No. 669,145. Patented Mar. 5, 1901.

P. C. PATTERSON.

APPARATUS FOR THE MANUFACTURE OF METAL TUBING.

(Application filed Apr. 21, 1898.)

(No Model.)

4 Sheets—Sheet 1.

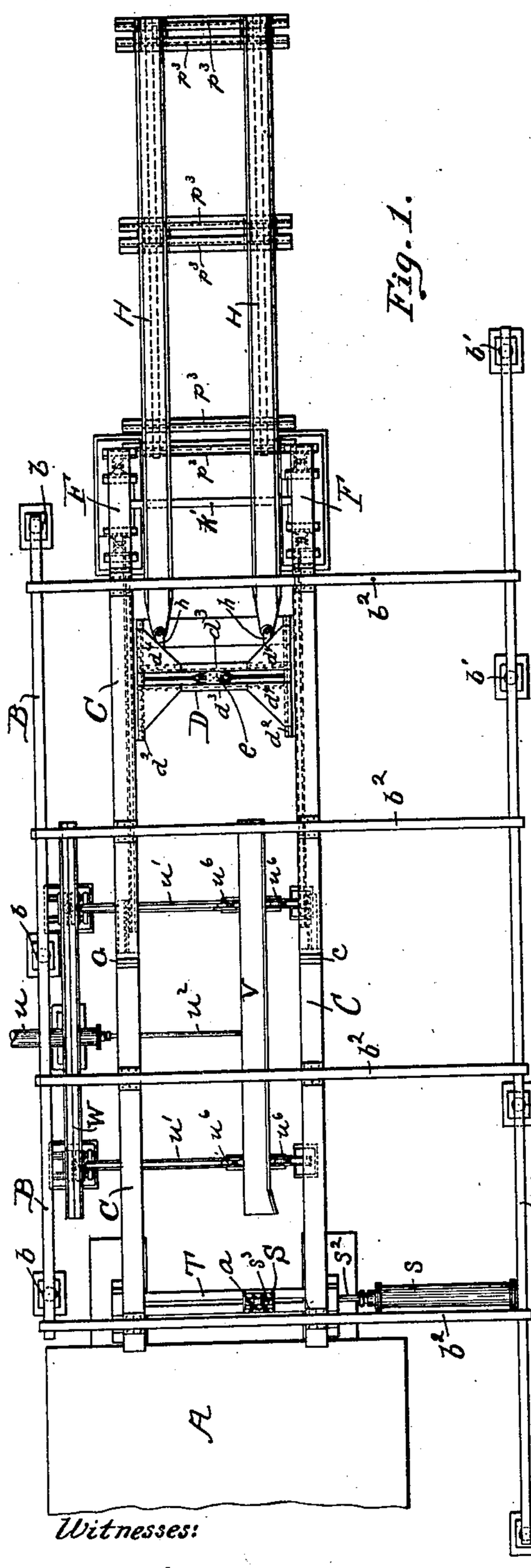

Fig. 1.

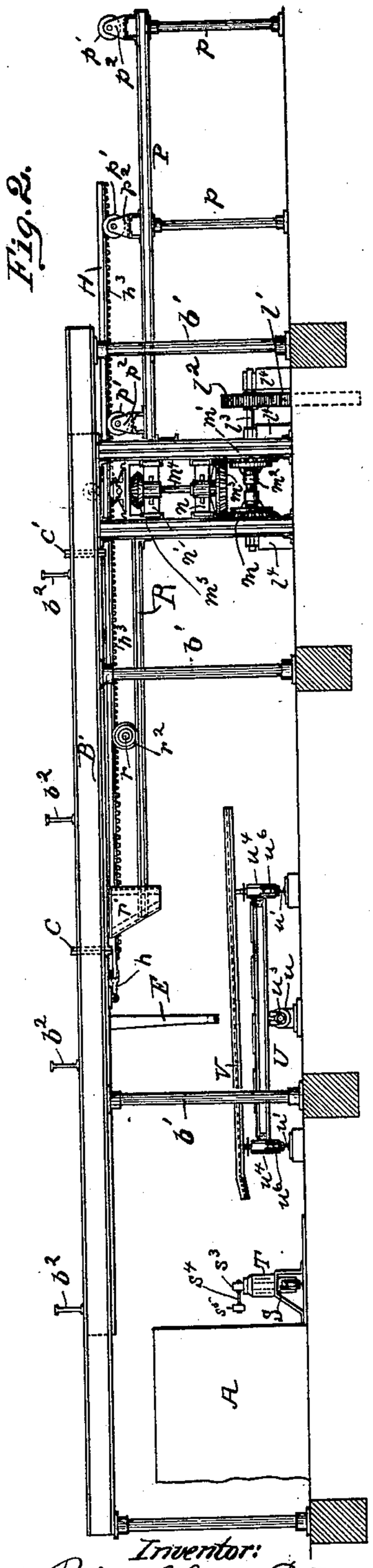

Fig. 2.

Witnesses:

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No. 669,145. Patented Mar. 5, 1901.

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(No Model.) 4 Sheets—Sheet 2.

