Sept. 4, 1928. 1,683,223

C. E. WILSON ET AL

METAL TUBING MACHINE

Filed April 30, 1925 4 Sheets-Sheet 1

Fig. 1.

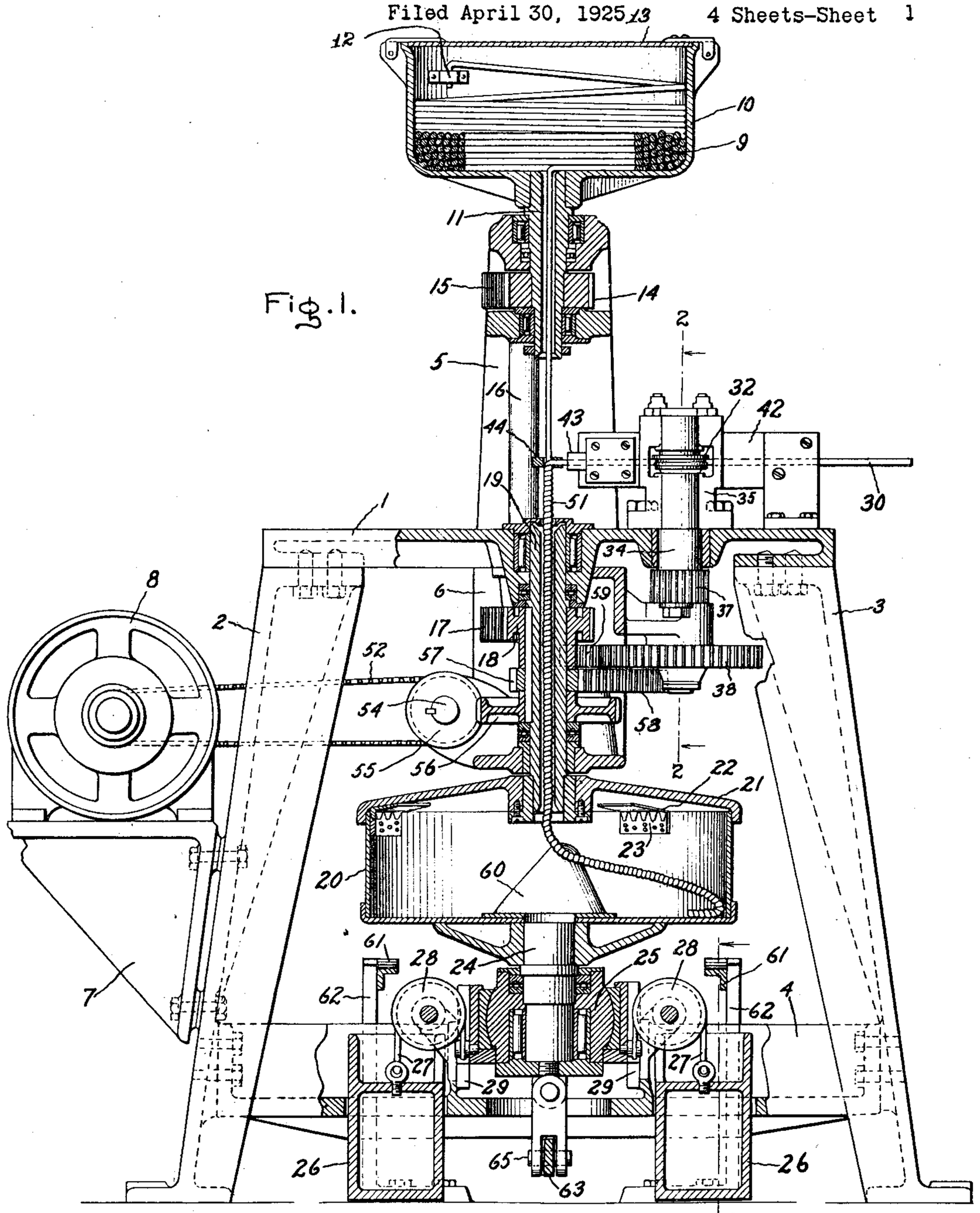


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Fig. 2.

