described, the combination with mechanism for wrapping insulating material on a moving wire comprising a revoluble frame and suitable guiding devices, of a worm on the upper end of said frame, a drawing-pulley, gearing intermediate of said drawing-pulley and worm, a loosening device, and gearing intermediate of said loosening device and the worm, whereby the drawing-pulley and loosening device are operated by and simultaneously with the wrapping mechanism, substantially as described.

17. In a machine of the character described, the combination with mechanism for wrapping insulating material on a moving wire comprising a revoluble frame and suitable guiding devices, of a worm on the upper end of said frame, a shaft carrying a drawing-pulley on one end and a gear-wheel on the other end, another shaft carrying gears meshing respectively with the worm and the gear-wheel on the drawing-pulley shaft, whereby the drawing-pulley is operated by and simultaneously with the wrapping mechanism, substantially as described.

18. In a machine of the character described, the combination with mechanism for wrapping insulating material on a moving wire comprising a revoluble frame and suitable guiding devices, of a worm on the upper end of said frame, a loosening-pulley adapted to loosen the insulation on the wire, an arm carrying said loosening-pulley, a loosening-shaft carrying said arm on one end and a gear-wheel on the other end, another shaft carrying a worm-gear on one end to mesh with the

worm on the wrapping-frame and a gear-wheel on the other end to mesh with the gear-wheel on the loosening-shaft, whereby the loosening arm and pulley are actuated by and simultaneously with the wrapping mechanism, substantially as described.

19. In a machine of the character described, the combination with mechanism for wrapping insulating material on a moving wire, comprising a revoluble frame and suitable guiding devices, of a worm on the upper end of said frame, a shaft carrying a drawing-pulley on one end and a gear on the other end, another shaft carrying a gear meshing with the worm on the wrapping-frame and another gear meshing with the gear on the drawing-pulley shaft, a loosening-pulley, an arm carrying said loosening-pulley, a loosening-shaft carrying said arm on one end and a gear on the other end, another shaft carrying a gear on one end meshing with the worm on the frame of the wrapping mechanism and a gear on the other end meshing with the gear on the loosening-shaft, whereby the drawing-pulley and the loosening arm and pulley are operated by and simultaneously with the wrapping mechanism, substantially as described.

20. In a machine of the character described, the combination with mechanism for wrapping insulating material on a moving wire, of means for drawing the wire through said mechanism, a revoluble reeling device operating to twist two or more insulated wires together and wind the same upon a reel carried in said device and a polishing device for smoothing the insulation on the wire, substantially as described.

21. In a machine of the character described, the combination with mechanism for wrapping insulating material on a moving wire, of a device for loosening the insulation on the wire and a polishing device arranged intermediate of the wrapping mechanism and loosening device for smoothing the insulation on the wire, substantially as described.

22. In a machine of the character described, the combination with mechanism for wrapping insulating material on a moving wire, of means for drawing the wire through said mechanism, a device for loosening the insulation on the wire and a reeling device for twisting two or more wires together and winding the same upon a reel and a polishing device for smoothing the insulation after it is wrapped on the wire, substantially as described.

23. A polishing device for insulated wire having an opening to permit the passage of the wire therethrough and a slot in its side to permit the passage of the insulating material to the wire, substantially as described.

24. A polishing device for insulated wire consisting of an elongated tube having a central opening to permit the passage of the wire and a slot in its side forming a passage for the insulating material, substantially as described.



25. A polishing device for insulated wire consisting of an elongated tube having a central opening to permit the passage of the wire and a slot in its side forming a passage for the insulating material and a contracted portion to smooth the insulation, substantially as described.

26. A polishing device for insulated wire comprising a tube having two members separated by an elongated slot, substantially as described.

27. A polishing device for insulated wire having two members separated by an elongated slot, one of said members being bent to bear upon the insulation, substantially as described.

28. A polishing device for insulated wire having a contracted portion and two members separated by a slot, one of said members being bent to bear upon the insulation, substantially as described.

29. In a machine of the character described, the combination with mechanism for wrapping insulating material on a moving wire, of devices for punching the insulating material as it passes from a supply-roll to the wire, substantially as described.

30. In a machine of the character described, the combination with mechanism for applying insulating material to a moving wire and comprising a revoluble frame and suitable guiding devices, of devices carried by said frame for punching the insulating material as it passes to the moving wire, substantially as described.

31. In a machine of the character described, the combination with mechanism for applying insulating material to a moving wire, of devices for crimping the insulating material, substantially as described.

32. In a machine of the character described, the combination with mechanism for wrapping insulating material on a moving wire comprising a revoluble frame and suitable guiding devices, of devices carried by said frame for crimping the insulating material as it passes to the wire, substantially as described.

33. In a machine of the character described, the combination with mechanism for applying insulating material to a moving wire, of devices for punching and crimping the insulating material as it passes from the supply-roll to the wire, substantially as described.

34. In a machine of the character described, the combination with mechanism for applying insulating material to a moving wire and comprising a revoluble frame and suitable guiding devices, of devices carried by said frame for punching and crimping the insulating material as it passes to the wire, substantially as described.

35. In a machine of the character described, the combination with mechanism for wrapping insulating material on a moving wire comprising a revoluble frame and suitable guiding devices, of a bracket secured on the

frame and provided with projecting arms and punching-wheels carried by said arms adapted to engage the insulating material and punch the same, substantially as described.

