No. 894,245. PATENTED JULY 28, 1908.

F. B. UNCAPHER.

MEANS FOR HANDLING BLOOMS.

APPLICATION FILED MAR. 3, 1908.

6 SHEETS—SHEET 1.

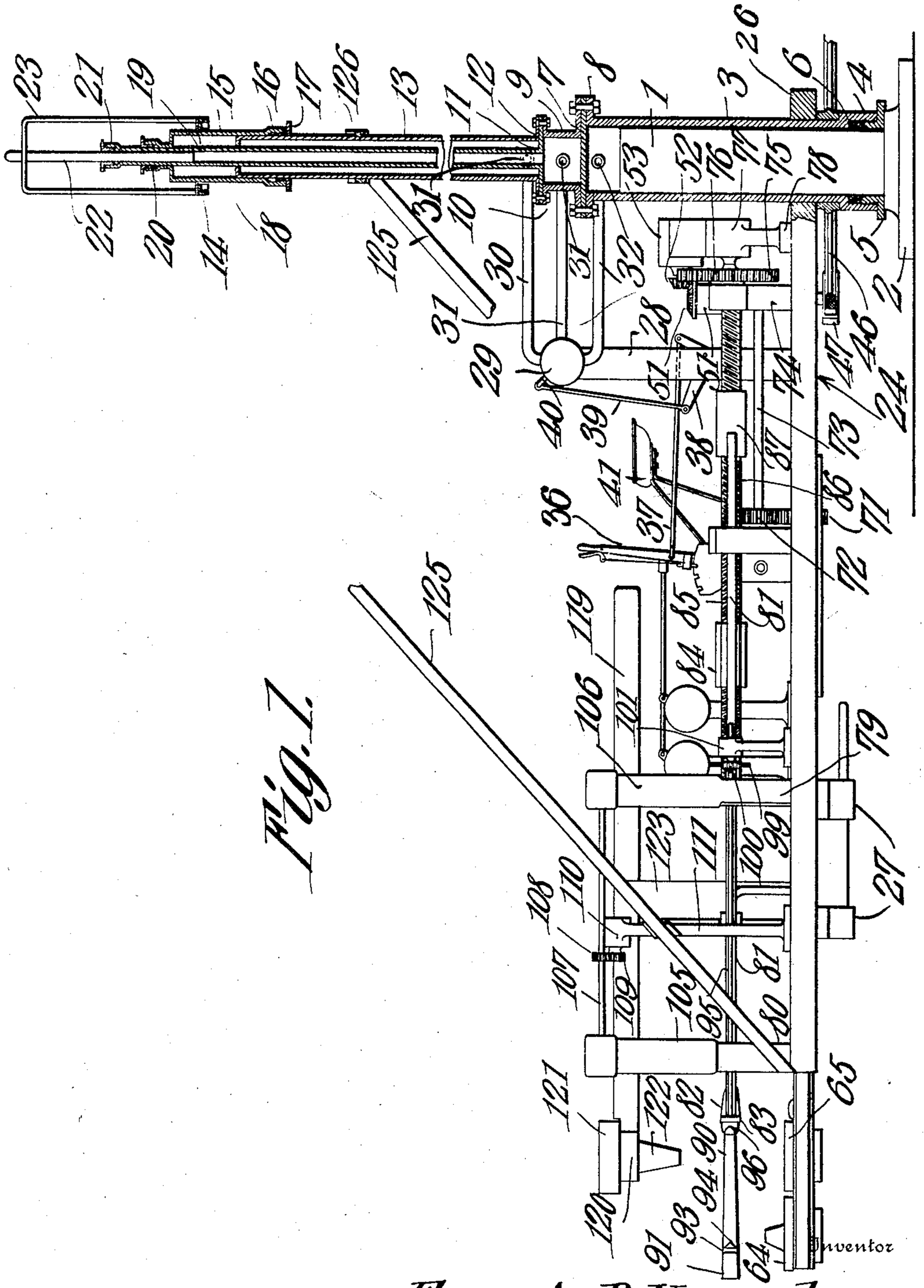

Fig. 1.

Witnesses

E. C. Hammond

F. J. Chapman.

Inventor

Francis B. Uncapher.