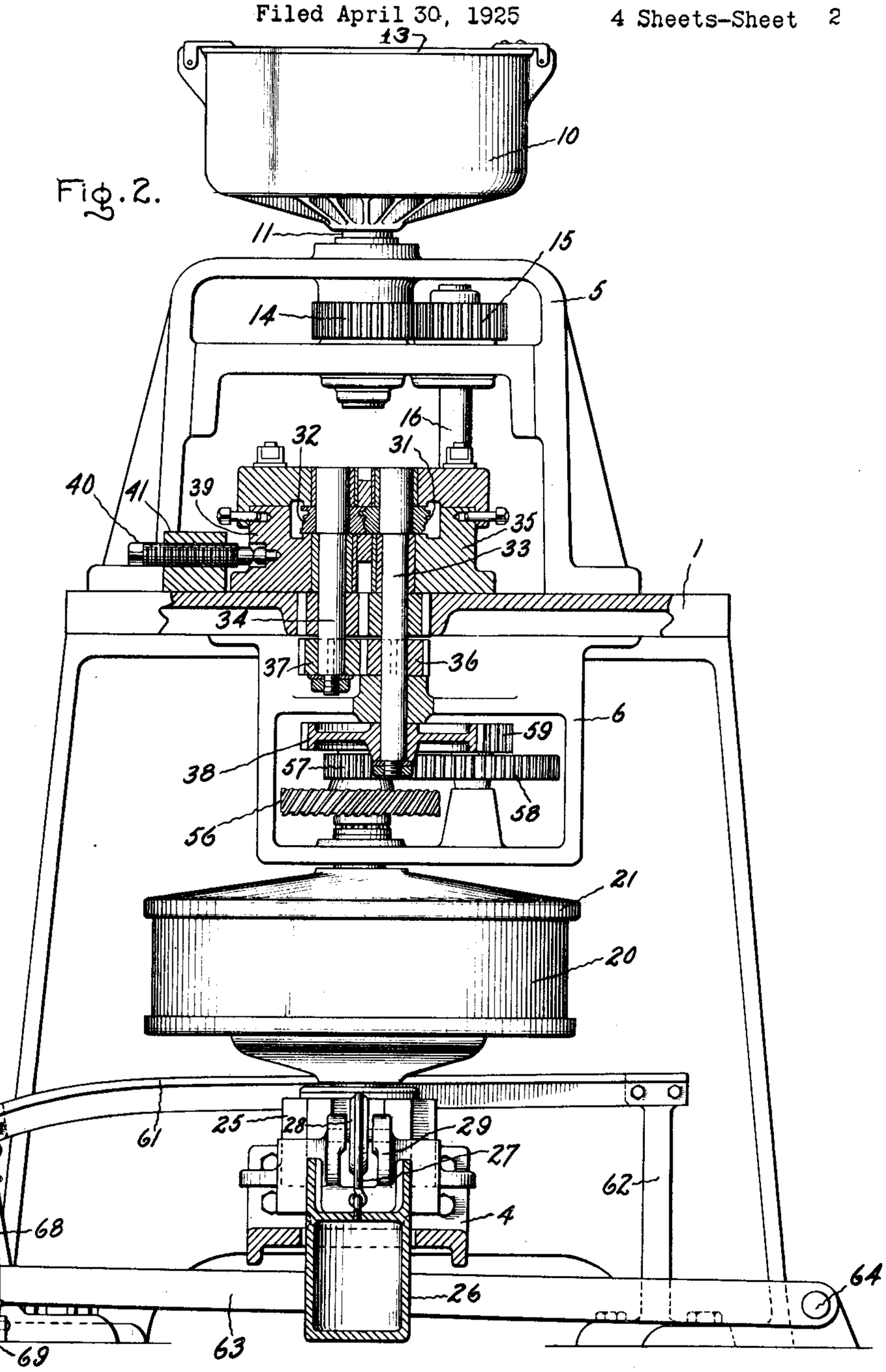


Fig. 8.

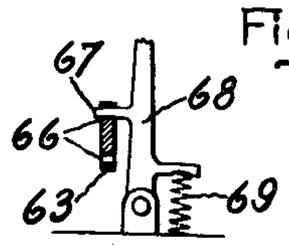


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Fig. 3.

