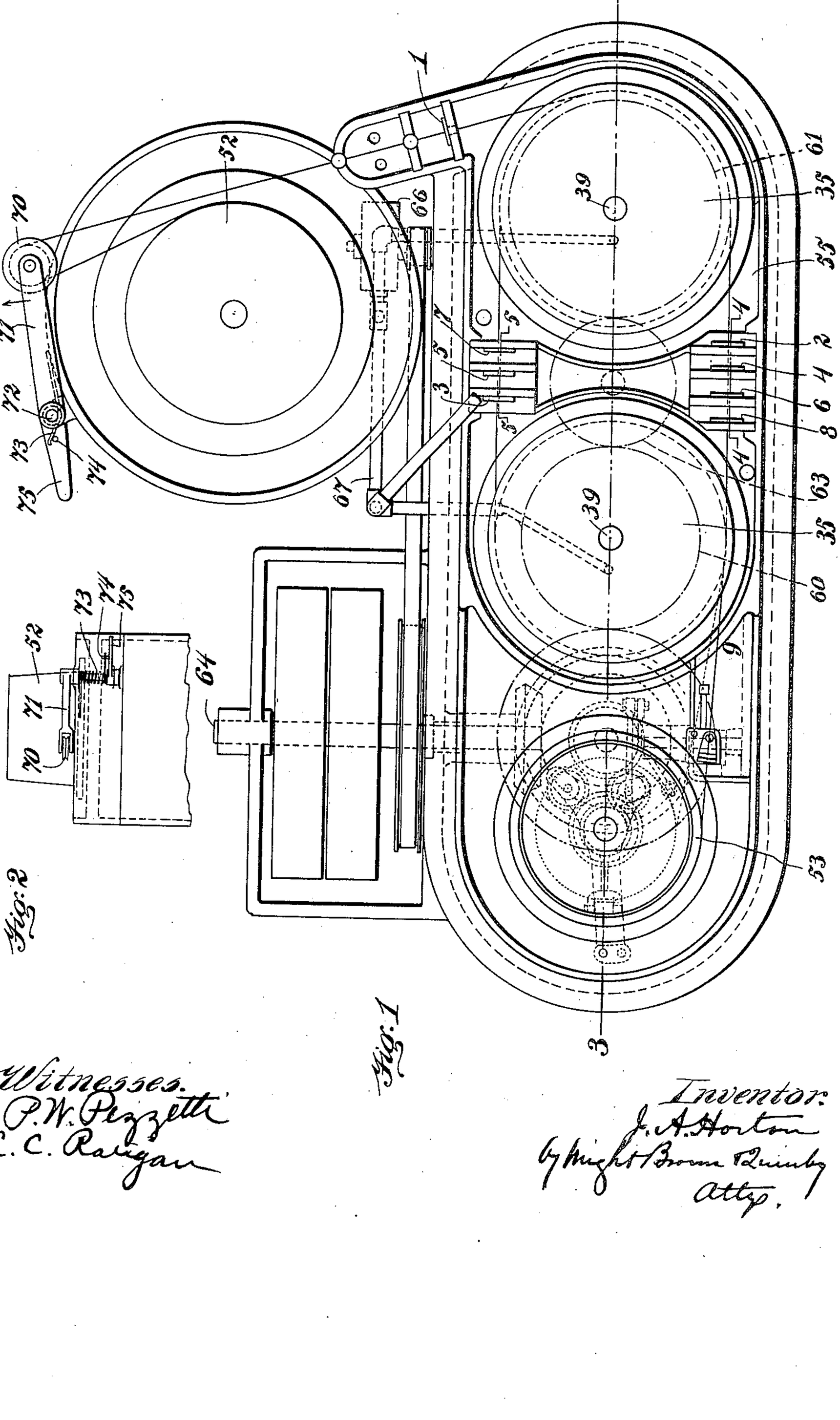
No. 824,654. PATENTED JUNE 26, 1906.

J. A. HORTON.

WIRE DRAWING MACHINE.

APPLICATION FILED JUNE 15, 1903.

4 SHEETS—SHEET 1.



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4 SHEETS—SHEET 2.

Fig: 3.

