No. 876,257. PATENTED JAN. 7, 1908.

C. O. BERG.

MACHINE FOR MAKING FLEXIBLE TUBING.

APPLICATION FILED JAN. 8, 1907.

4 SHEETS—SHEET 1.

Fig. 1.

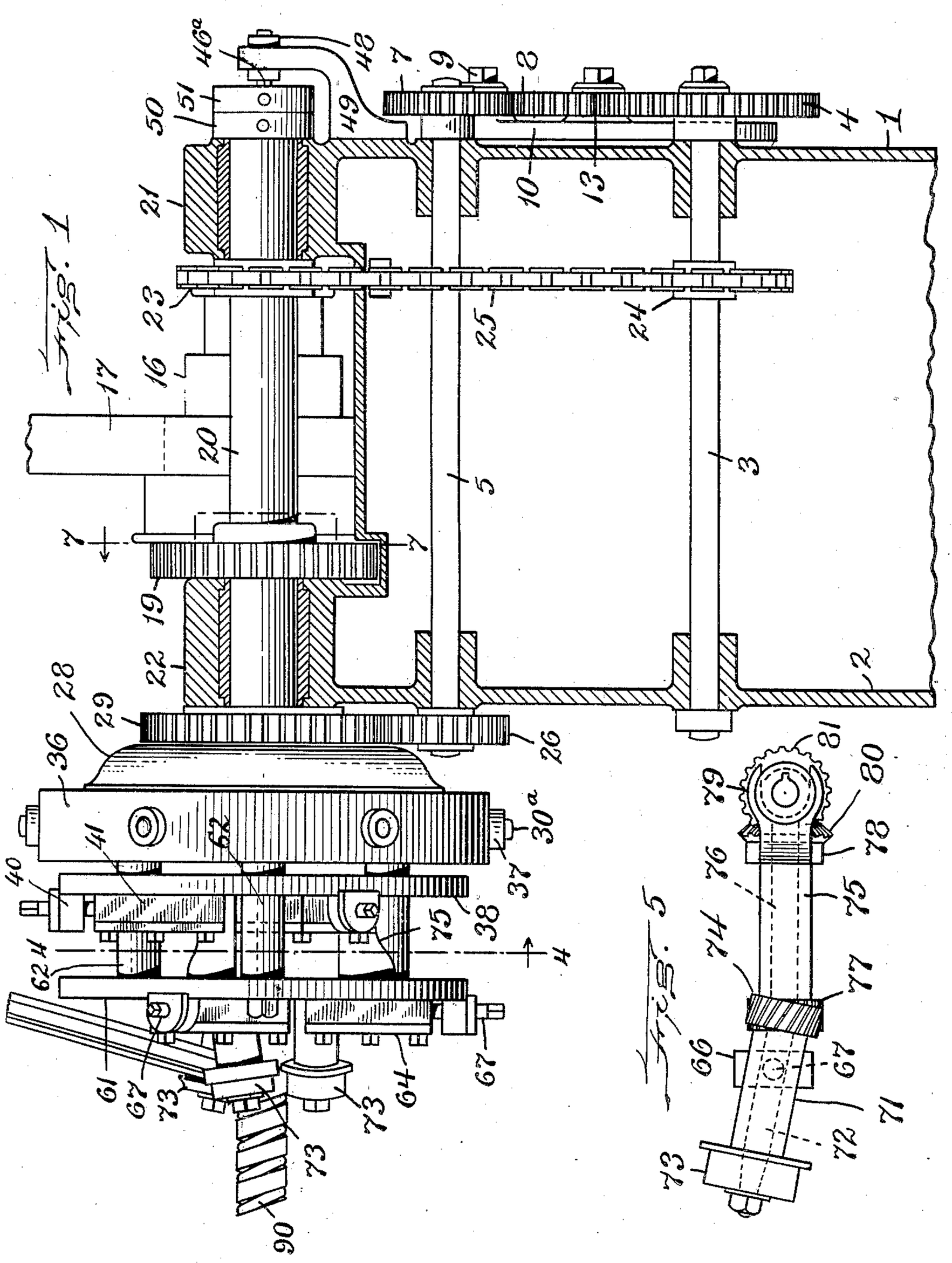

Fig. 5.