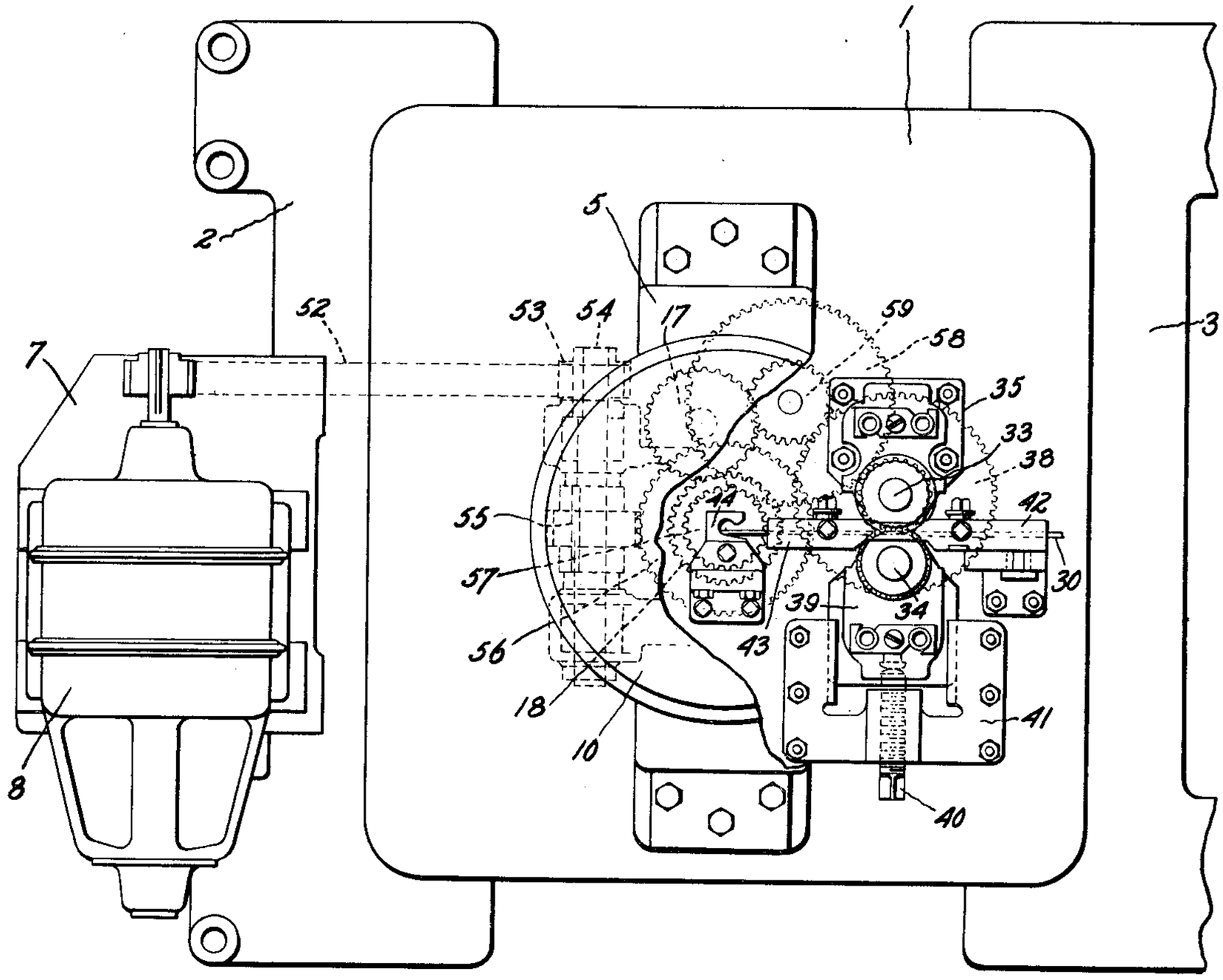


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Fig. 4.