By Cachow & Co

Attorneys

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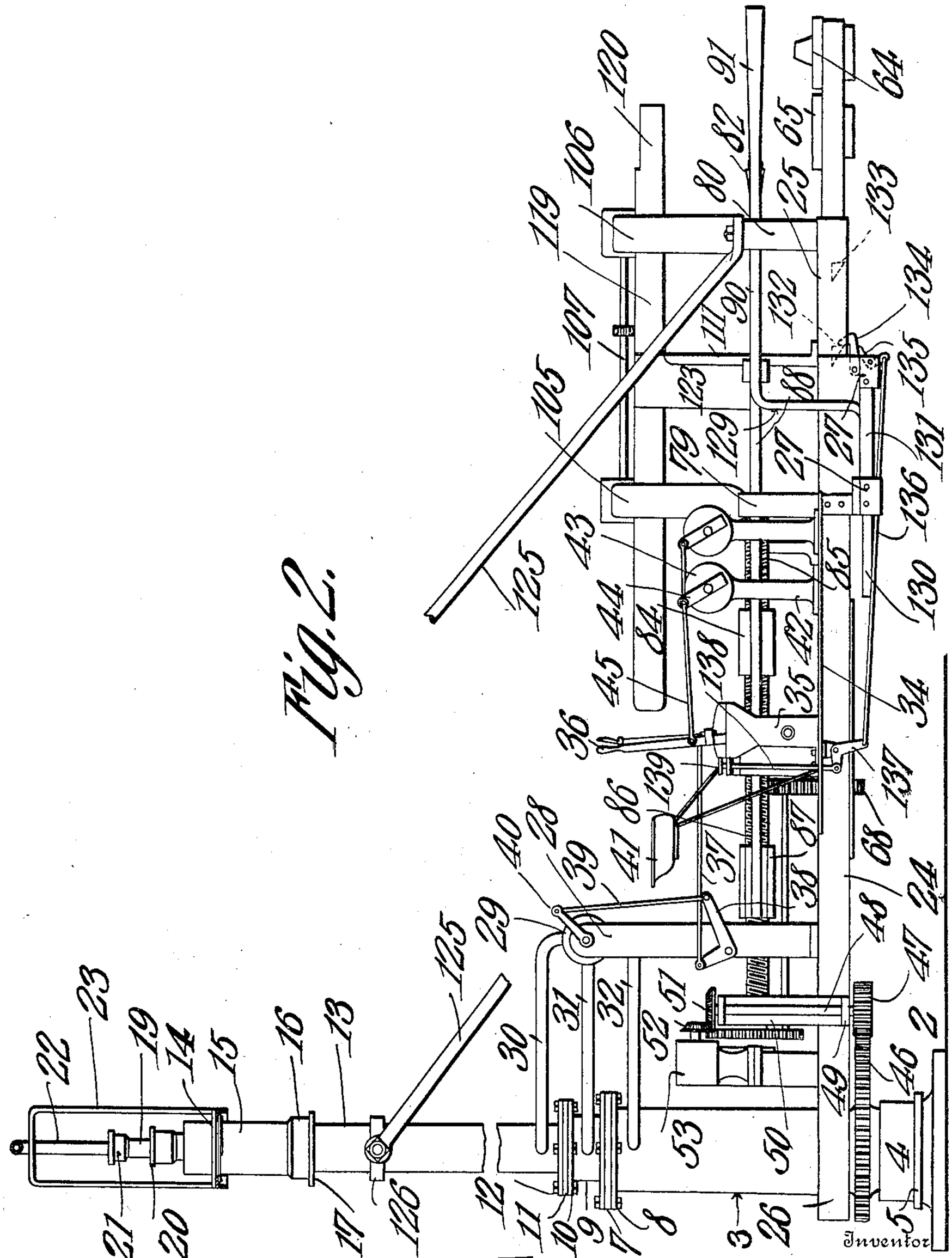
6 SHEETS—SHEET 2.

Fig. 2.



Witnesses

E. F. Hamet

F. T. Chapman

Inventor

Francis B. Uncapher.