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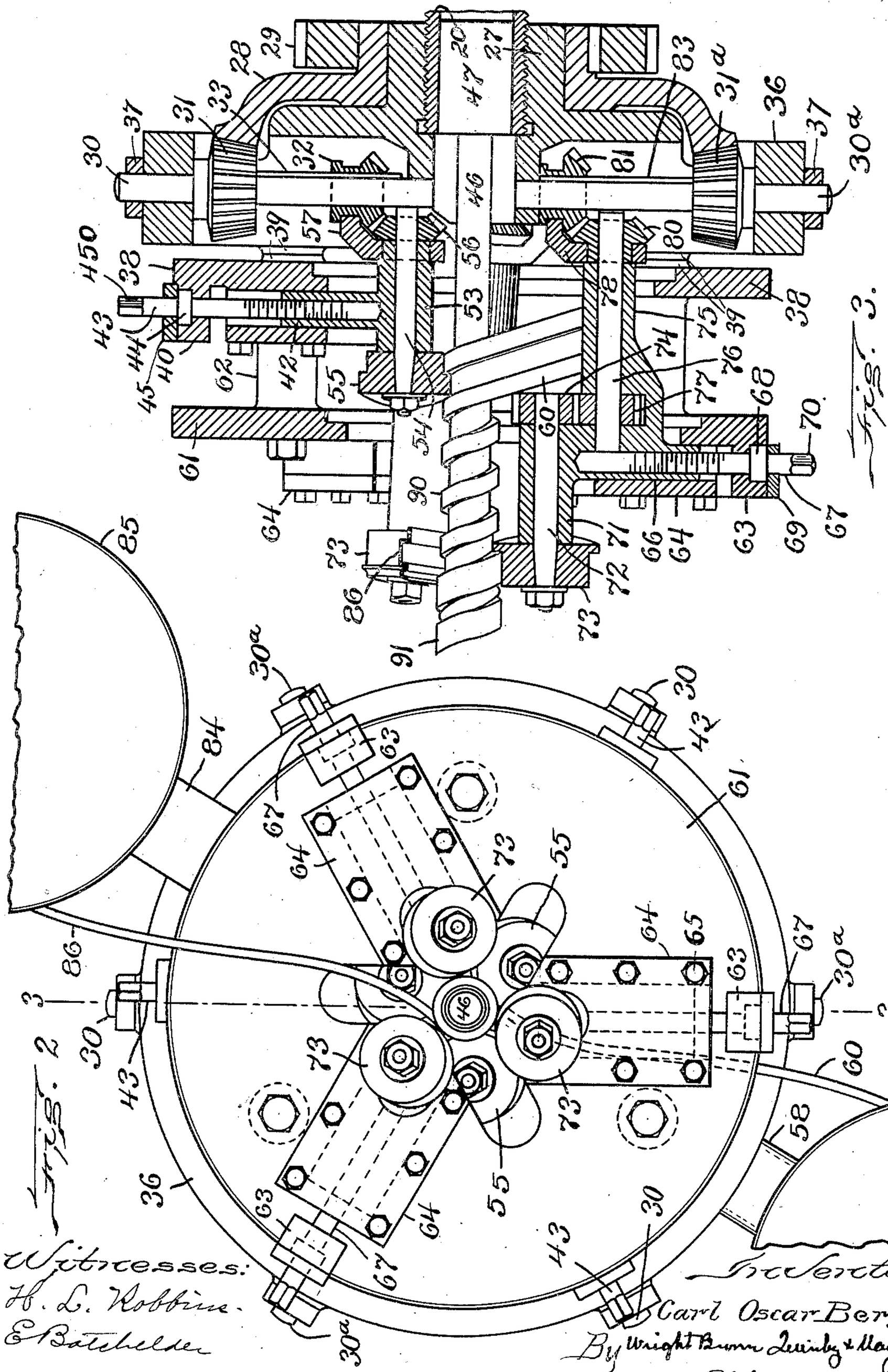

Fig. 3.

Fig. 2.