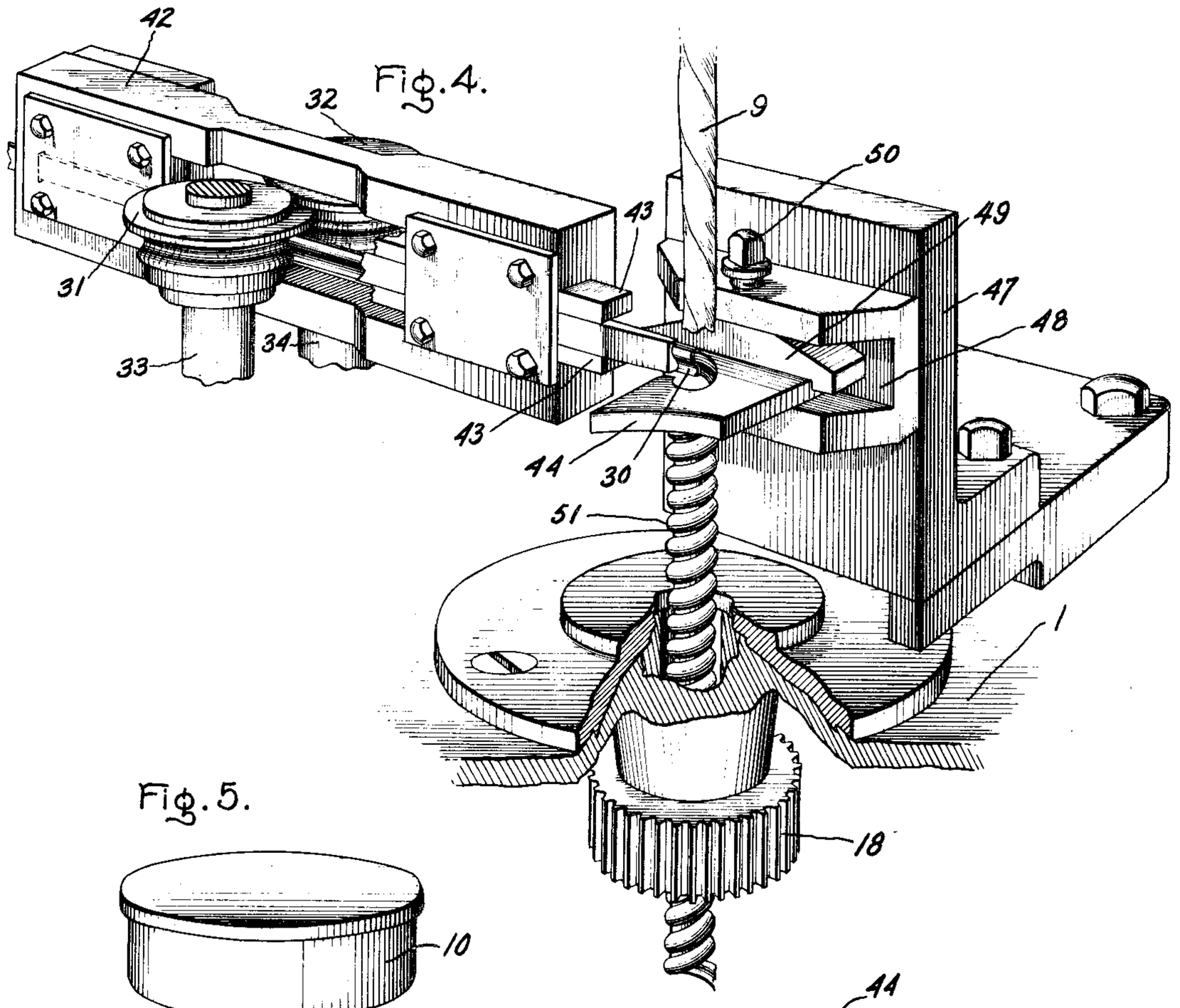



Fig. 5.