By Cachow & Co

Attorneys

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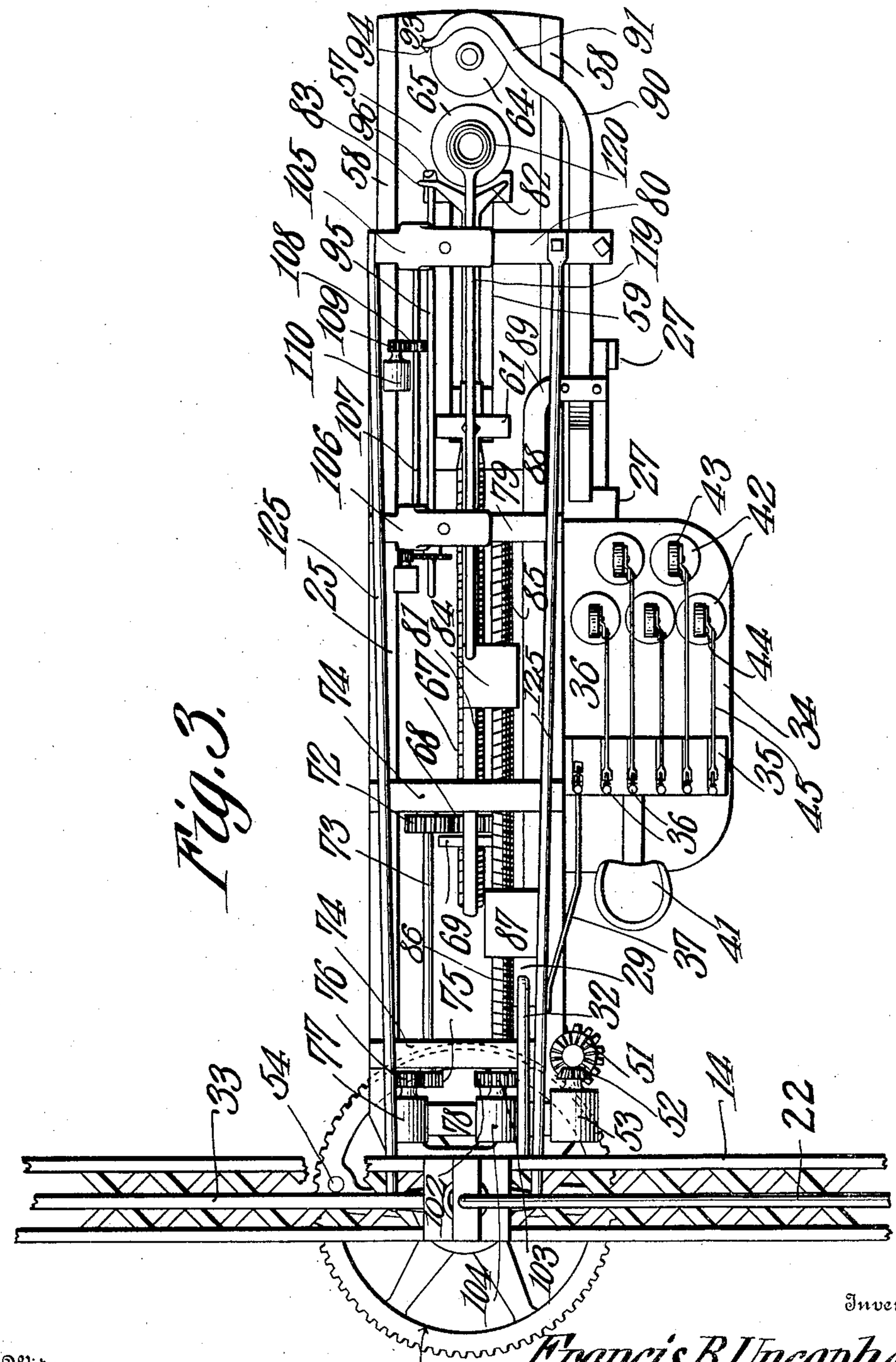

Fig. 3.

Witnesses

E. F. Clement

F. T. Chapman

Inventor

Francis B. Uncapher.

By Cachow & Co

Attorneys

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F. B. UNCAPHER.

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6 SHEETS—SHEET 4.