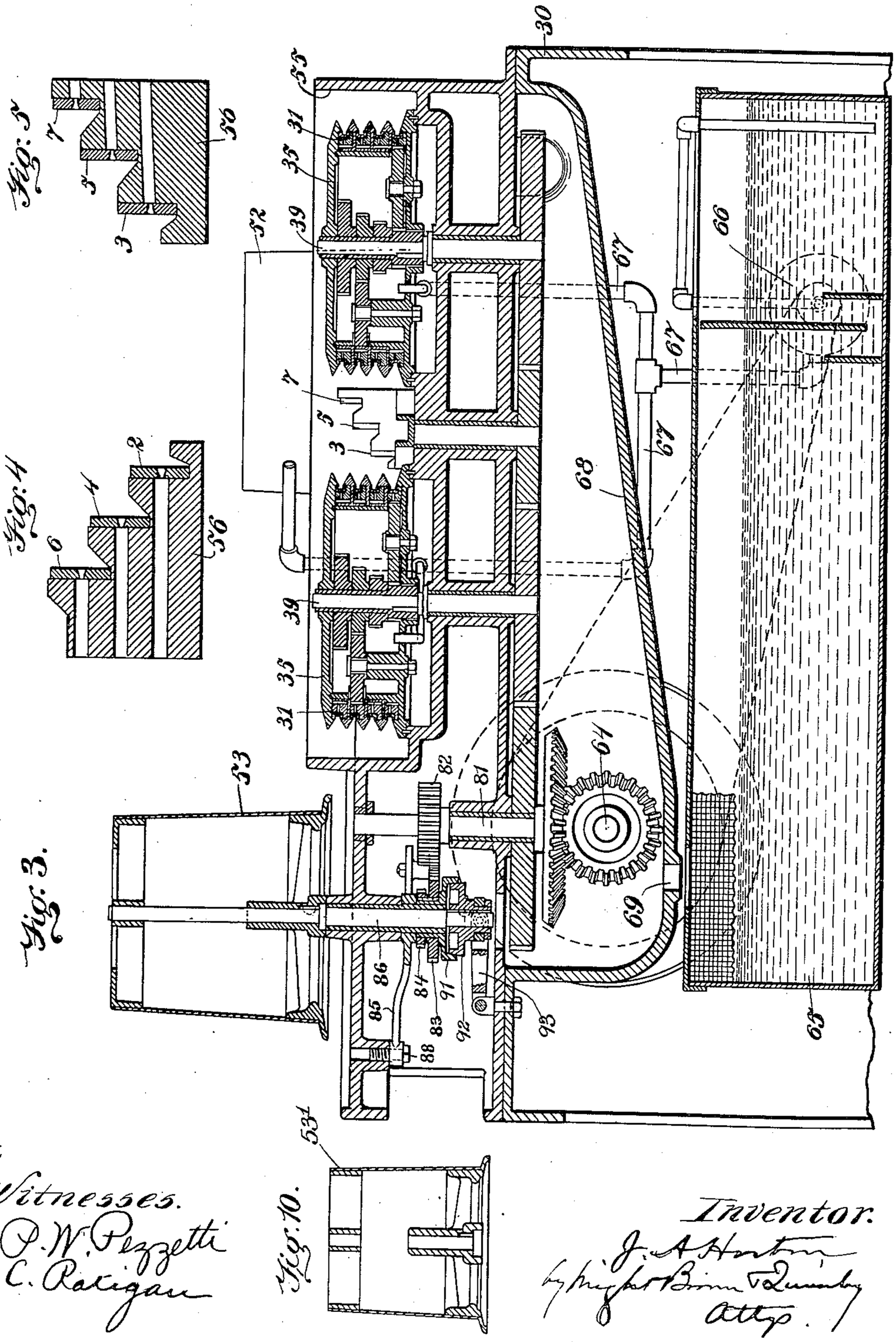

Fig: 4

Fig: 5

Fig: 10.

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4 SHEETS—SHEET 3.