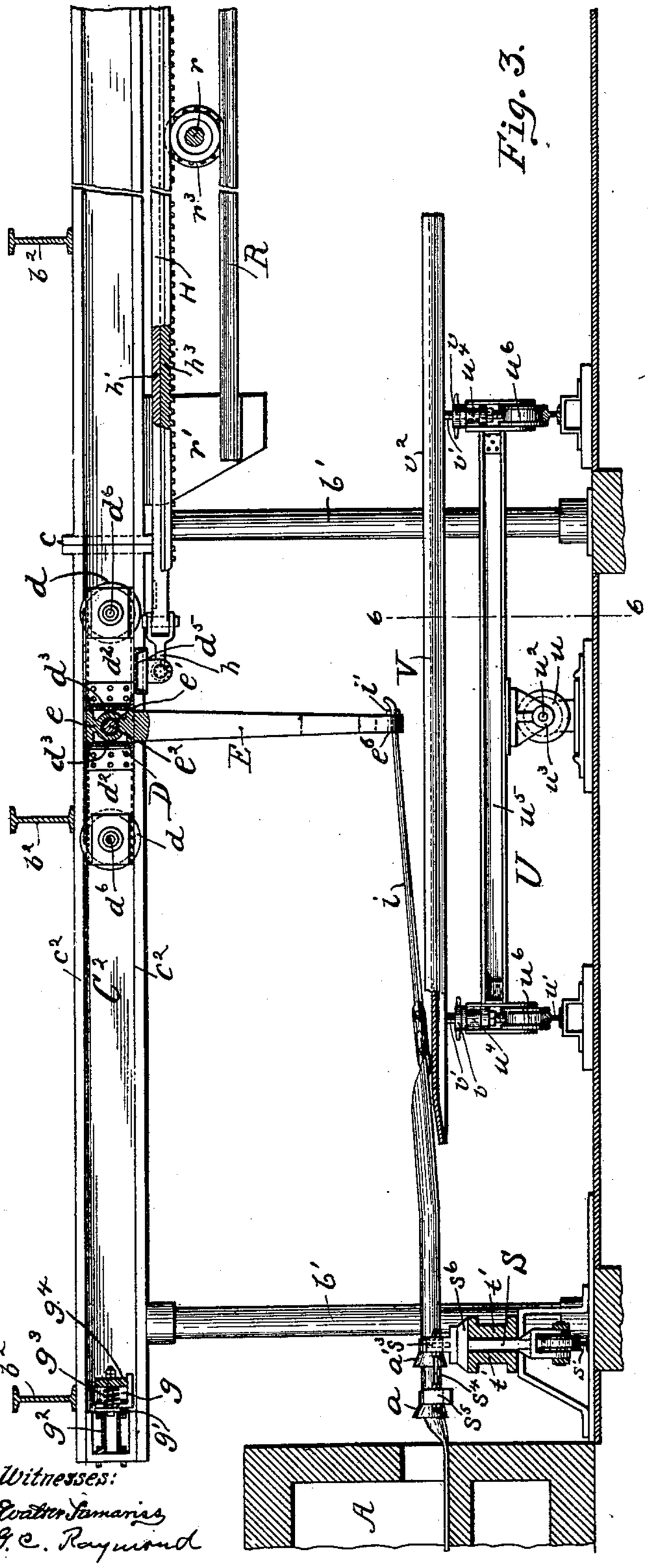

Fig. 3.

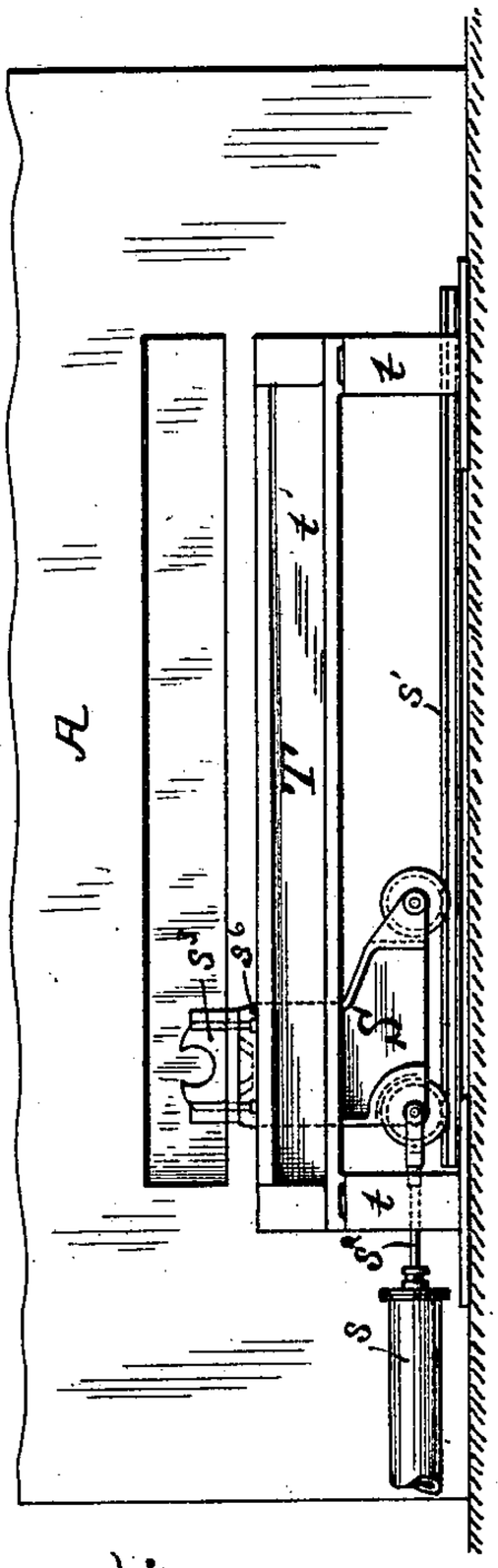

Fig. 5.

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No. 669,145. Patented Mar. 5, 1901.

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(Application filed Apr. 21, 1898.)

(No Model.) 4 Sheets—Sheet 3.