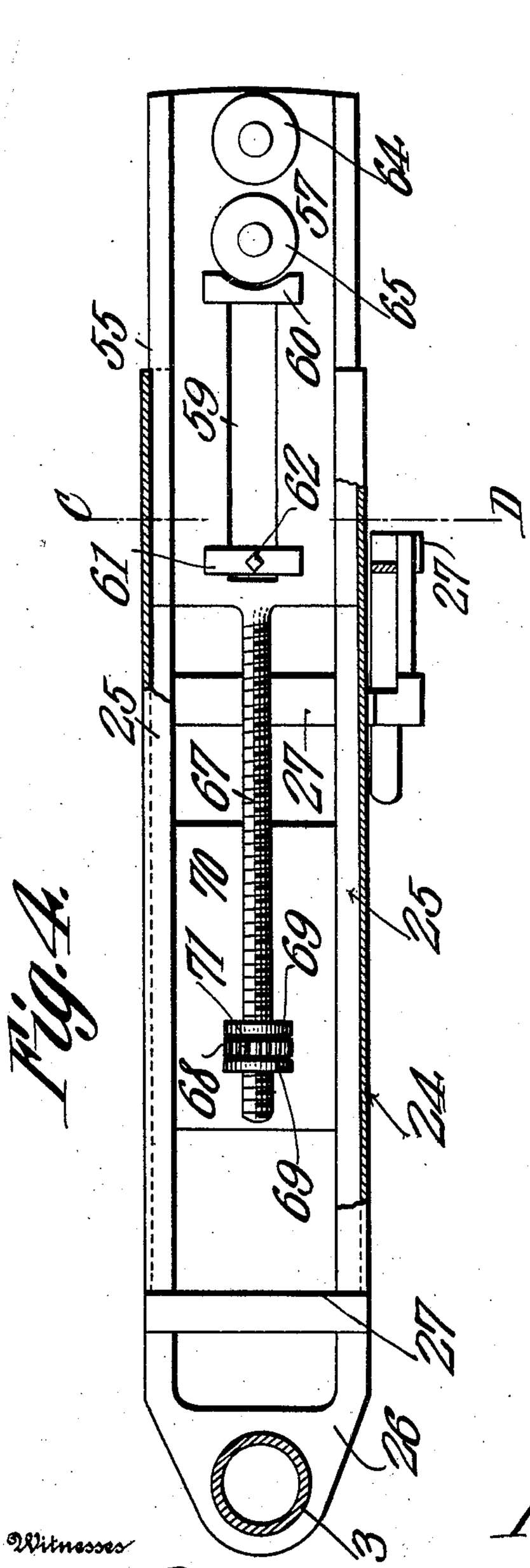

Fig. 4.

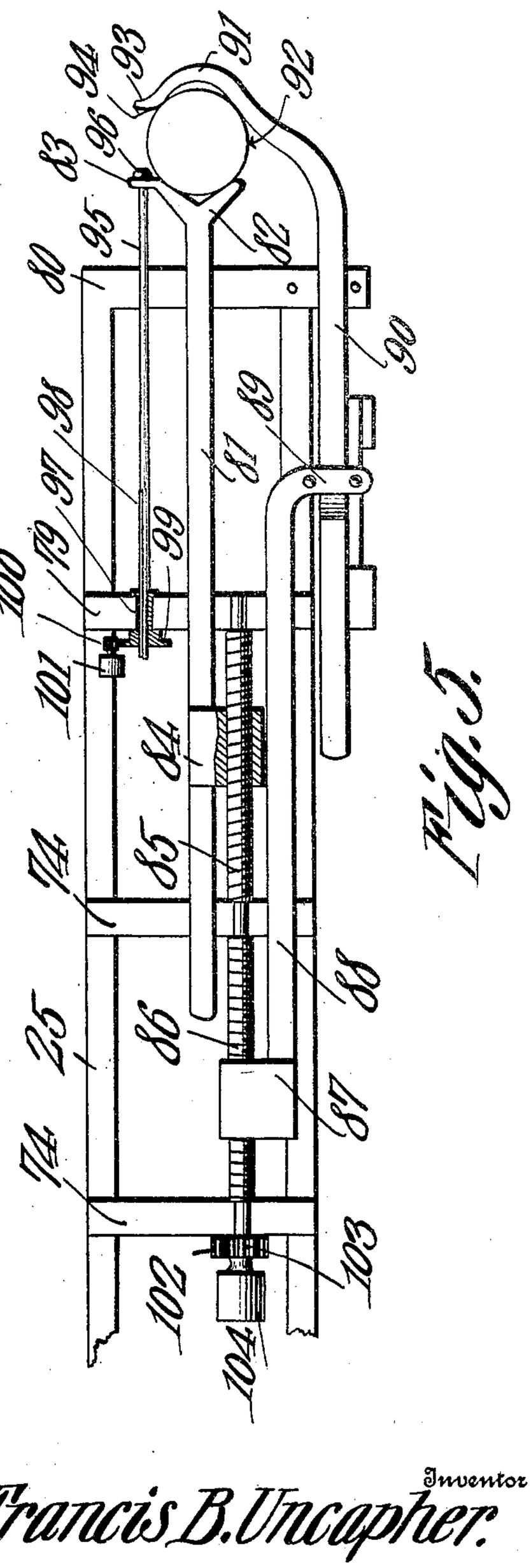

Fig. 5.

Witnesses

E. J. Clemmett

F. T. Chapman

Inventor

Francis B. Uncapher.

By Chamberlain

Attorneys

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6 SHEETS—SHEET 5.

Fig. 6.