Fig: 6

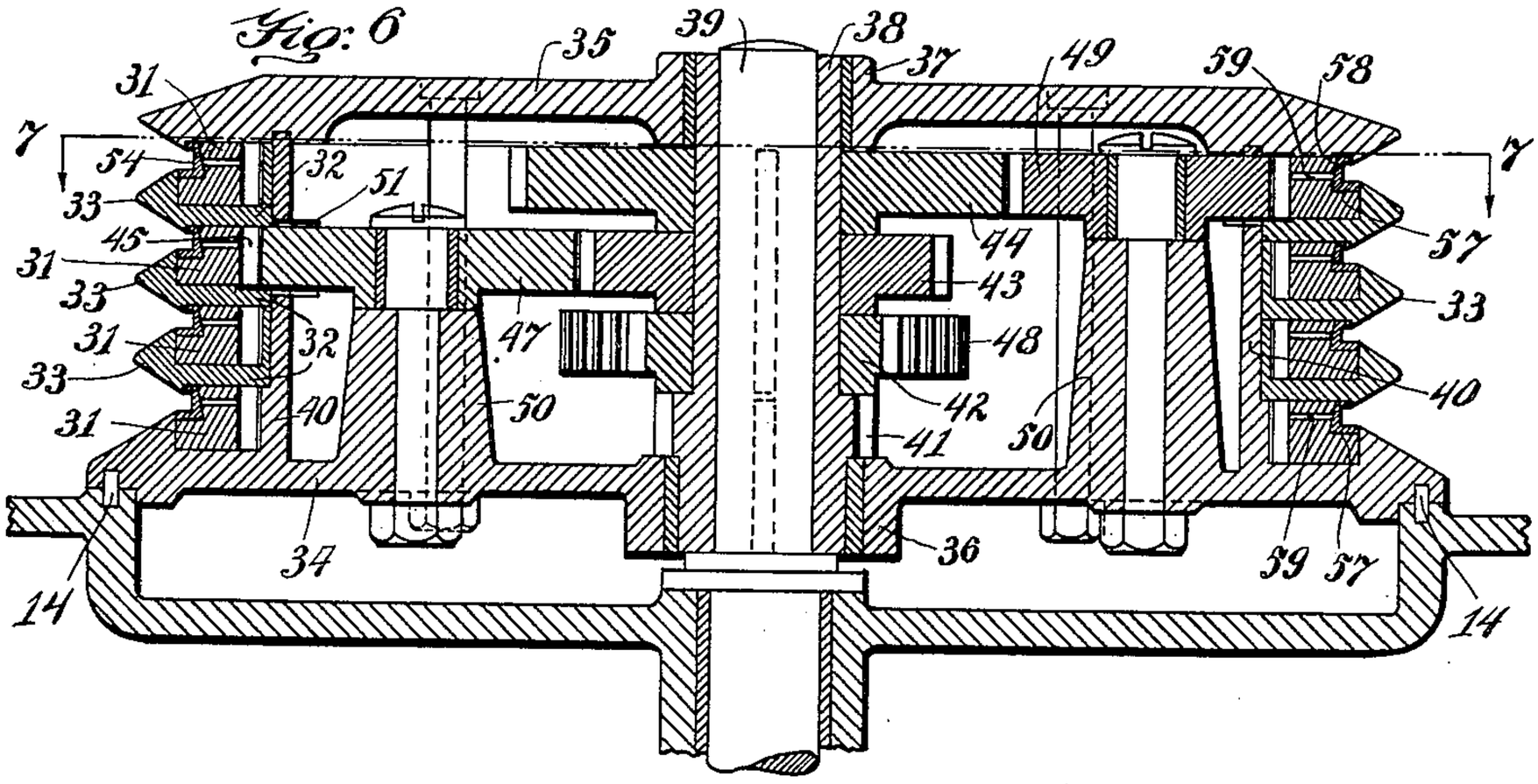
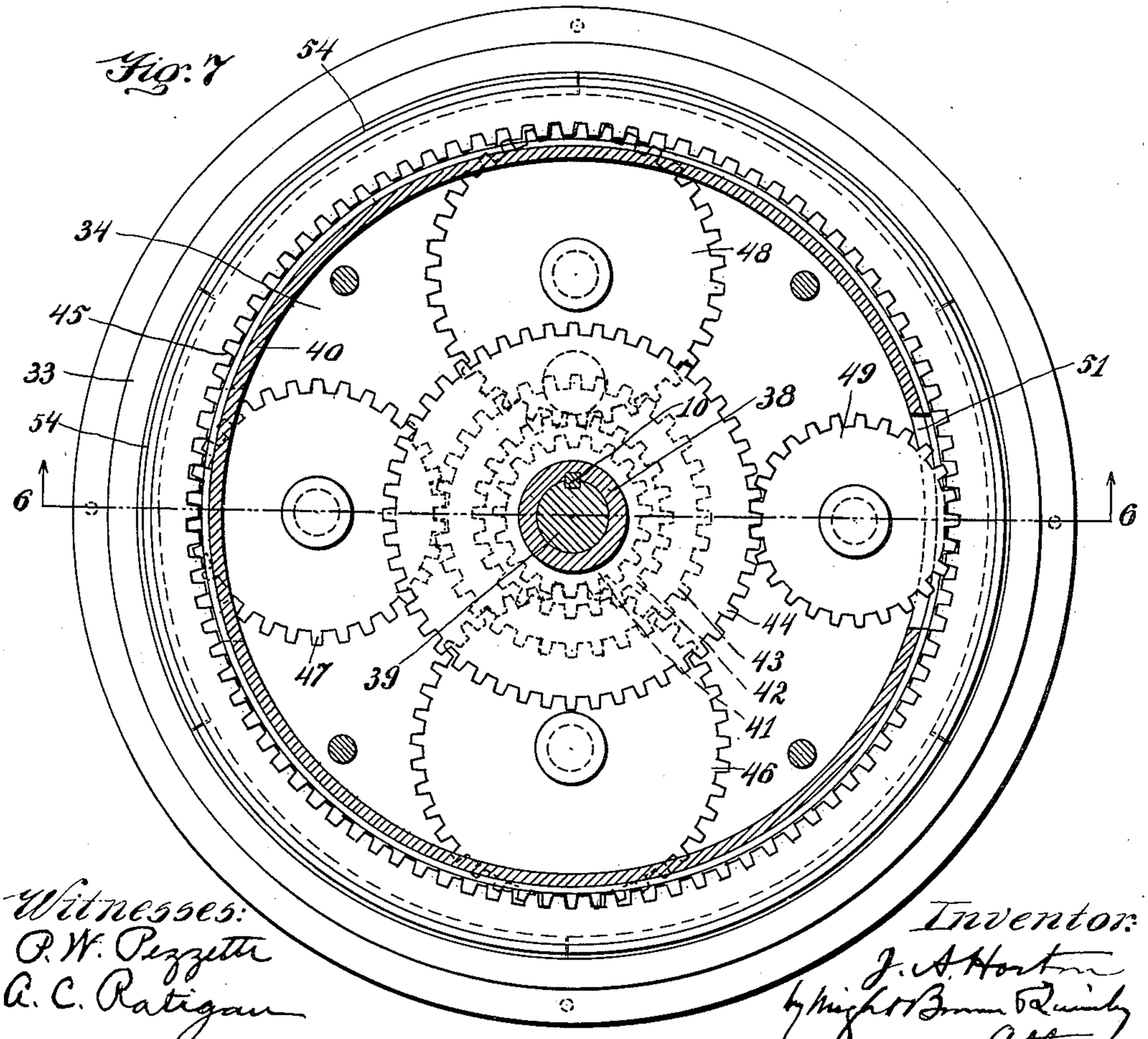


Fig: 7



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4 SHEETS—SHEET 4.