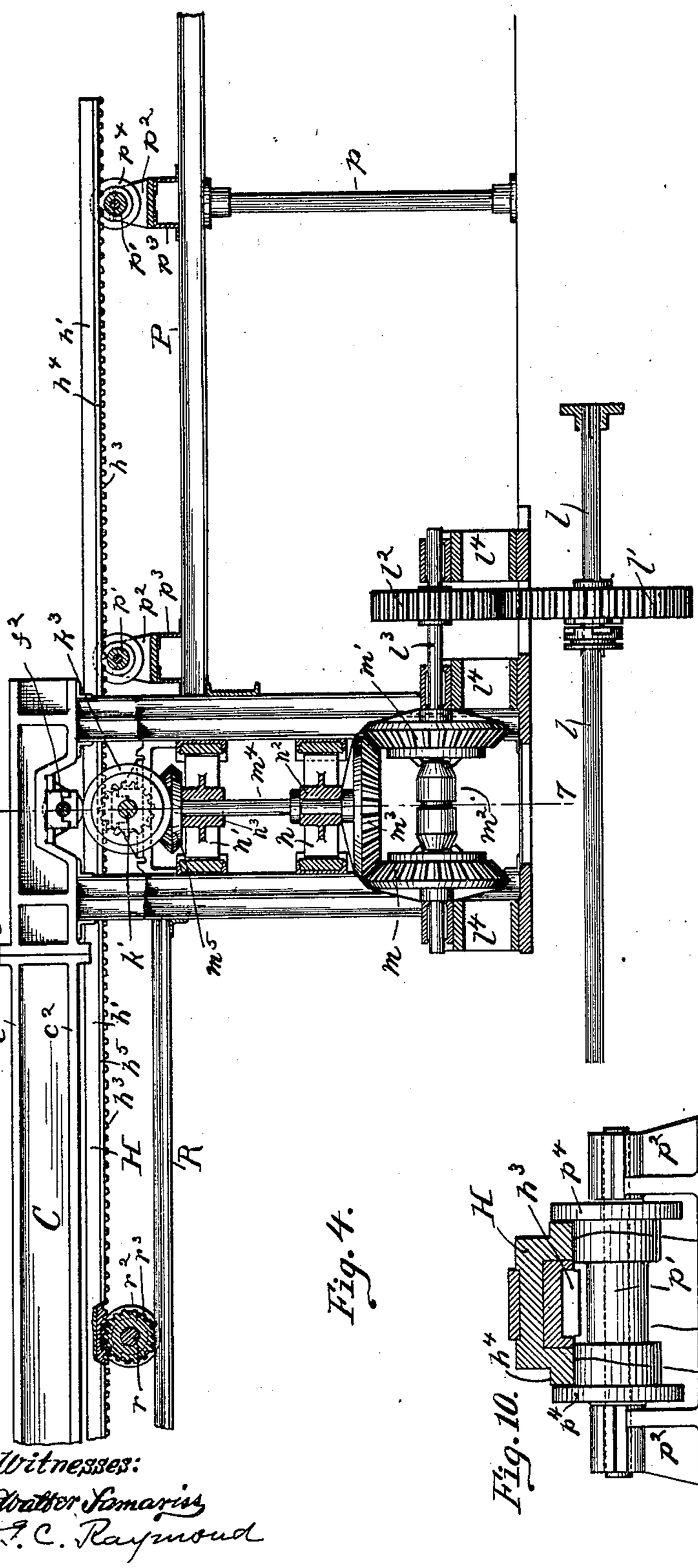

Fig. 4.

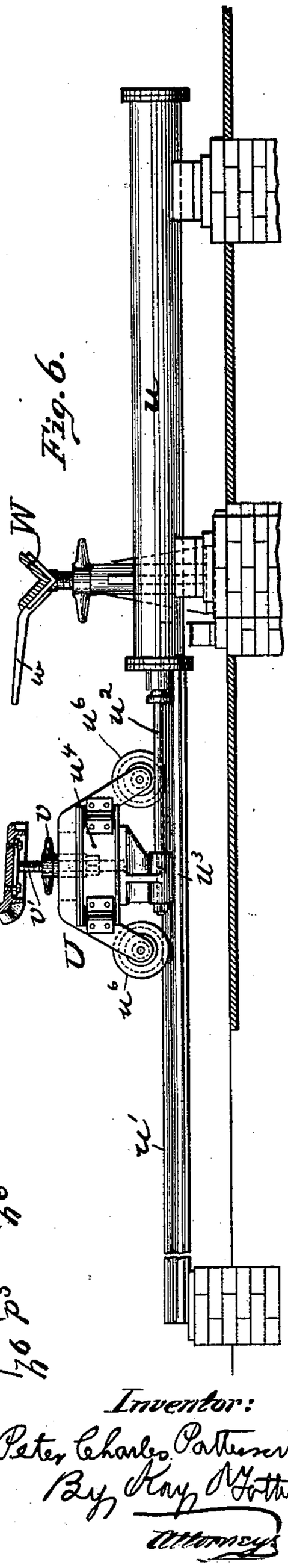

Fig. 6.

Fig. 10.

Witnesses:
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No. 669,145. Patented Mar. 5, 1901.

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APPARATUS FOR THE MANUFACTURE OF METAL TUBING.

(Application filed Apr. 21, 1898.)

(No Model.) 4 Sheets—Sheet 4.

Fig. 7.