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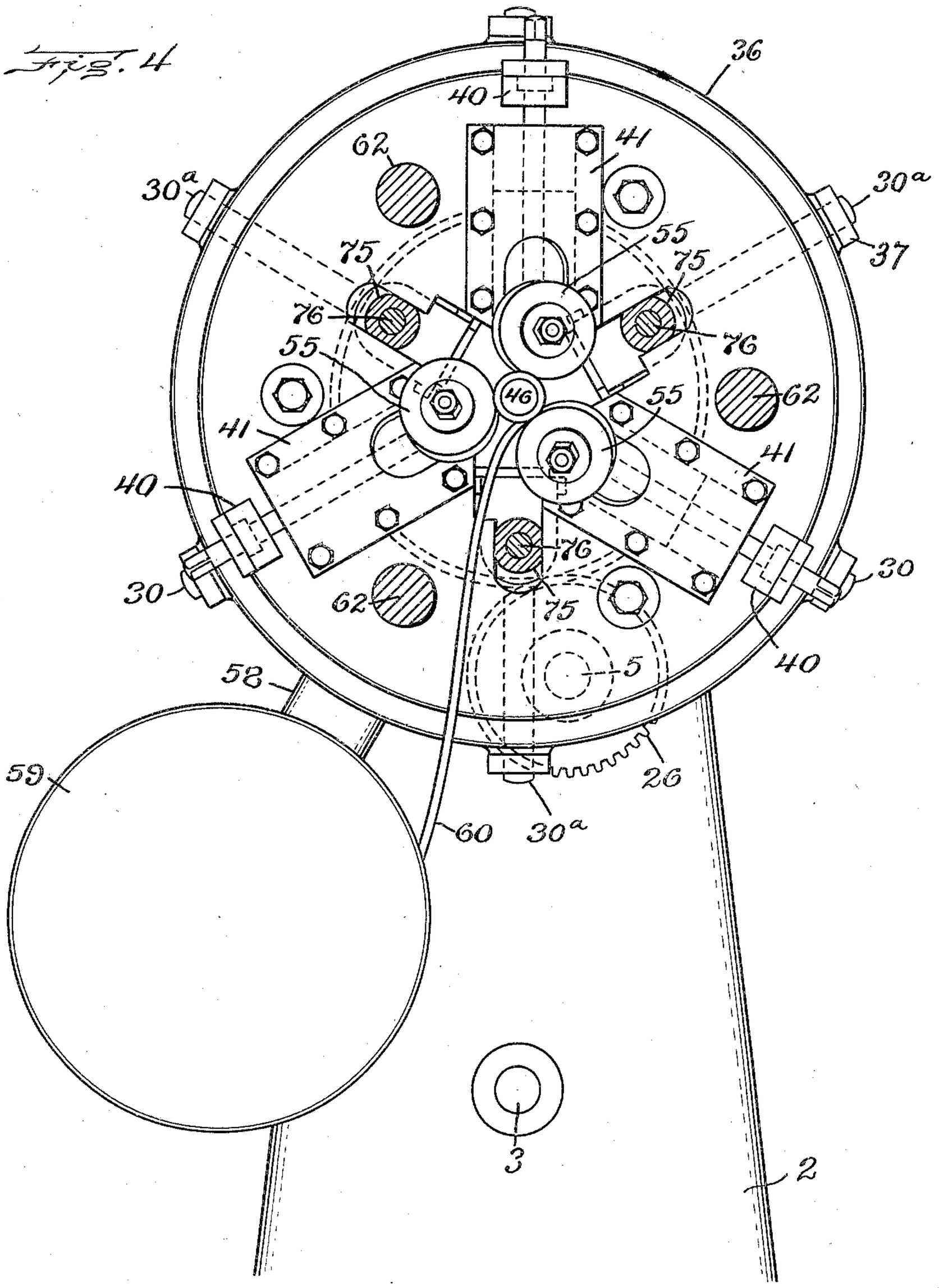
4 SHEETS—SHEET 3.