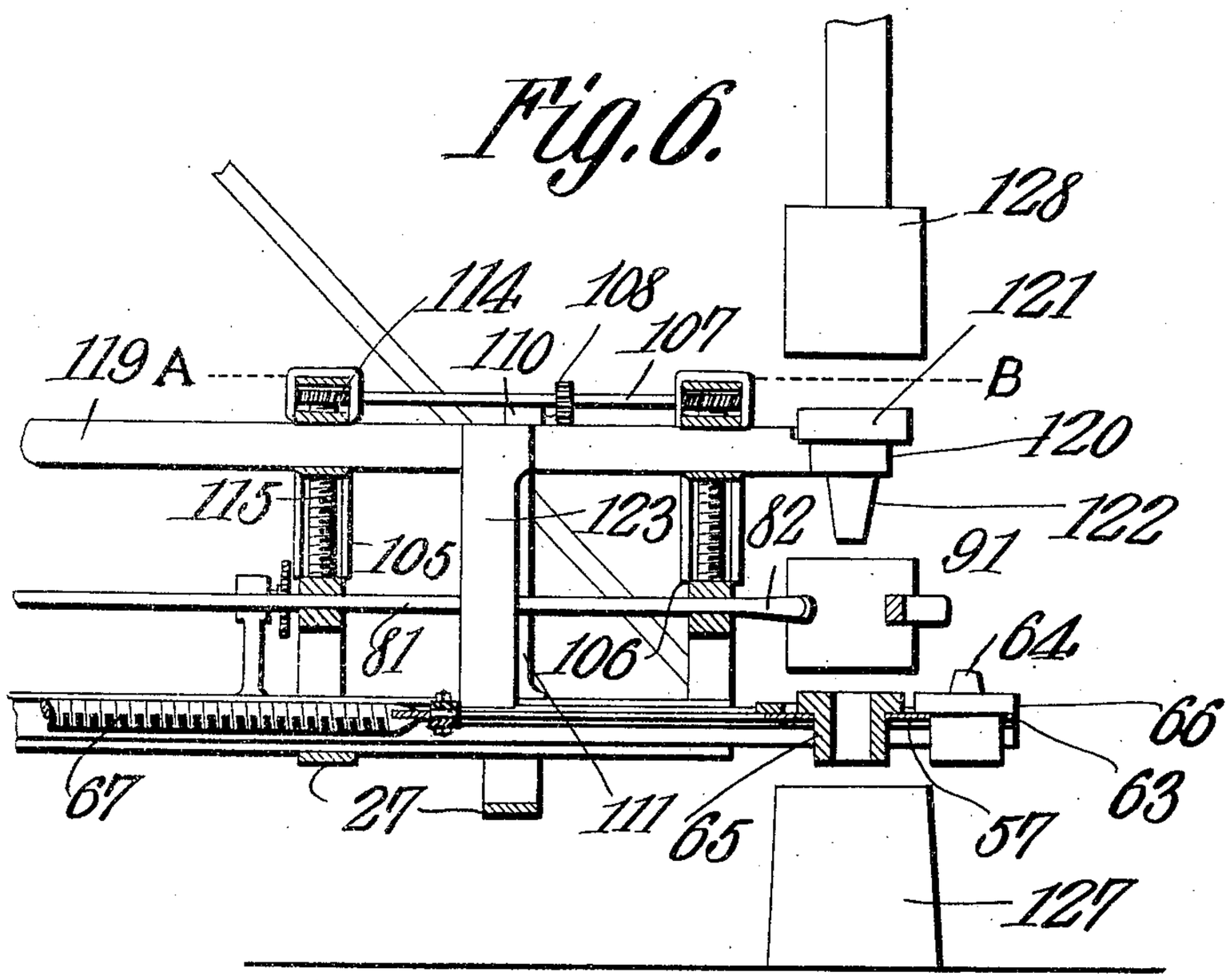