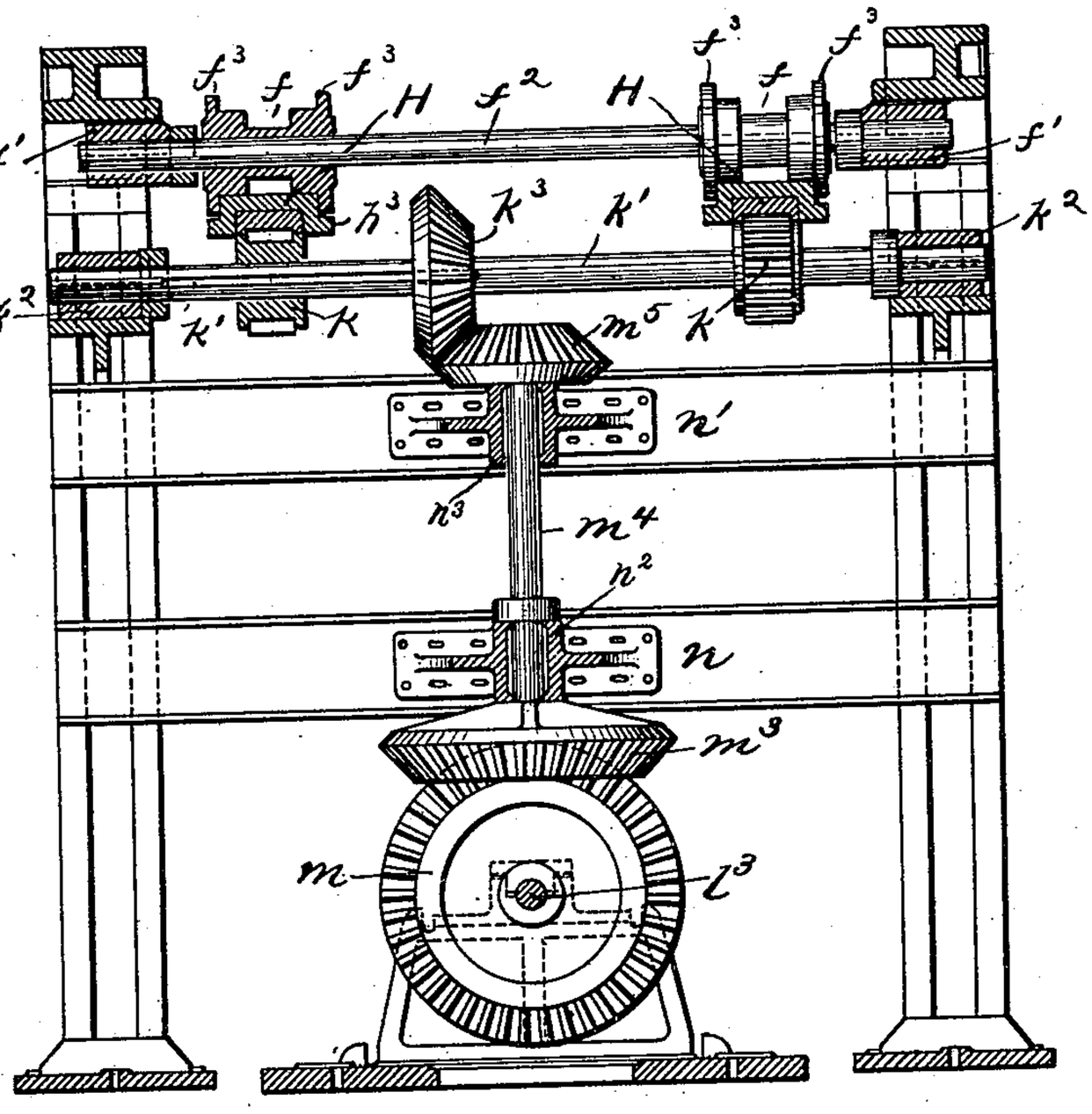

Fig. 8.