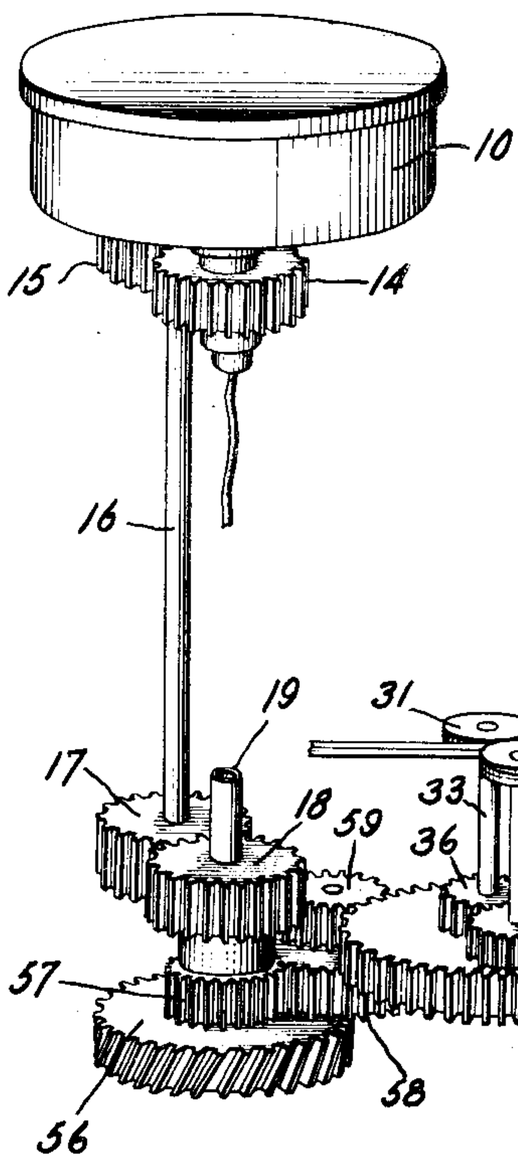



Fig. 6.

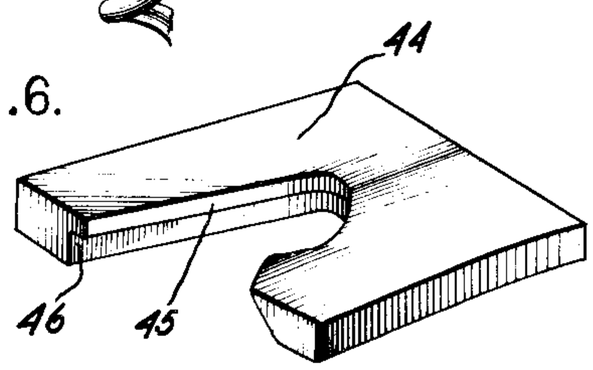
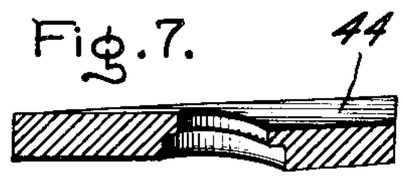



Fig. 7.




Inventors:
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Their Attorney.

Patented Sept. 4, 1928. 1,683,223

# UNITED STATES PATENT OFFICE.

CHARLES E. WILSON AND HENRY HUENERKOPF, OF BRIDGEPORT, CONNECTICUT, ASSIGNORS TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

## METAL-TUBING MACHINE.

Application filed April 30, 1925. Serial No. 27,034.

The present invention relates to flexible metallic tubing, such as conduit and armored cables for electrical purposes, etc. and more especially to apparatus for the manufacture thereof.

The object of our invention is the provision of an improved machine for the production of flexible conduit and armored cable which may be operated at high speed with slight attendance and which shall turn out its product in perfect condition and in as great lengths as desired ready for packaging for shipment.

One embodiment of the invention is shown in the accompanying drawings, in which Fig. 1 is a part front elevation and part vertical section of a complete cable armoring machine; Fig 2 is a similar view of the right-hand side of the machine with section taken on line 2—2 of Fig. 1; Fig. 3 is a plan of the machine with parts shown broken away; Fig. 4 is a detail perspective of the means for shaping and guiding the metal strip and for helically forming it about the insulated conductor; Fig. 5 is a similar view of the gear train employed; Fig. 6 is a similar view of the die in which the metal strip is helicallly formed; Fig. 7 is a transverse section of the die, and Fig. 8 is a fragmentary detail of the treadle latch.