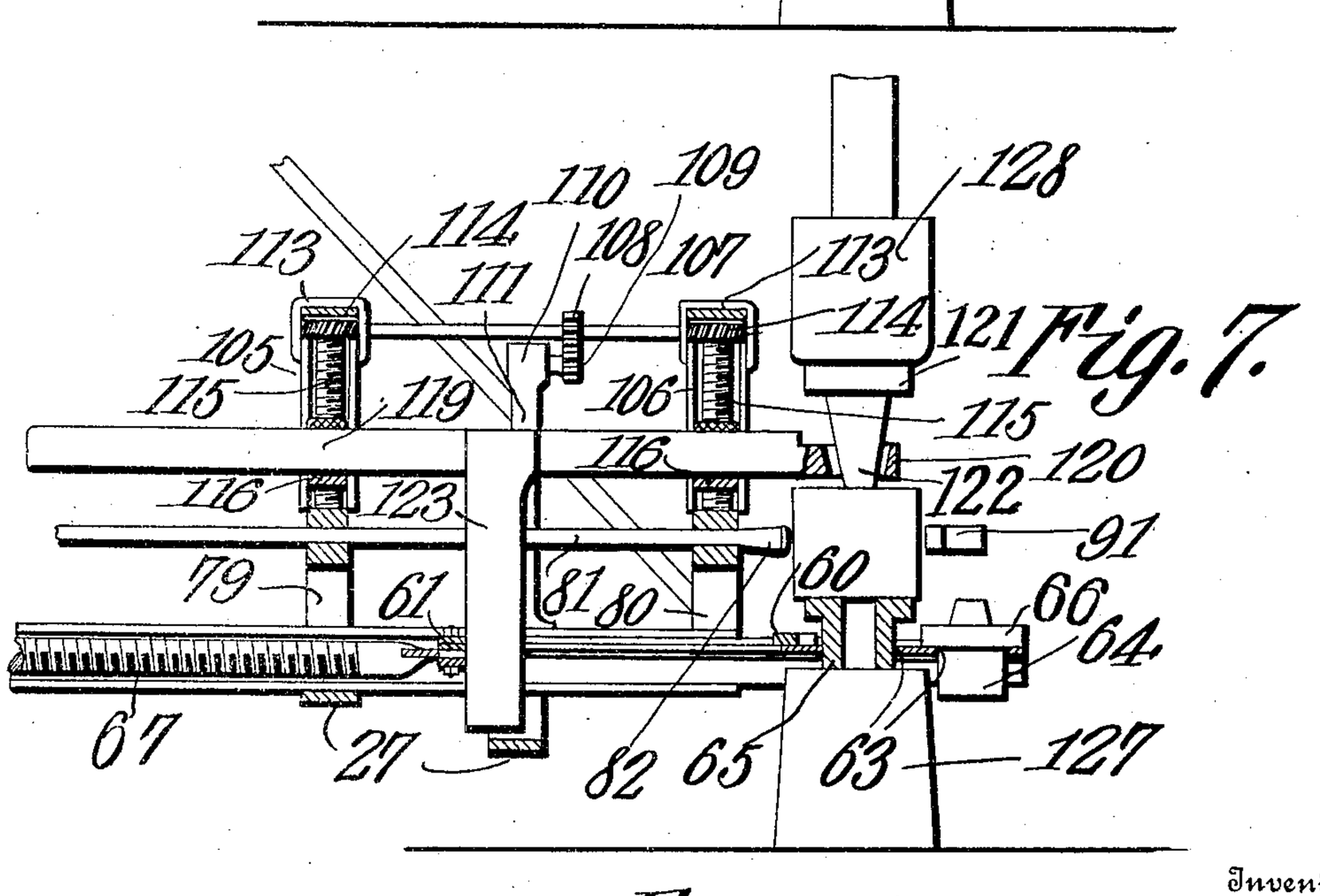