Fig. 4



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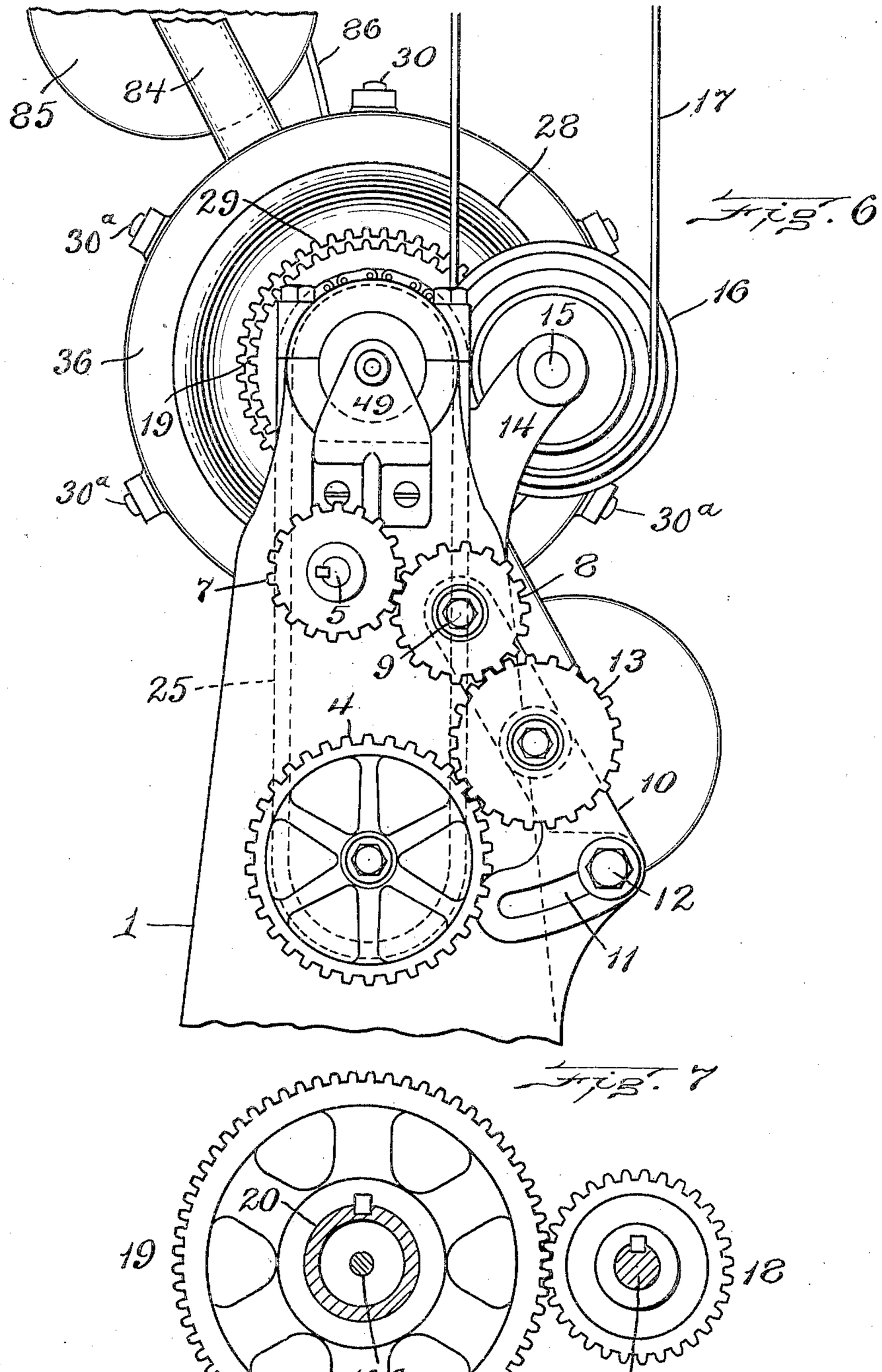

Fig. 6

Fig. 7

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UNITED STATES PATENT OFFICE.

CARL OSCAR BERG, OF CHELSEA, MASSACHUSETTS, ASSIGNOR TO JAMES S. WILSON, OF CHELSEA, MASSACHUSETTS.

MACHINE FOR MAKING FLEXIBLE TUBING.

No. 876,257. Specification of Letters Patent. Patented Jan. 7, 1908.

Application filed January 8, 1907. Serial No. 351,362.