Fig. 8

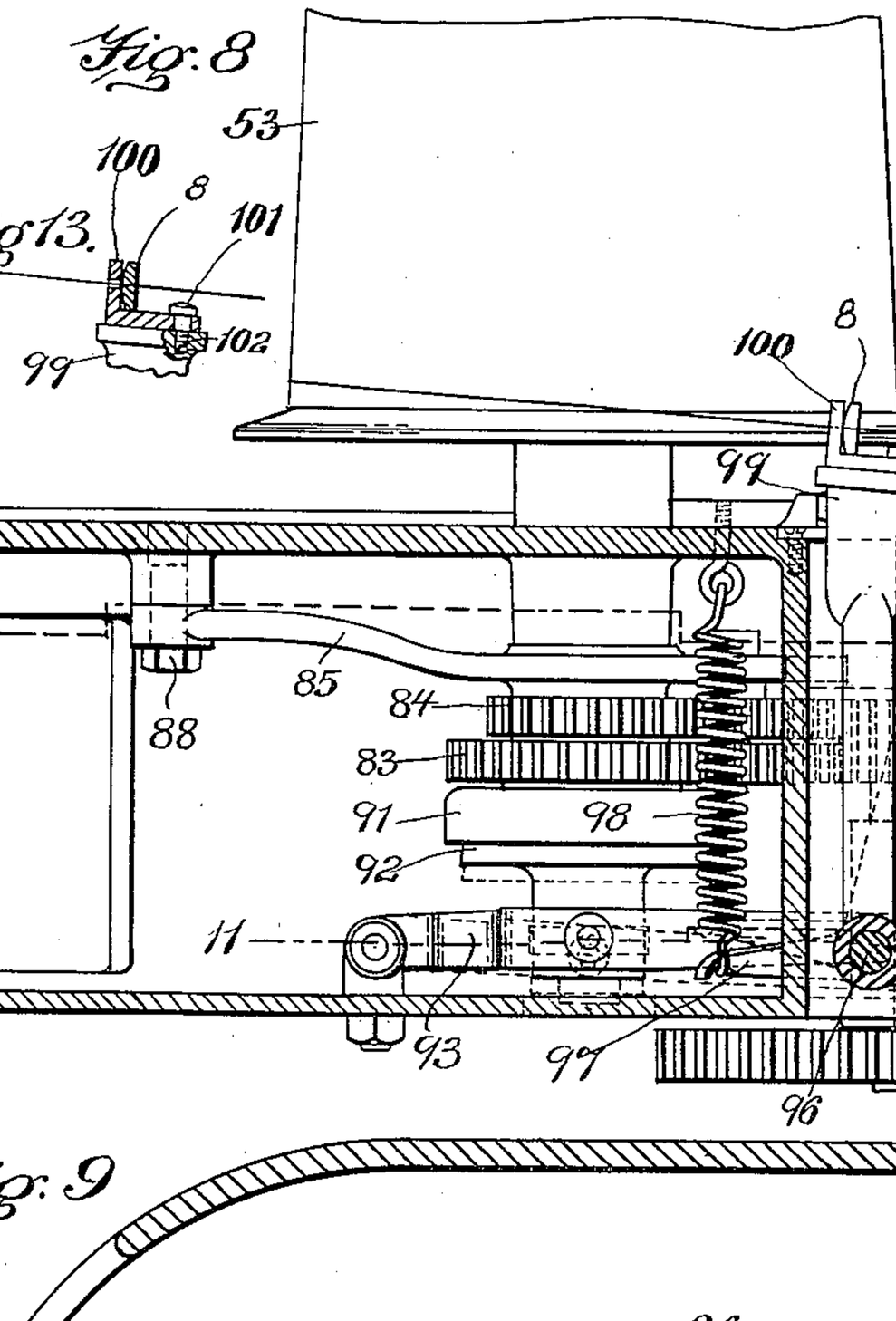


Fig. 12.

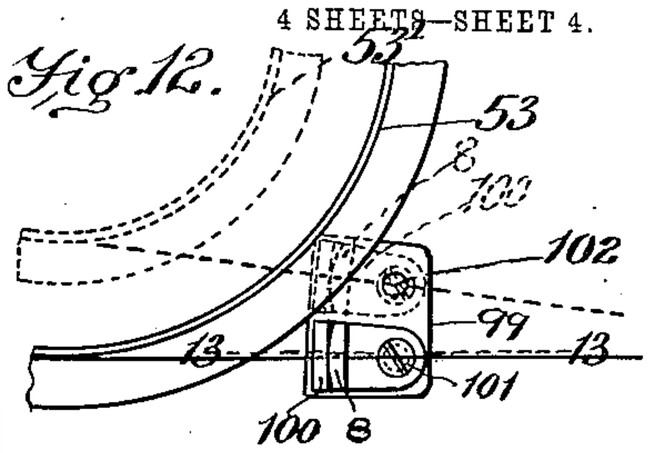


Fig. 13.

Fig. 9

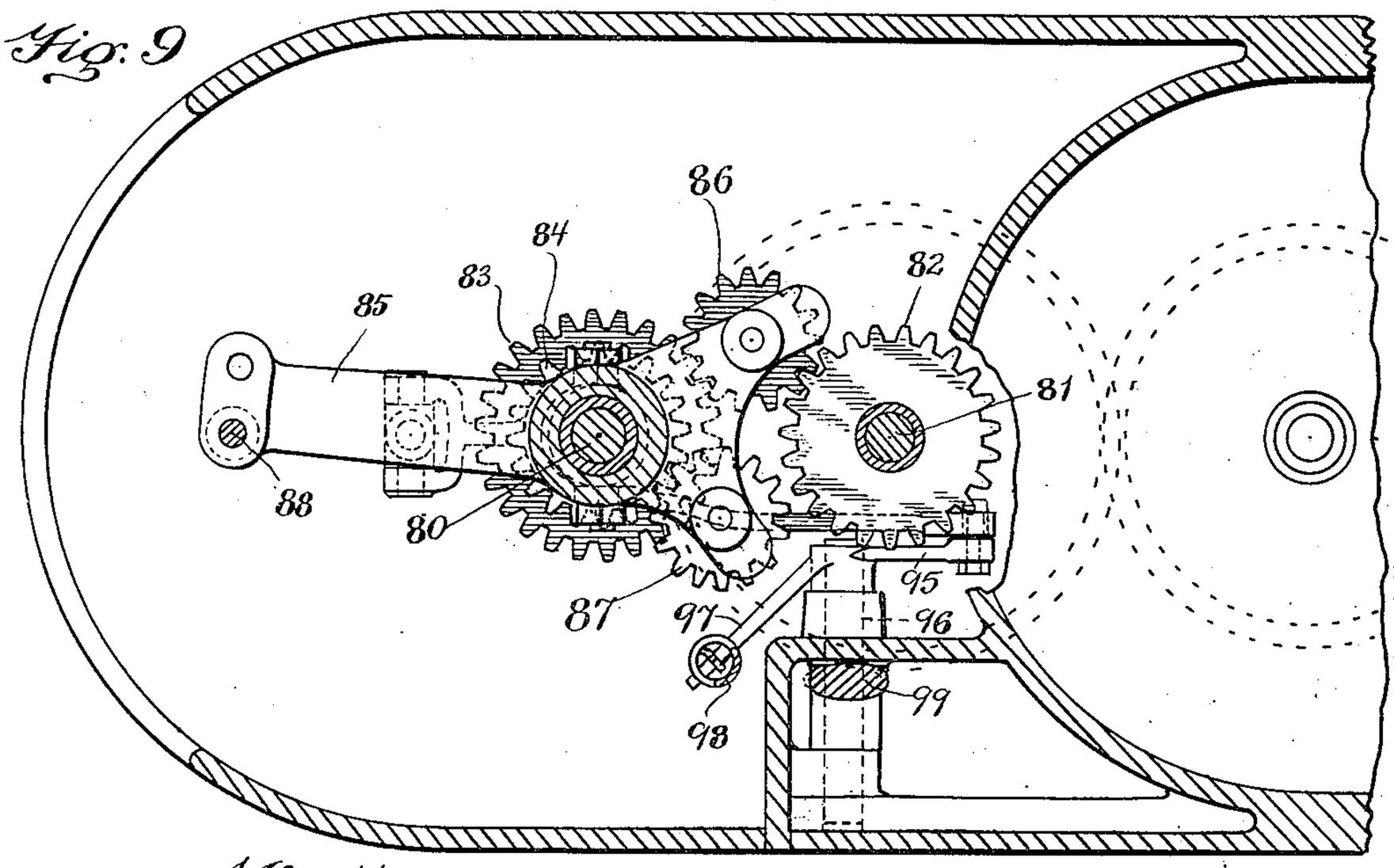
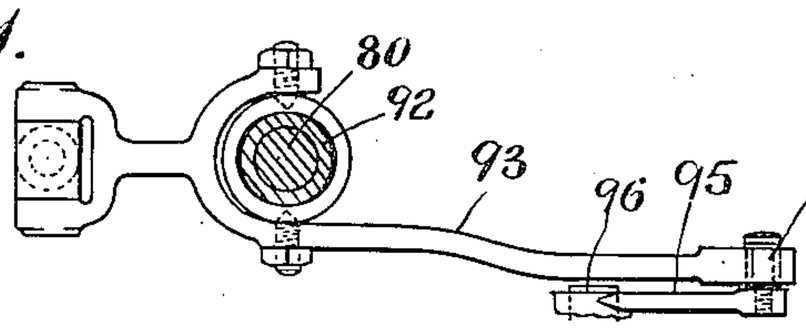