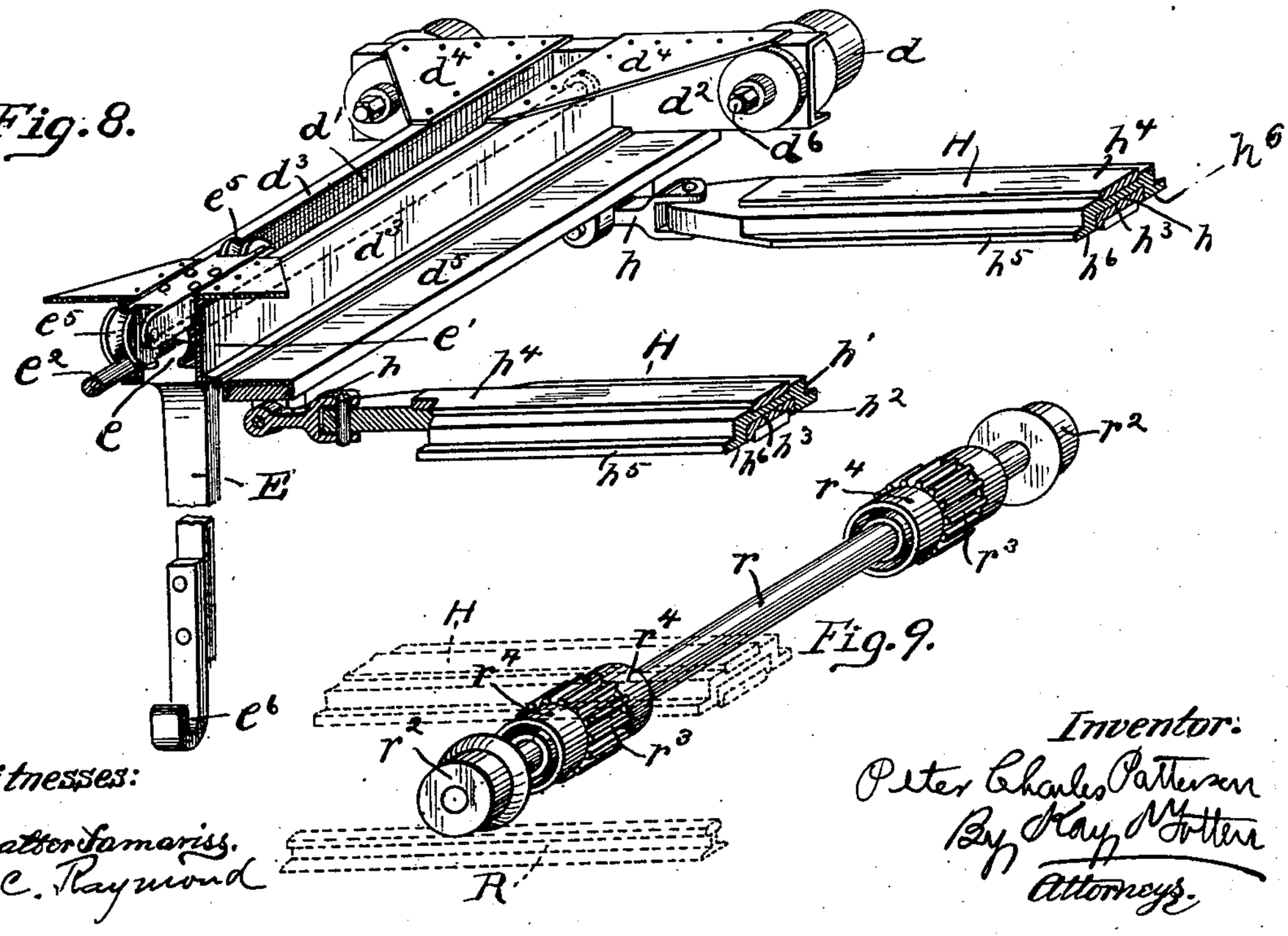

Fig. 9.

Witnesses:
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UNITED STATES PATENT OFFICE.

PETER CHARLES PATTERSON, OF McKEESPORT, PENNSYLVANIA, ASSIGNOR TO THE NATIONAL TUBE COMPANY, OF NEW YORK, N. Y., AND PITTSBURG, PENNSYLVANIA.

APPARATUS FOR THE MANUFACTURE OF METAL TUBING.

SPECIFICATION forming part of Letters Patent No. 669,145, dated March 5, 1901.

Application filed April 21, 1898. Serial No. 678,384. (No model.)

To all whom it may concern:

Be it known that I, PETER CHARLES PATTERSON, a resident of McKeesport, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Apparatus for the Manufacture of Butt-Weld Tubing; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to machines for drawing metal tubing, and has more particular reference to that class of machines employed for drawing tubing through the welding-bells to be formed up within the bell and welded by the abutting or other meeting of the edges of the plate within the bell.

The object of the invention is to provide a machine for such purpose having great strength sufficient for drawing the heavier sizes of tubing and providing positive moving mechanism for such operations.

To these ends the invention comprises, generally stated, the combination, with a stationary guide-frame, of draw-bars mounted in that frame and traveling longitudinally thereof and having rack-faces engaged by cog-gearing for imparting a positive longitudinal reciprocating motion to the same, and in peculiar mechanism, hereinafter referred to, for supporting the rack-bars in place and sustaining them in their movement.

It also consists in combining with such reciprocating drawing mechanism a transversely-sliding depending drawing-arm, with which the tongs engaging with the blank can be connected, so as to draw the tube through the welding-dies.

It also consists in certain other improvements in connection with the transverse movement of the bell-holder and the support for the same, as well as other specific improvements, to be hereinafter more fully set forth and claimed.

To enable others skilled in the art to employ my invention, I will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a plan view of the apparatus. Fig. 2 is a longitudinal or side view of the same. Fig. 3 is a side view, partly in section, of the forward end of the apparatus. Fig. 4 is a like view of the rear end of the apparatus. Fig. 5 is a cross-section showing the transversely-moving bell-holder and its method of support. Fig. 6 is a rear sectional view on the line 6 6, Fig. 3, of the reciprocating receiving-table and its operating mechanism. Fig. 7 is a cross-section on the line 7 7, Fig. 4. Fig. 8 is a perspective view illustrating the method of connecting the rack-bars with the reciprocating depending drawing-arm. Fig. 9 is perspective view of the traveling support for the rack-bar; and Fig. 10 is a detail of one of the fixed roller-supports, showing the rack-bar in section.

Like letters of reference indicate like parts in each view.

In the accompanying drawings, A is the welding-furnace, the apparatus being located in front of the same and it being found that the best construction can be obtained by mounting the reciprocating rack-bars overhead, for which purpose I provide the longitudinally-extending beam structure having the posts or pillars b b', on which are supported the longitudinally-extending beams B B', which are connected at intervals by the cross-beams b^2. Hung from the cross-beams b^2 are the trackways C C, in which the overhead carriage D travels, said carriage supporting the depending arm E. Such trackway C is formed of sections of cast metal connected at c and also connected to the gearing-housing F at c', support being thus obtained for the rear ends of the trackways. The trackways have inwardly-extending flanges c^2, within which the wheels d of the draw-arm frame D travels. At the forward end of the trackways I secure the spring-buffer g to check the forward movement of the carriage D in case it should strike the same, such buffer being formed of boxes g', supported in transverse beams g^2 and containing the springs g^3 and supporting the buffer-plate g^4, which extends entirely across between the trackways C C in the course of the draw-arm carriage. The draw-arm carriage is illustrated more particularly in Figs. 3 and 8, being formed of the side beams d^2 and cross guide-beams d^3, the inner faces of the latter forming the guideway d'