The frame of the machine comprises a table 1 supported on two uprights side webs 2 and 3 transversely connected near their central lower ends by a beam 4. On the top of the table 1 is secured a U-shaped bracket 5 and on the underside of the table is secured a box-shaped bracket 6. The left-hand side web 2 carries a stand 7 for the support of the power motor 8.

The supply of core material, such as insulated conductor, to be armored is placed in the form of a loose coil 9 in a pan 10 revolvably supported on a vertical hollow shaft 11 journaled in the upper bracket 5. One end of the coil is caught in a clip 12 on the side of the pan to prevent it from entangling with the conductor as it is paid out through the hollow shaft and the pan is provided with a hinged lid 13 to retain and protect the coil from injury. The shaft 11 has fixed thereon a spur gear 14 driven by a similar gear 15 fixed to the upper end of a vertical shaft 16 journaled in the bracket 5 and extending down through the table 1 where it is provided with a gear 17 which meshes with a corresponding gear 18 fixed upon a hollow shaft 19 having at its lower end a second or receiving pan 20 for the reception of the completed armored cable, which by reason of the gear connection described is caused to rotate in unison with the upper pan 10. The top 21 of the lower pan 20 is fixed to the lower end of the hollow shaft 19 and is provided on its inner surface near the periphery with clutch teeth 22 which engage corresponding teeth 23 on the inner side wall of the pan 20 to cause the latter to rotate therewith. The receiving pan 20 is loosely mounted on a vertical shaft 24 journaled in a vertically movable bearing block 25 normally held in elevated position by counterweights 26 connected therewith by bands 27 passing over pulleys 28 journaled in brackets 29 on the cross beam 4.

The material of which the flexible armor is made consists of a flat steel strip or ribbon 30, which, upon being introduced to our armoring machine, is first longitudinally bent or shaped with a letter S cross section and is then forced through a helical forming die so as to produce a continuous spiral thereof about the insulated conductor 9 and with the edges of each convolution interlocked with its next adjacent convolutions in well known manner.

The means for longitudinally bending and forcing forward of the steel strip 30 consists of two suitably grooved rolls 31 and 32 fixed upon vertical shafts 33 and 34 journaled in a bearing block 35 located on the table 1 a short distance to the right of the central hollow shaft 19 and both shafts are connected to rotate in cooperation by gears 36 and 37 fixed thereon. The shaft 33 is somewhat longer than the other and has at its lower end a drive gear 38. The bearing block 35 has an adjustable section 39 in engagement with shaft 34 whereby the roll 32 may be adjusted toward or from roll 31 by turning of the set screw 40 threaded in a block 41 secured to the table adjacent the adjustable bearing section 39. On opposite sides of the bearing block 35 are supported guide bars 42 and 43 for introducing the strip 30 to the rolls and for providing a vertebrate passage through which the shaped strip is forced by the rolls 31 and 32 into and through the helical forming die 44, which, as indicated in Figs. 4, 6 and 7, consists of a slab of tempered steel having there-

in a helical slot 45 with grooved wall 46 to conform to the shaped strip 30. The die is held directly opposite the guide bar 43 and centered about the path of travel of the insulated conductor 9, as indicated in Figs. 1 and 4, by an angle bracket 47 secured to the table 1 and provided with a transverse slot 48 in which the die 44 is clamped by a filler plate 49 and set screw 50.

As the formed armor 51 leaves the die, it moves freely downward without any force being applied to move it other than the slight amount due to the weight of the short fall of conductor between the delivery and receiving pans 10 and 20, and, in consequence of this free passage, we avoid all the troubles incident to the employment of take-ups or feeders or pushers commonly employed to effect the travel of the cable through the machine.

Owing to the defects in the product caused by failure of the previously employed tubing machines to function uniformly, a considerable percentage of any machine's output was of less than the standard merchandisable length and was sold at a reduced price, whereas practical use of our machine has shown that by the free passage of the cable therethrough defective or short lengths are reduced to an insignificant amount and the output of uniformly perfect cable greatly increased.