To all whom it may concern:

Be it known that I, CARL OSCAR BERG, of Chelsea, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Machines for Making Flexible Tubing, of which the following is a specification.

This invention relates to machines for making flexible tubing.

Figure 1 in side elevation, shows a machine constructed in accordance with my invention, the reel or reels for supporting the roll or rolls of strips of material from which the tubing is made being omitted, this view showing a portion of the formed tubing upon the mandrel, a strip running from a reel, not shown, through the forward spinning rolls to the mandrel and tube, the strip to the rear spinning rolls not being shown. This view also shows means whereby the spinning rolls are positively driven and the supports or head-blocks for the reels, as well as the spinning rolls mounted to rotate around the space as a center or axis occupied by the tube. Fig. 2 is a front end elevation of the machine showing the rotary head-blocks that carry the spinning rolls and reel-supporting arms, parts of the reels being broken away; showing the means for adjusting the front spinning rolls, the rear spinning rolls being obscured by the front head-block and only the front spinning rolls showing. Fig. 3 is a vertical sectional view on line 3—3 of Fig. 2, showing the arrangement of the two sets of spinning rolls, the gears for driving said spinning rolls, the adjusting mechanism for the spinning rolls, the mandrel and the arrangement of the two head-blocks by which the gears and spinning rolls are not only rotated but revolved about the mandrel. Fig. 4 is a vertical sectional view on line 4—4 of Fig. 1, looking in the direction of the arrow, and showing the rear head-block, the spinning rolls carried by the rear head-block, also the reel arm and reel carried by the rear head-block. Fig. 5 is a detail view showing the arrangement of the shaft and gearing, by which each of the front spinning rolls is rotated. Fig. 6 is a rear end elevation of the machine shown in Fig. 1. Fig. 7 is a vertical cross sectional view on line 7—7 of Fig. 1, looking in the direction of the arrow and showing the arrangement of gears for driving the gear case sleeve.

The same reference characters indicate the same parts in all of the figures.

1, 2, represent respectively, the rear and forward standards of the framework of the machine.

3 represents a shaft arranged in the lower part of the framework. This shaft at its rear end carries a spur gear 4 (Figs. 1 and 6). A shaft 5 is mounted in the framework above the shaft 3, and at its rear end carries a spur gear 7.

8 represents a spur gear mounted upon a stud 9 carried by the rear end of the framework (Figs. 1 and 6).

10 represents a lever, the upper end of which is pivoted upon the stud 9. The lower end of this lever is formed with an arc slot 11, in which is engaged a stud 12 carried by the framework, the stud and arc slot providing means whereby the lower end of the lever may be swung toward and away from the shaft 3 and its spur gear 4.

13 represents a spur gear carried by the lever 10 and adapted to mesh with the spur gears 4 and 8. The lever 10 provides means whereby gears of different size may be used to connect the spur gears 4 and 8, in order to change the speed of the spinning rolls to provide for the making of different size tubing.

14 (Fig. 6) represents bracket arms that support the power shaft 15, upon which are arranged power pulleys 16 to receive a driving belt 17 from any suitable motor or other form of power pulley. In Figs. 1 and 6 are shown four different sizes of pulleys 16, this being a feature common in driving mechanism, known as stepped cones.

18 (Fig. 7) represents a spur gear fast on the front end of the shaft 15 and meshing with a spur gear 19 fast on a sleeve 20 that is supported in suitable bearings 21, 22, on the top of the machine (see Fig. 1), the sleeve 20 lying in front of the shaft 15 as the parts appear in Fig. 1 (see Fig. 7).

23 represents a sprocket-wheel fast on the sleeve 20 just in front of the bearing 21.

24 represents a complemental sprocket wheel fast on the shaft 3.

25 represents a sprocket-chain connecting the sprocket-wheels 23, 24. The spur gear

18 in driving the spur gear 19 turns the sleeve 20. Power is transmitted from the sleeve 20 to the shaft 5 through the sprocket-chain 25 and the chain of spur gears 4, 13, 8, 7 (Fig. 6).

26 represents a spur gear fast on the front end of shaft 5 (see Fig. 1).