for the movement of the head *e* of the draw-arm E. To brace the side beams and cross-beams, I employ the triangular plates d^4, riveted to both beams, as shown in Fig. 8, and also the connecting-beam d^5, extending below the side beams d^2 and firmly secured thereto, to which connecting-beam the rack-bars H are connected for imparting movement to the frame. The wheels *d* are mounted on axles d^6, connected to the longitudinal or side beams d^2. The draw-arm E, which depends from the draw-arm carriage D, has the rectangular head *e*, above referred to, which slides between the cross-beams d^3 in the guideway d^4, above referred to, fitting within the same sufficiently close to hold the beam against longitudinal swinging movement, but free enough to permit its easy movement by the hand. To support such draw-arm head *e* and permit its easy sliding movement, I form in the same the central passage e', through which passage the bar e^2 passes, said bar being bolted to the longitudinal beams d^2 and forming a support for the draw-arm head within the guideway d^4. To overcome friction between the bar e^2 and the head *e*, I provide the rollers e^5 on the head *e*, which rest upon and travel along the bar e^2, and so provide for easy movement of the head *e* of the draw-arm within such guides. The draw-arm E depends below the frame D and has the seat e^6, into which the end of the tongs or tag *i* is dropped, as shown in Fig. 3, the head i' of the tongs or tag catching in said seat and connecting them with the draw-arm.

The rack-bars H are employed to impart a longitudinal movement to the frame D and arm E, being coupled to the connecting-beam d^5 of the frame D by the links *h*, which form universal joints therewith and leave the frame D free to travel in its natural course. As these rack-bars are made of great length—longer than the tube to be drawn and longer than is practicable to form in a single casting—and are subject to sudden strains which might cause the stripping of a tooth, I prefer to construct them as follows: The main casting or rack-casing h' is made in as long sections as practicable and has the seat h^2 on its bottom face to receive the racks h^3, which are generally made in short sections to provide for easy repair in case of breakage. Extending above the rack-casing is the wrought-metal slab h^4, and the sections of rack, rack-casing, and slab are all solidly riveted together, the sections of the different parts meeting at different points. The rack-casing h' has the flanges h^5, extending out beyond the rack, the lower faces of which form bearing-faces h^6 for the gear-wheels and idle wheels driving and supporting the rack-bars. Movement is imparted to the rack-bars H by the pinions *k*, meshing with the racks h^3. These pinions *k* are mounted in the gearing-housings F, above referred to, which support the rear end of the guideway *c*, the gear-housings being formed of heavy castings, as the principal strain of the mechanism comes upon the same. The gear-housings F are mounted in suitable foundations, as more particularly shown in Fig. 7, and carry in the upper portion thereof the bearings f' for the cross-shaft f^2, on which are mounted the rollers *f*, which bear upon the top faces of the rack-bars H and hold them down upon the driving-pinions *k*, directly under them, the rollers *f* having flanges f^3 extending down the vertical faces of the rack-bars H and holding them from side movement. Supported in said housing, below the rollers *f*, are the bearings k^2, in which is mounted the shaft k', carrying the driving-pinions *k*, which mesh with the rack H, as above referred to, the bearings k^2 being rigidly secured to the housing, as heavy strain is brought upon them. The shaft k' also carries the pinion k^3, by which power is applied to the same in the following manner: Extending under the bed-plate of the machine is the longitudinal power-shaft *l*, which is driven from any suitable source of power and has the spur-gear l', which meshes with a spur-gear l^2 on the shaft l^3, extending longitudinally and centrally within the gear-housing F and supported in bearings l^4 on the bed-plate. Said shaft l^3 carries the reversing-gears m m', operated by the clutch m^2, such gears both engaging with the bevel-pinion m^3 upon the vertical shaft m^4, which carries at its upper end the bevel-pinion m^5, meshing with the pinion k^3 on the shaft k', power being transmitted in this way to the pinions *k*, working in the rack-bars H. To support the shaft m^4 and its pinions, I employ the horizontal cross-frames n n', extending from side to side between the housings F and carrying thereon the bearings n^2 n^3, the frames n n' being rigidly secured to the housing F and a rigid structure capable of standing heavy strains being thus obtained. As above stated, the rack-bars H must be of greater length than the tube to be drawn, and they must be supported in such way so as to overcome friction. Support for the rear portions of such rack-bars is provided in the rear or supplemental frame P, extending back from the housing F and supported on the pillars *p*. This supplemental frame P carries the rollers p', mounted on pillow-blocks p^2, carried on cross-beams p^3, such rollers being flanged, as shown at p^4, so as to extend up over the outer flanges h^4 of the rack-bars, while the rollers have central recesses p^5, into which the cog-faces h' of the racks pass, the bearing-faces h^6 of the rack-bars resting on the rollers. In this way as the rack travels past the housing F support is given to the free end thereof, while friction is reduced to a minimum.

Support is given to the forward ends of the rack-bars by the draw-arm carriage D; but as the bars are of great length and the flexible connection to the carriage is not, of course, a rigid support it is also considered wise to support that end of the same independently of the carriage, and for this purpose I pro-

vide the longitudinally-extending track R, the rear end of which rests upon the housing F, while the front ends are connected to the bracket r', which extends down from the guideways C about midway of the length of the guideways. The shaft or axle r carries wheels r^2, traveling on such track R, and rigidly secured to the shaft r are the toothed pinions r^3, directly under the rack-bars H and meshing therewith, the shrouds r^4 of the pinions bearing on the faces h^6 of the rack-bars. Such construction provides a loosely-running pinion-shaft, which travels forward as the rack-bar travels forward, its wheels r running upon the track R as it is turned by the rack meshing in the pinions; but the shaft, with its wheels, travels at half the speed and forms a reciprocating support for the rack-bar as it advances and recedes in its course in drawing the pipe, such loosely-running pinion-support maintaining a position midway between the driving-pinions k and the forward end of the rack-bar and carrying the weight of the same, and so overcoming friction and relieving the rack-bars of strain due to their weight.