The driving gear of the machine, as indicated in Figs. 1, 3 and 5, comprises a chain belt 52 connecting the shaft of the motor 8 with a wheel 53 fixed on a counter shaft 54 horizontally journaled in the box-shaped bracket 6 and having fixed at its center a helical gear 55 intermeshing with a larger companion gear 56 fixed on the lower hollow shaft 19 near its lower end, and somewhat below the gear 18 and between the gears 56 and 18 the shaft 19 has fixed thereon a small gear 57 which transmits motion to the shafts of the shaping rolls 31 and 32 through speed reduction gears 58, 59 and 38.

It will be understood that the ratios of the gears will be changed to correspond with the size of armored cable produced so that the rate at which the strip 30 is forced through the die 44 by the shaping rolls 31 and 32 will correspond with the peripheral travel of the cable as rotated on its axis by the concurrently rotating pans 10 and 20.

Insulating conductor suitable for armoring purposes, as purchased in the market, is done up in the form of coil bundles without supporting spool or reel. A coil in its commercial condition is untied and placed in the upper pan 10, as indicated in Fig. 1, one end caught in the clip 12 and the other threaded through the upper hollow shaft 11, the die 44 and loosely introduced into the lower hollow shaft 19. The machine is then started by switching current onto the motor 8 in the usual manner. The steel strip 30 is then introduced to the shaping rolls 31 and 32 and is automatically caught by them, longitudinally grooved and forced through the die 44. As the leading end of the armored cable passes through the lower hollow shaft 19 into the receiving pan 20, it is deflected sidewise by a cone projection 60 extending upwardly from the bottom of the pan and thereafter centrifugal force acts to lay it up against the circular wall of the pan in a uniform and compact coil.

When a coil has been completed, the pan 20 is moved sidewise from beneath the table 1 by lowering it from engagement with its lid 21 and onto guide ways 61 and then slid outward and the coil removed and tied up ready for the market.

The guide ways 61 are short sections of angle iron supported from the floor on standards 62 and the means for lowering the pan 20 upon the guide ways consists of a treadle 63 extending centrally beneath the machine near the floor and fulcrumed at its rear end to a post 64, while connected to its middle is a link 65 attached to the counter-weighted bearing block 25 upon which the pan 20 is pivoted. Near the front end of the treadle 63 are provided two vertically spaced holes 66 for the engagement therewith of a finger 67 carried by a latch lever 68 normally pressed into engaging position by a spring 69 and whereby the treadle is latched in both its elevated and depressed positions.

In addition to the advantages of greater production, better quality of product, and lower cost of attendance, our machine consumes much less rental space than any prior machine for like service known to us, since the floor area occupied by the machine and that necessary for its attendance is made a minimum by its erect design, and by dispensing entirely with spools and reels and the auxiliary unreeling and rereeling devices, the rental space needed for the complete production of an armored coil is reduced to one-half or less of that required by prior machines.

While we have shown and described the best embodiment of the invention known to us, we do not desire to be restricted thereto.

What we claim as new and desire to secure by Letters Patent of the United States, is:

1. A metal tubing machine comprising pan means for supporting a loose coil of core material so as to be freely paid out therefrom, means freely to form a metal strip helically into a flexible tube about said core, power means to propel the metal strip into and through said tube forming means, and means freely to receive the product from the said forming means.

2. A metal tubing machine comprising pan means for rotatably supporting a loose

coil of core material so as to be freely paid out therefrom, a forming die for tubing a metal strip helically about the core, power means to propel the strip into and through said die, and means to receive the product from said die and from it into a coil without application of tension thereto.

3. A metal tubing machine comprising a rotatable pan support for a loose coil of core material, a stationary forming die for freely tubing a metal strip helically about the core, power means to propel the strip into and through said stationary die, receptacle means to receive the product from said die without tension, and means for rotating said support and said receptacle means in unison.

4. A metal tubing machine comprising a rotatable support adapted to receive a loose coil of core material, a forming die for freely tubing a metal strip about the core, and a rotatable container adapted to receive the product from said die without tension and to form the same into a coil therein.

5. A metal tubing machine comprising a rotatable container for a loose coil of core material having an axial exit passage through a wall thereof, a forming die for freely tubing a metal strip about the core as it passes from said container, a rotary receptacle having an axial ingress passage for reception of the product without tension, and means to rotate said container and receptacle in unison.