Fig. 11.



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UNITED STATES PATENT OFFICE.

JAMES A. HORTON, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR TO IROQUOIS MACHINE COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

WIRE-DRAWING MACHINE.

No. 824,654. Specification of Letters Patent. Patented June 26, 1906.

Application filed June 15, 1903. Serial No. 161,567.

To all whom it may concern:

Be it known that I, JAMES A. HORTON, of Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Wire-Drawing Machines, of which the following is a specification.

This invention relates chiefly to wire-drawing machines in which the wire is drawn continuously or in one operation through a series of dies whereby its diameter is reduced by stages and its length correspondingly increased, the wire being drawn through each die through the instrumentality of a rotating drum around which the wire is passed.

The invention has for its chief objects to economize space; to prevent the liability of the scattering of the lubricating liquid by the rotation of the wire-drawing drums; to enhance the convenience of the operation of threading the wire through the dies and passing it around the various drums of the system; to make the machine interchangeable for winding coils of different diameters, and to automatically stop the coil of wire when the latter breaks.

The invention consists of the several improvements which I will now proceed to describe and claim.

Of the accompanying drawings, Figure 1 represents a top plan view of a wire-drawing machine embodying my invention. Fig. 2 represents a side elevation of a portion of Fig. 1. Fig. 3 represents a section on line 3 3 of Fig. 1. Fig. 4 represents a section on line 4 4 of Fig. 1. Fig. 5 represents a section on line 5 5 of Fig. 1. Fig. 6 represents an enlargement of a portion of Fig. 3. Fig. 7 represents a section on line 7 7 of Fig. 6. Fig. 8 represents a vertical section through the stop-motion. Fig. 9 represents a horizontal section through the change-gear mechanism. Fig. 10 represents a vertical section showing a smaller size of receiving or storing drum from that shown in Figs. 1 and 3. Fig. 11 represents a section on line 11 11 of Fig. 8. Fig. 12 represents a plan view showing the oscillating die-holder with different diameters of drums. Fig. 13 represents a section on line 13 13 of Fig. 12.

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

In the drawings, 30 represents the supporting-frame of the machine. Said frame may be of any desired form and may be adapted to contain any desired number of the groups or tiers of drawing-drums hereinafter described. Instead of arranging the drawing-drums in a horizontal row or series or in tandem order I assemble the drums in tiers or groups, the members of each group being superimposed or arranged one above another, so that the horizontal space occupied by a tier or group of drums does not materially exceed the horizontal space occupied by one of the drums. In this embodiment of my invention two groups or tiers constitute an entire series of drawing-drums adapted to effect the desired reduction in the size of the wire supplied to the machine. Each group or tier comprises a series of preferably four drums 31, although the number may be obviously greater or less than that specified. Each drum is of annular form, so that it may be rotated by power internally applied, as hereinafter set forth. The drums of each group are supported by means of a casing which comprises a fixed top or cover 35, surmounting a bottom section 34, and a series of intermediate sections 32. Said intermediate sections correspond in number to the drums, each section having an annular body portion which is located at the inner side of one of the annular drums 31 and a flange which projects under the under surface of one of the drums, each flange forming a support or guide for a drum and a guard which projects outwardly beyond the outer periphery of the drum. The margins of the top and bottom sections also project outside the peripheries of the top and bottom drums and constitute guards corresponding to the guards or flanges 33. The guards 33 are separated by narrow peripheral slots or openings through which the acting portions of the peripheries of the drums (or the wire-forwarding shoes thereon, hereinafter described) are exposed.

The sections 34 and 35 are provided, respectively, with hubs 36 37, which receive the driving sleeve or quill 38 and the driving shaft or spindle 39. The base-section 34 is provided with an annular upwardly-projecting flange 40, which bears against the inner sides of the sections 32 and supports the top section 35. The flanges 33 are provided with seats which support the drums 31, the drums

being freely rotatable on said seats. The guards or flanges 33 are shouldered to bear upon the outer portions of the drums, as shown in Fig. 6.