36. In a machine of the character described, the combination with mechanism for wrapping insulating material on a moving wire, of devices for punching the insulating material and a device adapted to engage the lips punched by said punching devices, substantially as and for the purpose described.

37. In a machine of the character described, the combination with mechanism for applying insulating material to a moving wire comprising a revoluble frame and suitable guiding devices, of devices carried by said frame for punching the insulating material as it passes from the guiding devices to the wire and an arm carried by the frame and arranged to engage the insulating material and change the direction of inclination of the lips punched through by the punching devices, substantially as described.

38. A reeling device comprising a revoluble frame carrying a reel, a reversing-worm supported in the frame and a guiding device comprising a block, guide-rollers carried by said block, a hollow nut secured in the block and a cam adapted to operate in the worm and secured in a stud mounted in said nut, substantially as described.

39. In a machine of the character described, the combination of mechanism for applying insulating material to a wire, means for moving the wire through said wrapping mechanism, means for twisting two or more insulated wires together, a device intermediate of the wrapping mechanism and twisting means for loosening the insulation on the wire, a revolving reeling device located in advance of the twisting means and a device for guiding the wire from the twisting means to the reel, substantially as described.

40. In a machine of the character described, the combination with mechanism for applying insulating material to a moving wire, of a twisting-head and a revolving device located above the twisting-head and adapted to twist two or more wires together in the head, substantially as described.

41. In a machine of the character described, the combination with mechanism for applying insulating material to a moving wire, of a twisting-head and a revolving device located in advance of the twisting-head and adapted to twist two or more wires in said head, substantially as described.

42. In a machine of the character described, the combination with a stationary standard, of mechanism for applying insulating material to a moving wire, a cross-piece on the standard, drawing means and a loosening device carried by said cross-piece, the upper end of said standard being provided with a central opening to receive two or more wires and constituting a twisting-head for twisting the same together and a revolving device located



above the twisting-head for twisting the wires together, substantially as described.

43. In a machine of the character described, a counter-shaft, a clutch in said shaft, an electrical circuit normally open, an electromagnet in said circuit, an armature, a tripping-arm adapted to engage the armature, and a spring-controlled arm normally in contact with the supply of wire or insulating material adapted to close said circuit and throw the clutch whenever the supply of insulating material or wire is exhausted, substantially as described.

44. In a machine of the character described, the combination of a counter-shaft, a clutch in said shaft, a clutch-lever, a link connected to said lever, a rock-shaft, said link being connected to the rock-shaft, an electrical circuit normally open, a magnet, an armature and a device adapted to be operated whenever the supply of insulating material or wire is exhausted to close the circuit, thereby disengaging the armature and said arm and throwing the clutch, substantially as described.

45. In a machine of the character described, the combination with mechanism for wrapping insulating material on a moving wire, of a spring-controlled arm bearing against the supply of insulating material or wire, an electrical circuit normally open, an electromagnet in said circuit, an armature, a tripping-arm engaged by said armature and a contact carried by said spring-controlled arm and adapted to be brought into engagement with another fixed contact to close the electrical circuit when the supply of insulating material or wire is exhausted, substantially as and for the purpose described.

46. In a machine of the character described, the combination with a wire-bobbin having an annular groove in its hub, of a spring-controlled arm arranged to bear against the wire in radial alinement with said groove and close an electric circuit when the wire is exhausted from the bobbin to stop the machine, substantially as described.

47. In a machine of the character described, mechanism for wrapping insulating material and a thread on a moving wire simultaneously, substantially as described.

48. In a machine of the character described, the combination with mechanism for wrapping insulating material on a moving wire, of a supply of thread and devices for guid-

ing the thread to be wrapped upon the wire under that edge of the paper which would normally contact with the wire, substantially as described.

49. In a machine of the character described, mechanism for winding insulating material on a moving wire and comprising a frame, devices for guiding the insulating material to the wire in one portion of the frame and devices for guiding the insulating material to the wire in another portion of the frame and an intermediate polishing device, substantially as described.

50. In a machine of the character described, mechanism for applying insulating material to a moving wire comprising a revoluble frame, devices for guiding insulating material to the wire in one portion of the frame, devices for guiding insulating material in another portion of the frame, a polishing device arranged to operate on the insulating material first applied to the wire and another polishing device arranged to operate on the completely-insulated wire, substantially as described.

51. In a machine of the character described, the combination with a pulley adapted to be actuated by a moving wire, of a measuring device and gearing intermediate of said pulley and said measuring device for operating the latter, substantially as described.

52. In a machine of the character described, the combination of a pulley adapted to be operated by a moving wire, a measuring device, gearing intermediate of said pulley and measuring device for operating the latter, an electrical circuit normally open and devices adapted to be operated when the required amount of wire has passed a given point for closing the electric circuit and thereby stopping the machine, substantially as described.

53. In a machine of the character described, the combination of a pulley adapted to be operated by a moving wire, a normally open electric circuit, a measuring device connected with said circuit and contact-arms carried by said measuring device and adapted to be set so that when the required amount of wire has been measured off they will engage each other and close the electric circuit and thereby stop the machine, substantially as described.

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Witnesses:

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C. L. WOOD.