Fig. 7.



Witnesses

E. F. Ellwood

F. T. Chapman

Inventor

Francis B. Uncapher.

By Church & Co.

Attorneys

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6 SHEETS—SHEET 6.

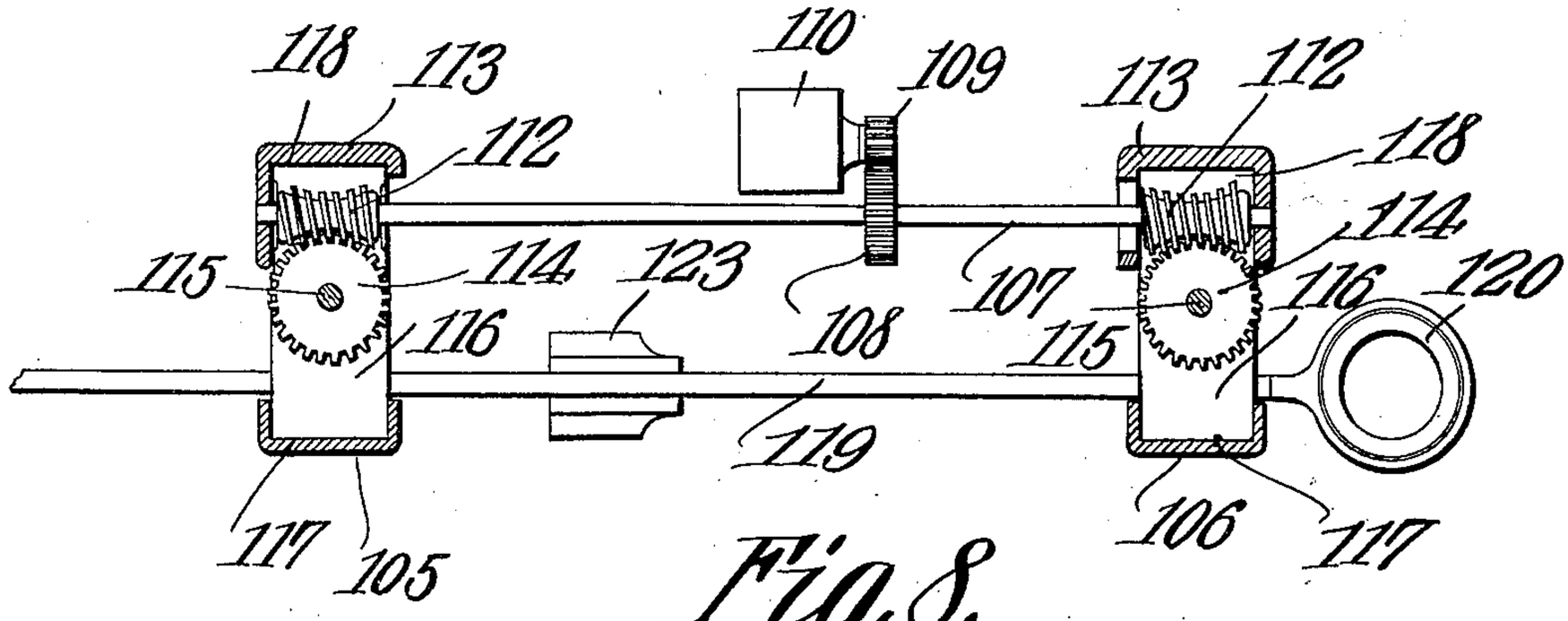

Fig. 8.