6. An upright metal tubing machine comprising a container for a loose coil of core material mounted on a vertical shaft having an axial passage for the passage of the core therethrough, a forming die arranged concentric to the axis of said vertical shaft, a covered receptacle rotatably mounted beneath said die coaxially with said vertical shaft, a hollow shaft supporting the cover of said receptacle, and means to rotate said shafts in unison.

7. An upright tubing machine comprising a rotatable core support, a forming die for tubing a metal strip about the core, a receptacle for the product having a cover coupled therewith and adapted to be positively rotated, and means for raising and lowering said receptacle into and out of engagement with its cover.

8. In a machine of the character described, the combination with means for forming a metallic strip into a spirally wound revolving and longitudinally advancing armor conduit, of means for axially rotating a coiled conductor to be armored and axially delivering the conductor from said coil and into the armor conduit, and means for timing the rotation of said coil to impart to the delivered conductor an average speed of rotation substantially that of the armor conduit.

9. In a machine of the character described, the combination with means for forming a metallic strip into a spirally wound revolving and longitudinally advancing armor conduit, of means for revolving a coiled conductor to be armored about the axis of the coil, means for directing the conductor as drawn from said coil into axial alignment with the coil, and means for timing the rotation of said coil with that of the armor forming mechanism such that the average rotary speed of the conductor as delivered into the armor is substantially the rotary speed of the armor.

In witness whereof, we have hereunto set our hands this 25th day of April, 1925.

CHARLES E. WILSON.
HENRY HUENERKOPF.

coil of core material so as to be freely paid out therefrom, a forming die for tubing a metal strip helically about the core, power means to propel the strip into and through said die, and means to receive the product from said die and from it into a coil without application of tension thereto.

3. A metal tubing machine comprising a rotatable pan support for a loose coil of core material, a stationary forming die for freely tubing a metal strip helically about the core, power means to propel the strip into and through said stationary die, receptacle means to receive the product from said die without tension, and means for rotating said support and said receptacle means in unison.

4. A metal tubing machine comprising a rotatable support adapted to receive a loose coil of core material, a forming die for freely tubing a metal strip about the core, and a rotatable container adapted to receive the product from said die without tension and to form the same into a coil therein.

5. A metal tubing machine comprising a rotatable container for a loose coil of core material having an axial exit passage through a wall thereof, a forming die for freely tubing a metal strip about the core as it passes from said container, a rotary receptacle having an axial ingress passage for reception of the product without tension, and means to rotate said container and receptacle in unison.

6. An upright metal tubing machine comprising a container for a loose coil of core material mounted on a vertical shaft having an axial passage for the passage of the core therethrough, a forming die arranged concentric to the axis of said vertical shaft, a covered receptacle rotatably mounted beneath said die coaxially with said vertical shaft, a hollow shaft supporting the cover of said receptacle, and means to rotate said shafts in unison.

7. An upright tubing machine comprising a rotatable core support, a forming die for tubing a metal strip about the core, a receptacle for the product having a cover coupled therewith and adapted to be positively rotated, and means for raising and lowering said receptacle into and out of engagement with its cover.

8. In a machine of the character described, the combination with means for forming a metallic strip into a spirally wound revolving and longitudinally advancing armor conduit, of means for axially rotating a coiled conductor to be armored and axially delivering the conductor from said coil and into the armor conduit, and means for timing the rotation of said coil to impart to the delivered conductor an average speed of rotation substantially that of the armor conduit.

9. In a machine of the character described, the combination with means for forming a metallic strip into a spirally wound revolving and longitudinally advancing armor conduit, of means for revolving a coiled conductor to be armored about the axis of the coil, means for directing the conductor as drawn from said coil into axial alignment with the coil, and means for timing the rotation of said coil with that of the armor forming mechanism such that the average rotary speed of the conductor as delivered into the armor is substantially the rotary speed of the armor.

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HENRY HUENERKOPF.

## CERTIFICATE OF CORRECTION.

**Patent No. 1,683,223.** **Granted September 4, 1928, to**

**CHARLES E. WILSON, ET AL.**

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, line 6, claim 2, for the word "from" second occurrence read "form"; and the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 9th dav of October, A. D. 1928.

(Seal)

M. J. Moore,
Acting Commissioner of Patents.