To support the welding-bells in position in front of the furnace, I employ an independent transversely-moving carriage S, located close to the mouth of the furnace A and running on the track s', the carriage being moved by suitable fluid-pressure operating within the cylinder s, the piston-rod s^2 being connected close to the base of the carriage, the carriage having at its upper end the bell-holder s^3, and projecting beyond the same and connected to that bell-holder by bolts s^9 is the primary bell-holder s^5, which is brought in this way close to the mouth of the furnace. As these bell-holders must sustain the entire strain of the welding of the tube, the bell-holder carriage must be firmly braced, no matter in what position it may rest with relation to the furnace and the drawing mechanism, and for this purpose I have mounted it within the transversely-extending guideway T, formed of the end standards t, which carry the cross-beams t', extending one on each side of the carriage-body, close to the same, so as to support the carriage-body firmly against the transverse strain brought upon it, while leaving it free when relieved from such strains to be moved transversely in front of the furnace. As is seen in Fig. 3, the carriage-body has the flanges s^6 extending over the top of the cross-beams t' and aiding in the bracing of the carriage when the drawing strain is brought upon it. It is to be noticed that the space back of this carriage is open and free and that the workmen can move around in it with full opportunity to conduct the necessary furnace operation. Back of this bell-holder carriage is the tube-receiving carriage U, which moves on tracks u' transversely of the furnace, being moved by fluid operating in the cylinder u through the piston-rod u^2, connected to the carriage at u^3. This carriage U is formed of the end bearings u^4, connecting the longitudinal beams u^5 and having mounted therein the wheels u^6, traveling on the tracks u'. In each bearing u^4 is the screw-jack v, the vertically-adjustable bar v', which supports the platform V, on which the tube is delivered after passing through the welding-bells, the tube being received on this platform and either carried thereby over to the receiving-arms w of the sizing-roll trough W or being connected to said receiving-arms by a sliding or telescopic guideway, so that the tube may roll from the platform V into the trough. On one side of the platform V is the rib v^2, which prevents the pipe from rolling off that side of the platform.

In the regular operation of the apparatus the plates or strips from which the pipes are to be formed are charged into the welding-furnace at the opposite end from which they are to be withdrawn, several such strips being side by side on the hearth at the same time, and such strips being successively drawn from the furnace by the apparatus when ready for welding and other strips charged in their place as they are withdrawn. The drawing-arm E is normally at the forward end of the drawing mechanism, the rack-bar moving it into this position for drawing a tube. When a plate is to be welded into tubing through the cylinder s, the bell-holder carriage S is drawn into line with the tube, and the welder stands in front of the furnace watching the plate, so as to draw it at the proper welding-heat. As soon as it is brought to that heat he grasps the plate by means of the tongs i, and he slips the welding-bells a a' over the tongs, letting them drop in proper position before the bell-holders s^3 s^5 on the bell-holder carriage. He then reaches back and pushes or pulls the drawing-arm E into line with the bell-holders and drops the end of the buggy into the seat e^6 of the same, a shoulder on the tongs engaging the said seat, and the mechanism then being ready to draw the blank through the bells and so weld it into tubing. By means of the clutch mechanism m^2 the gearing above described is set in motion, so as to rotate the driving-gears k, power being transmitted through the bevel-gears m m^3, shaft m^4, bevel-gears m^5 and k^3, shaft k', and the driving-gears k. In this way the racks H are drawn backwardly together, drawing with them the carriage D and drawing-arm E, a positive unyielding pull or draw upon the same being obtained and the mechanism being so strong as to overcome the friction of the bells, even in the making of very heavy tubing, and to draw the blank through the two welding-bells, the only possible accident to prevent the proper drawing of the tube being the slipping of the tongs, which in the drawing of such heavy pipe must be made sufficiently strong to hold the blank firmly. As soon as the tube is welded the tongs are grasped by a workman at the rear of the bench, who quickly lifts them from the draw-arm and opens the tongs, so freeing

the pipe, and by means of the tube-supporting carriage U it is carried over to the sizing-roll trough W and passes thence into the sizing and finishing rolls. The mechanism is then reversed, the rack-bars H moving forward and bringing the draw-arm in position for the next drawing operation, and the bell-holder carriage S and tube-supporting carriage U being moved into line with the next blank to be drawn into tubing. As the rack-bars move back and forward their rear ends are supported on the idle rollers p', between the flanges p^4 thereof, the rack-teeth entering the recesses p^5, and at the same time the rack is supported not only on the driving-pinions k, but on the loosely-running supporting-pinions r, with their wheels r^2 running on the tracks R, four or more points of support for the rack-bars being provided in this way and the friction from the use of such heavy rack-bars being therefore reduced to a minimum. In case the carriage D would have such momentum that it could not be properly checked in its forward movement, as might be the case on account of the weight of the rack-bars, it will strike against the cushion g at the forward end of the guideways C and its motion be checked without injury to the parts. The draw-arm E while firmly braced, so as to transmit the power from the carriage D to the tube, is so mounted as to be easily moved by the operator from side to side, as necessary, the draw-arm being supported upon the rollers e^5, running on the bar e^2, while its side faces travel within the transverse guide-beams d^3. As the rack-bars are built up from sections, as above described, it is evident that in case of the stripping of any of the teeth of any portion of the rack the section carrying such teeth can be quickly and easily replaced. This accident, however, is not liable to occur, as the parts are made sufficiently strong to prevent the same.