27 (Fig. 3) represents a gear case that is secured upon the front free end of the sleeve 20, just in front of the bearing 22, the front end of the sleeve 20 being screw-threaded and taking into complemental threads in the circular opening in the gear case 27.

28 represents a dish-shaped bevel gear, the hub of which is loosely mounted on a suitably formed seat on the gear case 27.

29 represents a spur gear rigidly mounted upon the hub of the bevel gear 28. The spur gear 29 meshes with the spur gear 26 (Fig. 1), and by this means motion is imparted to the spur gear 28. The sleeve 20 is maintained in place by the hub of the gear case 27 engaging the front end of the bearing 22, and by collars 50, 51, (Fig. 1) secured to the sleeve 20, and to the rear of the bearing 21.

30, 30ª, (Figs. 1, 2, 3, 4, 6) represent a series of radial shafts, six in all, carried by a circular flange 36 formed on the front part of the gear case 27. These shafts 30, 30ª are arranged like the spokes of a wheel about the central opening in the hub of the gear 27. The shafts 30, 30ª at their outer ends project through the flange 36 of the gear case and are secured by means of collars 37. Each of the shafts 30 is provided with a beveled gear 31 that meshes with the beveled teeth on the periphery of the dish-shaped gear 28, the gear 31 being held in place by a key 33. Upon each of the shafts 30 is arranged a beveled gear 32, held in rotatable position by means of the key 33, but capable of being slid on the key longitudinally of the shaft, as hereinafter described.

38 (Figs. 1, 3, and 4) represents the rear head-block secured by hubs or connections 39 to the front end of the gear case 27 (Figs. 1 and 3). The hubs or connections 39 may consist of parts integral with the head-block 38 and the gear case, or there may be pins or bolts, or any preferred means of securing the head-block to the gear case. The rear head-block 38 carries at its margin three forwardly extending lugs 40 (Fig. 4). A box 41 is secured upon the front of the rear head-block 38 inside of each lug 40. In each box 41 is arranged a rectangular shaped sleeve 42, the sides of which slidingly engage the complemental rectangular walls of its box 41.

43 represents an adjusting screw, there being one for each box. Each screw 43 (Fig. 3) is formed with a collar 44 that is arranged in a suitable recess upon the outside of its lug 38. A cap 45 is arranged on the adjusting screw 43 and bears against the outer side of the lug 40 and the collar 44. This cap 45 is secured to the lug 40 in any desired way and serves to prevent longitudinal motion of the adjusting screw 43. The end of each adjusting-screw 43 is screw-threaded and arranged in a complemental screw-threaded recess in the outer end of each sleeve 42. The outer end of each screw 43 is squared as at 450 to receive a wrench. By turning the screw 43 its complemental sleeve 42 may be moved toward or from the axis of the machine or the center represented by the position of the mandrel 46. At the front end of the sleeve 20 this mandrel is formed with an enlargement or cylindrical part 47 that fits the sleeve. The block 47 is rigidly connected by a rod 46ª to a nut 48 (Fig. 1) affixed to and carried by the bracket 49 at the rear end of the machine, which nut holds the block 47 against rotation and against endwise movement, and thereby holds the mandrel against rotation and endwise movement.

Each sleeve 42 carries a horizontally arranged hub 53, which, by means of the adjusting screw 43 can be moved toward or away from the mandrel 46. In each hub 53 is loosely mounted a short shaft 54. Upon the free end of each shaft 54 is arranged a spinning roll 55, the face of which is shaped or grooved to correspond with the cross sectional configuration of the strip to be fed to the mandrel by said roll. Upon the rear end of each shaft 54 is secured a bevel gear 56 meshing with a gear 32.

57 represents a casting or bracket carried by each hub 53 and arranged to engage and support a complemental gear 32, the bracket 57 not only serving to keep the gears 32 and 56 in engagement, but also to maintain such engagement when the spinning roll 55 is adjusted toward or away from the mandrel 46 (Figs. 3, 4, and 5). Three of the spinning rolls 55 are shown arranged at an angle of 120° from each other about the mandrel.