The driving shaft or spindle 39 may be rotated by power applied to it in any suitable manner, the said shaft imparting rotation to the driving-quill 38. Said quill is provided with a group or series of gears 41 42 43 44, these gears corresponding in number and position to the drums 31. The said gears are of different sizes, the gear 41 being the smallest, while the gears 42, 43, and 44 are of successively increasing diameter.

The internal surfaces of the drums 31 are provided with gear-teeth 45, constituting internal gears. Each drum is connected with one of the above-mentioned driving-gears by means of an intermediate pinion, these pinions being of different diameters and located at different heights. The lower drum 31 is connected with the smallest driving-gear 41 by an intermediate gear 46, the second drum from the bottom is connected with the driving-gear 42 by an intermediate gear 47, an intermediate gear 48 connects the third drum from the bottom with the driving-gear 43, and an intermediate gear 49 connects the topmost drum with the driving-gear 44. The gears 46, 47, 48, and 49 are mounted on bosses 50, affixed to the bottom section 34 of the casing, said bottom section being formed to support the intermediate gears at the various heights required. The intermediate gears decrease successively in diameter from the lowest to the highest member of the series, as clearly shown in Fig. 3. The flange 40 of the casing is provided with openings or slots 51 for the intermediate gears, there being one of these slots for each gear, the slots being formed to permit the several gears to project through the flange 40 and engage the internal gear of the accompanying drum 31. The driving-gears and the intermediate gears above described are preferably so proportioned that each drum above the lower one rotates faster than the drum below it.

The quill 38 is detachably engaged with the spindle 39 in such manner that the quill can be readily lifted from the spindle, the casing and the tier of drums therein being also adapted to be raised from the supporting-frame and from the spindle. As here shown, the quill and spindle are detachably connected by a key 10, which permits the quill to be moved endwise on the spindle. The casing is engaged with the supporting-frame and prevented from rotating thereon by dowel-pins 14 14, affixed to the frame and entering orifices formed in the bottom plate 34 of the casing.

The above-described construction permits the casing, with the drums, quill, and gears to be raised from the frame as one part. The top plate or cap 35 is detachably connected with the base 34 by screws, so that it can be readily removed to permit access to the interior of the casing. When the said top plate is removed, the drums 31 and the sections 32 can be successively removed.

As above stated, two groups of drums organized and operated as above described constitute the entire series required to provide, in connection with a suitable number of dies and the delivering and receiving reels or drums, a complete wire-drawing apparatus. In Fig. 1 I have shown the said two groups of drums, and in connection therewith a series of dies 1, 2, 3, 4, 5, 6, 7, 8, and 9. The die 1 is interposed between the wire-delivering reel 52 and the first group of drawing-drums, the wire passing from the die 1 around the lower drum 31 of the first group, this drum having the slowest rotation. From the lower drum 31 of the first group, the wire passes through the die 2 to the lower drum of the second group. From said drum the wire passes through the die 3 to the second drum of the first group, and successively from said drum through the die 4, around the second drum of the second group, through the die 5, around the third drum of the first group, through the die 6, around the third drum of the second group, through the die 7, around the fourth drum of the first group, through the die 8, around the fourth drum of the second group, and from the latter through the die 9 to a storing-drum 53.

As above stated, the variation between the speed ratio of each drum and that of the next in the same tier or group of drums is preferably about double the elongation of the wire. This increase is about twice as great as that required to provide for the elongation of the wire between one drum and the next of the series. The same ratio is preserved in the second group of drums; but in said second group each drum rotates as much faster than the corresponding drum in the first tier as the elongation of the wire passed through the intervening die, so that the result is the same as if eight drums were arranged in tandem order, each rotating at the speed required to provide for the elongation of the wire passing to it from a preceding drum. It will be seen that by arranging the entire series of drawing-drums in two tiers or groups, as shown, and driving the drums of each group at different speed ratios, the increase of which from drum to drum in each tier is double the required increase, the drums of the second group being driven at rates which provide for only the desired increase in speed between the successively-acting drums, I greatly economize space without sacrificing efficiency or speed, the two tiers or groups of drums occupying only about one-quarter of the horizontal space which would be required for eight drums arranged in tandem order.

The independently-driven drums may be

given relative speeds corresponding to a very considerable elongation in each die, such as will give certain novel and desirable results in the drawing of steel wire, as set forth in a co-pending application, Serial No. 185,636. To carry such speed ratios through any large number of drawing-stations with tiers of relatively fixed drums of different diameters would be impracticable, owing to the great difference in diameter which would be required between the largest and smallest drums. I have mentioned a series of eight drums; but it is obvious that each tier or group of drums may have four or any other suitable number of drums, a corresponding number of dies being employed. Each drum is preferably provided with a wire-forwarding means adapted to slip circumferentially on the drum and frictionally driven at the speed required by the "call" or tension of the wire, as shown in my Letters Patent of the United States, No. 742,987, November 3, 1903, said wire-forwarding means as here shown comprising a series of segmental shoes 54, encircling the outer peripheries of the drums 31 and adapted to slip thereon, said shoes having outwardly-projecting flanges at their edges. The lower flange of each shoe rests on a horizontal seat 57, Fig. 6, formed on a drum 31. The back or inner side of each shoe bears on a peripheral face 58, formed on the drum 31. To prevent the shoes from being pressed upwardly against the fixed guards 33 by the pull of the wire or otherwise, I incline each face 58 so that it overhangs the seat 57, the backs of the shoes being correspondingly inclined. Excessive friction, such as would be caused by pressure of the shoes against fixed surfaces, is thus prevented. This is an important feature of my invention, and I do not consider it limited to the particular mechanical construction shown, nor is it solely applicable to the exact type of wire-forwarding means which is herein illustrated—viz., the segmental shoes 54.