The mechanism described, therefore, provides positive operating drawing mechanism of sufficient strength to draw the largest sizes of tube formed in welding-bells and to draw the same by a positive and unyielding power, while the mechanism provides for the easy power handling of the different parts of the mechanism necessary in adjusting the same to the plates within the welding-furnace, the independent movement of these parts, and the handling of the heavy tubing produced.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In tube-drawing mechanism, the combination of a welding-furnace, longitudinally-reciprocating drawing mechanism back of the same having a transversely-moving depending arm, and an independently transversely moving tube-receiving platform, substantially as set forth.

2. In tube-welding mechanism, the combination with a welding-furnace, of a transverse guideway in front of the same having guide-beams, and a bell-holder carriage traveling on a track below the guide-beams and extending up between said guide-beams, substantially as set forth.

3. In tube-drawing mechanism, the combination with a welding-furnace, of the guide-frame T having the guide-beams t', the bell-holder carriage S traveling transversely in front of said furnace on a track below the guide-beams and extending between said beams, and having the flanges s^6 extending out over the guide-beams, substantially as set forth.

4. In tube-drawing mechanism, the combination of the welding-furnace, a bell-holder supported in front of the same and carrying horizontal bolts or bars and another bell-holder between the furnace and the main bell-holder supported on said bolts, substantially as set forth.

5. The combination of overhead guideways and a carriage reciprocating longitudinally therein and having a transverse guideway, a draw-arm having a draw-head mounted within said guideway and having a central passage therein, and a guide-bar extending through said passage and within the transverse guideway, substantially as set forth.

6. The combination of overhead guideways and a carriage reciprocating longitudinally therein and having a transverse guideway, a draw-arm having a draw-head mounted between said guideways and having a central passage therein, a guide-bar extending through said passage and within the transverse guideway, and rollers carried by the draw-arm head and traveling on said bar, substantially as set forth.

7. In tube-drawing mechanism, the combination with overhead guideways, of a carriage mounted in said guideways and carrying a draw-arm, and one or more rack-bars connected to said carriage by flexible connections, substantially as set forth.

8. In tube-drawing mechanism, the combination of a carriage carrying drawing mechanism, a rack-bar extending back from the same and having a rack-face on its under surface, and a driving-pinion under such rack-bar engaging with said rack-face and acting to support such bar, and mechanism for driving the pinion, substantially as set forth.

9. In tube-drawing mechanism, the combination of a carriage carrying drawing mechanism, a rack-bar extending back from the same and having a rack-face on its under surface, and a driving-gear under such rack-bar engaging with said rack-face and acting to support such bar, mechanism for driving the gear, and a rack-supporting frame back of the driving-gear carrying idle rollers supporting the rack-bar, substantially as set forth.

10. In tube-drawing mechanism, the combination of a carriage carrying drawing mechanism, a rack-bar extending back from the same and having a rack-face on its under surface, and a driving-gear under such rack-bar engaging with said rack-face and acting to

support such bar, mechanism for driving the gear, and a rack-supporting frame back of the driving-gear carrying the idle rollers supporting the rack-bar, and depressions within such rollers in which the rack-face runs, substantially as set forth.

11. In tube-drawing mechanism, the combination of a carriage carrying drawing mechanism, a rack-bar extending back from the same and having a rack-face on its under surface, and a driving-gear under such rack-bar engaging with said rack-face and acting to support such bar, mechanism for driving the gear, and a rack-supporting frame back of the driving-gear carrying idle rollers supporting the rack-bar, said rollers having flanges extending up the sides of the rack-bars, substantially as set forth.

12. In tube-drawing mechanism, the combination of a carriage carrying drawing mechanism, a rack-bar extending back from the same and having a rack-face on its under surface, and a driving-gear under such rack-bars engaging with said rack-face and acting to support such bar, mechanism for driving the gear, a trackway extending forward from the housing supporting the driving-gearing below the rack-bar, a loosely-running shaft traveling on said track and having a pinion engaging with said rack-bar and supporting the same, substantially as set forth.

13. In tube-drawing mechanism, the combination of a carriage carrying drawing mechanism, a bar extending back from the same and having a rack-face on its under surface, and a driving-gear under such rack-bar engaging with said rack-face and acting to support such bar, mechanism for driving the gear, and a shaft having wheels running on said track and a pinion meshing with said rack and supporting the same, said shaft traveling back and forth on the track, substantially as set forth.

14. In combination with the overhead frame carrying guideways C, the housing F connected to the rear end of the guideways, carriage D traveling in said guideways, gearing supported in the housing and driving the gear k, the rack-bar H connected to the carriage D and meshing with the gear k, the tracks R extending forward from the housing and connected to the guideways, and the shaft r^2 carrying wheels running on the track R and gear engaging with the rack and supporting the same, substantially as set forth.

15. In tube-drawing mechanism, the combination with a drawing-carriage, of a rack-bar extending back therefrom and having a rack on its lower surface, a driving-gear engaging with said rack, and a shaft extending above and parallel with the shaft carrying said driving-gear and carrying an idle roller provided with flanges and bearing on the top face of said rack-bar, substantially as set forth.

16. In tube-drawing mechanism, the combination with a welding-furnace and with drawing mechanism, of an independently-operated tube-supporting carriage back of the bell-holder movable transversely of the furnace, substantially as set forth.

In testimony whereof I, the said PETER CHARLES PATTERSON, have hereunto set my hand.

PETER CHARLES PATTERSON.

Witnesses:

JAMES I. KAY,

ROBT. D. TOTTEN.