58 (Fig. 4) represents an arm carrying a spool or reel 59 adapted to be filled with a roll of tape 60 of any suitable material and of any desired cross section. The tape 60 is carried to the spinning rolls 55, the peripheries of which are shaped to conform to the cross section of tape, the rolls revolving around the mandrel 46, direct and conform the tape upon the mandrel to make the tubing, 90, or the inner tube in the organization illustrated.

61 represents the front head block (Figs. 1, 2, and 3) secured by lugs or bolts 62 to the front face of the rear head-block 38. Projecting from the margin of the front face of the front head-block 61 are three lugs 63. Inside each plate 63 in radial arrangement with said lug is a box 64 secured by bolts 65 in any desired way to the front of the head-block 61. In each box 64 is arranged a sleeve 66 rectangular in cross section, the walls of the sleeve fitting or adapted to slide in the complemental walls of the box 64. In each lug 63 is ar-

ranged a set screw 67. A collar 68 on the set screw is arranged in a complemental recess in the front face of each lug 63. A cap 69 is arranged upon the screw 67 and secured to the front face of the plate 68. This arrangement maintains the screw against longitudinal movement, but permits it to be turned. The outer end of each screw is squared as at 70 for the engagement of a wrench, the screw-threads of each screw 68 engaging complemental screw-threads in its complemental sleeve 66, and by turning the screw the sleeve may be adjusted toward or away from the mandrel 46. Each sleeve 66 carries a hub 71, in which is arranged a short shaft 72. Upon the outer end of each shaft 72 is secured a spinning roll 73, and upon the inner end of each shaft 72 is secured a spur gear 74, (Figs. 3, 4, 5). 75 represents a hub also carried by each sleeve 66, outside of and to the rear of the hub 71. (See Fig. 3). In each hub 75 is arranged a short shaft 76. Upon the outer end of each shaft 76 is secured a spur gear 77 adapted to mesh with the spur gear 74, the teeth of the spur gears 77 and 74 being spiral to permit the positioning of the shaft 72 at an angle to the shaft 76. (See Fig. 5.)

80 represents a beveled gear carried by the inner end of each short shaft 76 and meshing with a complemental beveled gear 81 upon one of the shafts 30^a. Each shaft 30^a carries a bevel gear 31^a, meshing with the teeth of the gear 28 (Fig. 3).

78 represents a bracket or casting carried by each hub 75. This bracket, as shown, is formed at its rear end as a fork 79 engaging a complemental groove in the hub in each gear 81. Each shaft 30^a is formed with a key 83, permitting the gear 81 to be slid upon the shaft 30^a, but compelling the gear to rotate with the shaft. By the described arrangement, as the screw 67 is turned to adjust the spinning roll toward and away from the mandrel 46, the gears 80 and 81 are shifted as a unit and maintained in engagement. As shown, there are three spinning rolls 73 (Fig. 4) arranged at an angle of 120° from each other about the mandrel 46 as a center.

84 represents an arm carried by the front head-block 61, adapted to support a reel 85 on which is wound a spool of tape 86 of any desired material. This tape 86, like the tape 60, may have any desired cross section and the spinning rolls 73 will have their periphery shaped to conform to the cross section of the tape 86, the tape 86 being fed to the front spinning rolls while the tape 60 is fed to the rear spinning rolls 65.

I do not wish to be understood as limiting myself to two sets of rolls, as I may use one, or any number of sets, depending upon the number of strips I desire to employ to form the tubing. The tubing may be formed, for instance, of strips whose edges are interlocked by the action of the spinning rolls to form a single piece tube, or I may employ two strips, as in the present instance, to form a two-piece tube, one tube arranged within the other, the members of one tube preventing the separation of the members of the other. Such two-piece form of tube is shown in patent to Harris, No. 826,658, dated July 24, 1906, and does not require further description.

I do not wish to be understood as limiting myself to any particular cross section of the strip, as that may be varied to meet the requirements of material or use in each particular instance.