The lubricating liquid enters the interior of the casing through feed-pipes connected therewith. To insure sufficient lubrication of the contacting surfaces of the drums and the shoes 54, I provide orifices 59, arranged to conduct the lubricant from the interior of the drum to the face 58. The well or cavity 55, which contains the drums and dies, is kept supplied by leakage from the interior of the casing with the lubricating liquid, which is preferably water containing a suitable proportion of lubricating compound, the drawing-drums and dies being practically immersed in the said liquid, which keeps the friction-surfaces of the drums and the casing, as well as of the drums and of the wire-forwarding shoes 54, constantly and uniformly lubricated.

It will be seen that the fixed casing, formed with flanges or guards which project beyond the outer peripheries of the drums, prevents the scattering of the lubricating liquid by the rotation of the drums and also enables the operator to more conveniently and easily pass the wire around the drums in the operation of threading up the machine. The fixed guards or flanges surrounding the bases of the drums of each group or tier might obviously be of different diameters, the lowest guard being the largest of the series and the others successively decreasing in diameter, as will be understood without additional illustration. This arrangement would enable the operator to readily locate the different drums by the sense of touch in engaging the wire with the drums at the commencement of the operation, the drums being immersed in the lubricant, so that they cannot be readily seen.

The dies may be detachably secured to the supporting-frame in any suitable way, preferably by the stepped holders 56 shown in Figs. 4 and 5, constituting a novel construction in which the dies overlap.

It is obvious that certain of the advantages obtained by my invention would result from a machine in which each annular internally-driven drum is mounted alone in a fixed casing instead of being a member of a group or tier. The machine may be provided with as many pairs of the above-described groups or tiers of drums as may be desired, and the groups may be distributed around the center of a circular frame. The driving-spindles 39 and the spindle that rotates the storing-drum 53 may be rotated by mechanism, such as that described for rotating the drawing and storing drums in my above-mentioned patent, or by any other suitable means. The means employed should be such that the driving-spindle of the second tier of drums will be rotated at a fixed rate relatively to the speed of the driving-spindle of the first tier, the second spindle being preferably driven about twenty per cent. faster than the first or at any relative speed suited to the elongation of the wire, as above indicated. In Fig. 1 I have shown by dotted lines, as suitable means for imparting motion from one of the spindles to the other, a gear 60, affixed to the spindle of the second tier of drums, a gear 61, affixed to the spindle of the first tier, and an intermediate gear 62, connecting the gears 60 and 61, the said gears being so proportioned that the spindle of the second tier, which is driven at a fixed rate by a driving-shaft 64 and suitable intermediate gearing, rotates at a suitable rate faster than the spindle of the first tier.

As it is often desired to wind coils of different sizes for the market I provide a plurality of receiving or storing drums of different diameters which are interchangeably fitted on the storing-drum spindle 80 by means of a key, such as that shown in Fig. 3, or other suitable coupling, and rotated thereby. One

size of drum 53 is shown in Figs. 1 and 3 and a smaller size 53′ in Fig. 10. As the smaller drum requires to be driven at the same peripheral speed as the larger drum it must have a greater angular speed. I have, as shown in the drawings, provided change-gear mechanism for two different speeds of the storing-drum spindle. 81 is a vertical counter-shaft driven from the shaft 64 and carrying a spur-gear 82 of a width comprehending the width of two spur-gears 83 84 of different diameters concentric with the storing-drum spindle 80. An oscillating lever or holder 85, carrying intermediate or idler-gears 86 87 in constant mesh with the respective gears 83 84, oscillates concentrically with the spindle 80 and is fixed in either of two positions by a bolt 88, entering the frame. In one of these positions the spindle 80 is driven through gears 82 86 83 and in the other position it is driven through gears 82 87 84, the intermediates 86 87 alternatively meshing with the driver 82.

The gears 83 84 are both fixed to the sleeve-hub of a clutch member 91. A complemental clutch member 92 is connected with a lever 93, whose oscillation sets and releases the clutch, said lever having a pivotal slot-and-pin connection at 94 with an arm 95 in a rock-shaft 96. Another arm 97 thereon is connected with a spring 98, which normally throws the parts so as to release the clutch. A third arm 99 on this rock-shaft is a support for the last die 9 of the drawing series. The frictional drag of the wire on the die oscillates the arm 99 in such a direction as to set the clutch 91 92 against the action of the spring 98. Should the wire break beyond the die 9, the spring 98 will act to automatically release the clutch and stop the rotation of the storing-drum, the arm 99 assuming the dotted-line position shown in Fig. 9. The die 9 is supported by a swiveled holder 100, pivoted upon a stud 101, which may be screwed into two different holes 102 on the arm 99 to correspond with the different directions or positions taken by the wire in leading onto the two different sizes of drums.

65 represents a tank to contain a supply of the lubricating liquid. The liquid is forced to the interior of the drum-casings by means of a pump 66 and suitable circulating-pipes 67, the pump being driven by connection with the driving-shaft 64. The lubricating liquid may be allowed to overflow from the cavity 55 at a suitable point or points, the overflowing liquid being received by a pan 66, having an inclined bottom and a discharge-opening 69, which is arranged to deliver the liquid to the tank 65.

To take up the slack of the wire passing from the supply-reel 52 to the first drawing-die 1, I provide a take-up roll 70, journaled at one end of a lever 71, which is affixed to a rock-shaft 72, journaled in bearings on the frame of the machine. 73 represents a spring coiled upon the rock-shaft 72, one end of said spring being engaged at 74 with an arm 75, fixed to the rock-shaft 72, while the other end of the spring bears upon a fixed support. The tendency of the spring is to force the lever 71 and the roll 70 away from the axis of the reel 52, as indicated by the arrow in Fig. 1. Consequently the roll 70 exerts a pull on the wire passing from the reel. It often happens that the coils of wire wound upon the reel are so arranged that at some periods the wire rotates the reel less rapidly than at others. This occasionally results in the stoppage of the reel until the slack has been taken up by the drawing-rolls, the reel in machines of this class as heretofore organized being then suddenly started by the pull exerted on the wire by the drawing mechanism, and considerable strain is imposed upon the wire, which not only tends to break it but imparts an undue momentum to the reel and gives an irregular delivery of the wire. These objections are overcome and the wire kept under a practically uniform tension by means of the yielding take-up roll 70.