It will be seen from the drawings, that the mandrel 46 is relatively short and does not extend beyond the roll 73, but is employed merely as a former about which the tapes are spun by the spinning roll, the action of the spinning rolls serving not only to form the tapes on the tube, but to feed the tube off the mandrel 46, said mandrel having no motion either of rotation or reciprocation. If desired, the mandrel may be omitted and the tube may be spun upon a cable as an armor or covering. In such a case the mandrel 46 and its connected parts would be removed from the sleeve 20 and the cable fed through the sleeve 20. There being no rotary motion to the cable, it could be fed through the machine in indefinite lengths and the armor applied to it, since the only action of the cable would be the passing through the machine and the reeling of it after the armor was applied, there being no rotary or twisting motion imparted to the cable. It may be desirable in some instances to dispense with the mandrel in making some forms of tubing, but as a general rule, I prefer the use of the mandrel, except when employing the machine to armor cables, and by cables I mean anything answering to that general description, whether it controls wires, or what not, or consists only of a rope, hose, or rods.

It will be seen that in my machine the mandrel is stationary and both sets of rolls are positively driven. It will further be observed that both sets of rolls, as well as the roll of material, are revolved about the mandrel 46, or the axis of the finished tubing 90, 91. This permits the forming of the tubes 90, 91, without imparting any motion to said tubing, except a longitudinal feeding motion off the mandrel or away from the machine, thereby permitting the tubing to be formed of indefinite lengths. It will further be seen that in my machine there are no dies or corresponding mechanism, to change the cross section of either of the strips 60 or 86. These strips have the same cross section after they pass the spinning rolls as they have when they engage them, the action of the spinning rolls serving to position each strip spirally

upon itself, but they do not impart to the strip a cross section, said formation of the strip being made upon a different independent machine. By the foregoing, I do not refer to the interlocking of the edges of a strip when interlocking edges are employed, but this action would be brought about by the use of the spinning rolls, but I refer to the cross section of the strip itself at the time it is applied to the mandrel. That cross section is not made by the spinning rolls 55 and 73, but by suitable dies or rolls on an independent machine. In my machine the interlocking of the lips would be brought about by the pressure of the spinning rolls upon the strip after the strip was on the mandrel, the previously formed edges of the strip being interlocked by the pressure effect by the mandrel and rolls.

The positive driving of the spinning rolls and their adjustment toward and from the mandrel are not new with me, being found in patent to Thibodeau, No. 794,433, dated July 11, 1905. In that machine, however, the cross section of the tape is made and the tape formed to a tube by the same machine, which machine does not permit the passage of the tape bodily around the mandrel, so that in the use of that machine a rotary motion is given to the formed tube necessarily, as well as a longitudinal motion off the mandrel, thus preventing the reeling up of the tube as soon as it leaves the machine, which work can be done with my machine. It will further be observed that with the tubes made as in the Harris patent, or as made by the Thibodeau machine, or as made by my machine, whether in single tubes or multiple tubes, there is no necessity of "crimping" or "setting", so called, of the metal to prevent the unwinding of the tube when the latter is cut off in lengths, because the tubes when formed by my machine, or made by the Harris patent the separation of the strips is prevented by the interlocking edges, when but a single strip of tube is formed, or by the interlocking of the members of the two-part tube. By thus constructing the tubing I avoid the weakening action of the "setting" process, the tubing formed with my machine being made of uniform strength throughout.

I believe myself to be the original, first and only inventor of the improvement in machines for making flexible tubing.

Having thus explained the nature of my invention and described a way of constructing and using the same, though without attempting to set forth all of the forms in which it may be made, or all of the modes of its use, what I claim and desire to secure is:

1. In a machine for forming metal tubing, a rotary head block, a series of spinning rolls carried thereby, a reel or strip-supporting member, and means for driving said parts, said rolls acting to spin up the strip into a tube.

2. In a machine for making metal tubing, a rotary gear case, two or more head blocks carried thereby, a series of spinning rolls carried by each head block, a tape-supporting member carried by each head block, means for rotating the head blocks, and means for positively driving the spinning-rolls.

3. In a machine for making metal tubing, a rotary gear case, two or more head blocks carried thereby, a series of spinning rolls carried by each head block, a tape-supporting member carried by each head block, means for rotating the head blocks, and means for positively adjusting the spinning rolls.

In testimony whereof I have affixed my signature, in presence of two witnesses.

CARL OSCAR BERG.

Witnesses:
ARTHUR H. BROWN,
H. L. ROBBINS.