I claim—

1. A wire-drawing machine comprising two tiers of independently rotatable wire-drawing drums, two series of dies facing in opposite directions coöperating therewith, and driving mechanism including two shafts or spindles, one for each tier, connections between each spindle and the drums of the corresponding tier whereby said drums are rotated at successively increasing rotative speeds, and connections between the spindles adapted to cause the rotation of the spindles at different speed ratios.

2. A wire-drawing machine comprising two tiers of annular wire-drawing drums each having an internal gear, fixed guides or supports for said drums, two driving-spindles one for each tier of drums, gearing connecting said spindles with the internal gears of the drums, said gearing having provisions for rotating the drums at successively increasing speeds, and gearing connecting the two spindles and having provisions for rotating one spindle faster than the other.

3. A wire-drawing machine comprising a tier of annular wire-drawing drums, fixed means for individually supporting said annular drums against the strain of the wire, and mechanism independent of the supporting means for driving said drums at different speeds.

4. A wire-drawing machine comprising a tier of annular wire-drawing drums, fixed means for individually supporting said annular drums against the strain of the wire, and mechanism independent of the supporting means for driving said drums, said driving mechanism having provisions for rotating the drums at different speeds.

5. A wire-drawing machine comprising a tier of annular wire-drawing drums, annular guides or supports therefor, mechanism for rotating said drums on their supports, and means for forcing a liquid lubricant into the interior of the supports for constantly lubricating the contacting-surfaces of the drums and support.

6. A wire-drawing machine comprising a tier of annular wire-drawing drums having internal gears, guides or supports for said drums, a driving shaft or spindle surrounded by the drums, and gearing connecting said spindle with the internal gears of the drums.

7. A wire-drawing machine comprising a tier of annular wire-drawing drums having internal gears, guides or supports for said drums, a driving shaft or spindle surrounded by the drums and having driving-gears of different diameters, and intermediate gears mounted on fixed supports and connecting the said driving-gears with the internal gears of the drums.

8. A wire-drawing machine comprising a tier of wire-drawing drums, means for rotating the same, and a non-rotating casing having guides or supports for the drums, and guards projecting outwardly from the peripheries of the drums.

9. A wire-drawing machine comprising a tier of annular wire-drawing drums each having an internal gear, a non-rotating casing having guides or supports for the drums, a driving-shaft common to all the drums having a tier of driving-gears of different diameters, and intermediate gears supported by said casing and connecting the driving-gears with the internal gears of the drums.

10. In a wire-drawing machine, a tier of wire-drawing drums adapted to act successively on the same wire and having internal gears, a shaft within said drums, having gears, and intermediate gears between the shaft-gears and the drum-gears, the ratios of the gearing being such that the several drums are driven at different rotative speeds.

11. In a wire-drawing machine, two fixed flanges or plates and a wire-drawing drum rotating between said plates.

12. A wire-drawing machine comprising a wire-drawing drum, a fixed casing having a support or guide for said drum and guards projecting outwardly above and below the drum, and means for rotating the drum.

13. In a wire-drawing machine, two wire-drawing drums in a tier, and a fixed guard projecting beyond the peripheries of said drums between the drums.

14. A wire-drawing machine comprising a drum having a carrying-seat and a fixed guard opposite the seat, wire-forwarding means circumferentially movable on said drum and resting on said seat, and means whereby the radial contraction of said wire-forwarding means forces the latter against said seat.

15. In a wire-drawing machine, a wire-drawing drum, wire-drawing means adapted to slip circumferentially thereon, the surface of said means where it rests on the surface of the drum being inclined to the axis of rotation of the drum, and a fixed guard adjacent said means at the larger diameter of said surface.

16. A wire-drawing drum having a recessed or grooved periphery, one side of the recess forming a seat or support, while another side forms a peripheral surface which is inclined to overhang said seat, said drum having also a series of loose segmental shoes bearing on said seat and having inclined backs bearing on the said inclined peripheral surface, and a fixed guard adjacent said shoes on the side opposite said seat.

17. A wire-drawing machine comprising a hollow drum having a liquor-channel connecting the exterior with its interior, wire-forwarding means on said drum arranged to be lubricated from said channel, and means to supply lubricating liquid to the interior of said drum.

18. A wire-drawing hollow drum, a liquor-channel connected with the interior thereof, an orifice communicating with the liquor-channel and extending to the exterior of the drum whereby the wire-forwarding surface of said drum is lubricated by liquor from its interior.

19. A wire-drawing drum having a recessed or grooved periphery one side of the recess forming a seat and another a peripheral surface, a series of loose segmental shoes bearing on said seat and surface, and ducts extending through said surface to admit a lubricant to the backs of the shoes.

20. In a wire-drawing machine, the combination with a drawing-drum, a die coöperating therewith and a loose delivering-reel, of a yielding take-up between the drum and reel which regulates the delivery of the wire from said reel.

21. In a continuous-wire-drawing machine, a plurality of drawing-drums, a series of dies, a storing-drum spindle having means for detachably receiving wire-storing drums of different diameters, and mechanism for operating said spindle at different predetermined speeds which give the same peripheral velocity to the drums.

22. In a continuous-wire-drawing machine, a die, a storing-drum spindle, a storing-drum thereon for pulling the wire through the die, a clutch to drive said spindle, and a die-holder having a direct operative connection with said clutch whereby the rotative movement of the drum causes the drag of the wire in the die to set and maintain the engagement of the clutch.

23. In a wire-drawing machine, a rotatable drum-holder having means for detachably receiving a storing-drum, a drawing-drum adjacent to the storing-drum, a die located between the drums, and means whereby the die may be adjusted to keep it on a common tangent to the two drums.

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

JAMES A. HORTON.

Witnesses:
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A. C. RATIGAN.