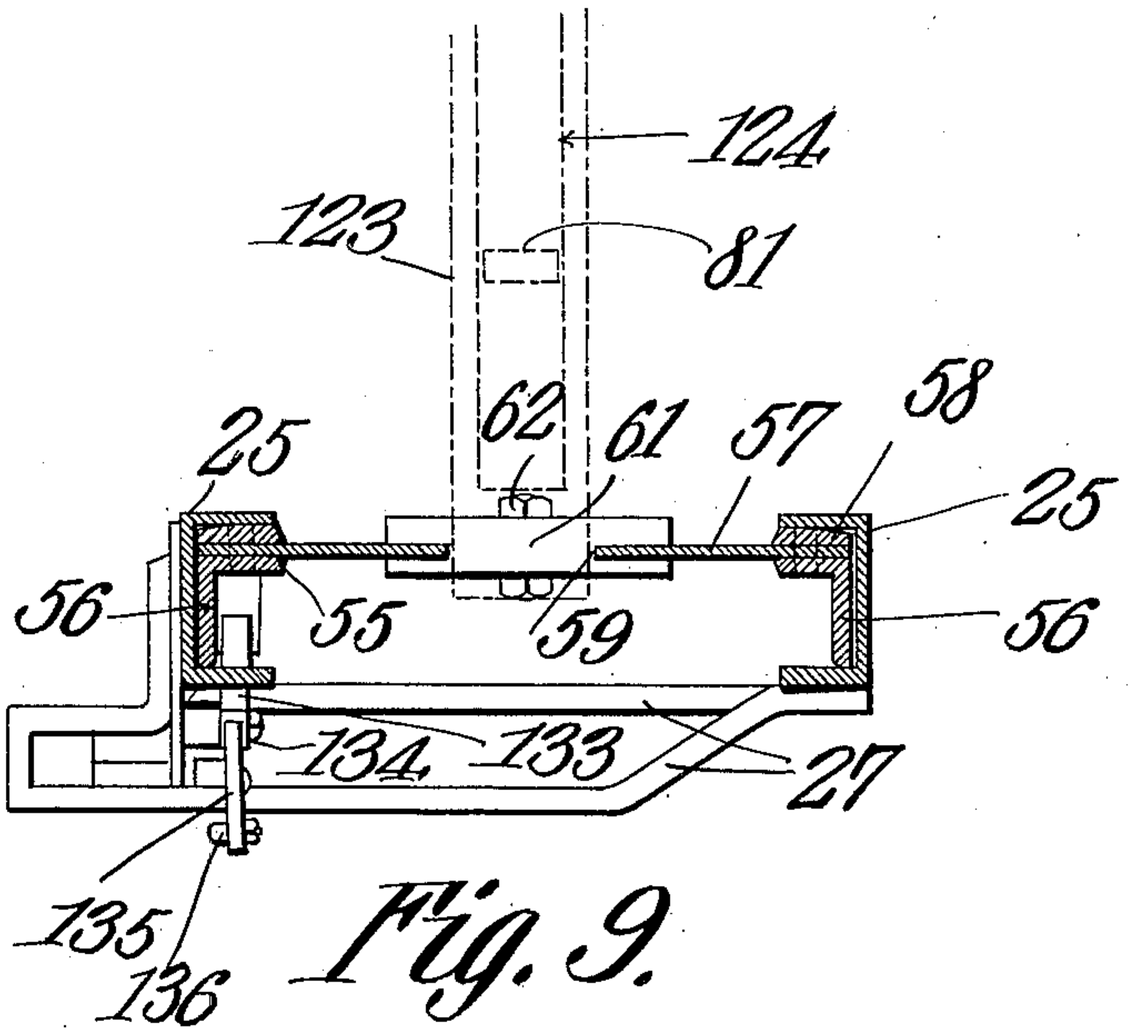

Fig. 9.

Witnesses

F. E. Clement

F. T. Chapman

Inventor

Francis B. Uncapher.

By Cachow & Co

Attorneys

UNITED STATES PATENT OFFICE.

FRANCIS B. UNCAPHER, OF LATROBE, PENNSYLVANIA.

MEANS FOR HANDLING BLOOMS.

No. 894,245. Specification of Letters Patent. Patented July 28, 1908.

Application filed March 3, 1908. Serial No. 419,025.

To all whom it may concern:

Be it known that I, FRANCIS B. UNCAPHER, a citizen of the United States, residing at Latrobe, in the county of Westmoreland and State of Pennsylvania, have invented a new and useful Means for Handling Blooms, of which the following is a specification.

This invention has reference to improvements in means for handling blooms while being subject to the action of a steam hammer, the structure being particularly adapted for use in foundries.

The object of the invention is to provide means whereby the blooms may be handled expeditiously and readily transported from one hammer to another and there manipulated as may be necessary, all the parts being under the control of a single operator at a safe distance from the hammer.

The invention comprises, essentially, a supporting structure upon which is pivotally secured a crane designed especially for the handling of heavy weights. The swinging arm of the crane is horizontal and the whole structure is vertically movable by means of a suitable hydraulic lift. The horizontal arm is capable of moving about the hydraulic lift as an axis and carries the various structures for holding the bloom. Mounted upon the crane arm is a pair of jaws adapted to grasp the bloom, and also carried by the crane arm is a carriage for supporting dies and other structures designed for the proper forging of the bloom while under the action of the steam hammer. The arrangement is such that the carriage may be moved entirely out of active relation to the bloom and the latter may be subjected to the action of the hammer without respect to the carriage or parts controlled thereby, and provision is made whereby the bloom may be turned upon a horizontal axis so as to be treated in different positions by the steam hammer.

The horizontal swinging arm of the crane also carries a supporting structure for a tool designed particularly for the formation of an eye in the bloom but which supporting member may carry other tools as needed, such tools being under the control of the steam hammer and coacting with dies mounted upon the carriage, the structure being such that operating tools are carried both above and below the bloom, one of the tools being designed to rest upon the anvil of the steam hammer and support the bloom, while the other tool is carried by a structure under the control of the carriage supporting the first-named tool and arranged to be moved into coincidence with the tool or tools mounted upon the carriage. In this manner the bloom may be subjected to the operation of suitable tools under the control of the steam hammer so that various operations may be performed upon the bloom by the steam hammer through mechanism under the control of a single operator.

For convenience of operation several structures are arranged to be controlled from a single point and by preference electric motors are employed for effecting the several operations, with the exception of the lifting of the crane bodily through a vertical plane, this last operation being preferably performed through the intermediary of a suitable hydraulic lift. Of course the electric motors may be replaced by hydraulic motors of appropriate form, but electric motors present advantages not found in hydraulic motors and overcome certain disadvantages of hydraulic motors and, therefore, it is preferred that electric motors be used wherever practical.

The invention will be best understood by a consideration of the following detail description taken in connection with the accompanying drawings forming a part of this specification, in which drawings—

Figure 1 is a side elevation, partly in section, of the crane. Fig. 2 is a side elevation of the crane as viewed from the side opposed to that seen in Fig. 1. Fig. 3 is a plan view of the structure. Fig. 4 is a plan view, with parts in section and parts removed, showing the longitudinally movable carriage. Fig. 5 is a plan view, with parts in section and parts removed, of the bloom-holding jaws and coacting parts. Figs. 6 and 7 are vertical sections, with parts in elevation, in a longitudinal central plane through the free end of the crane arm showing different phases of the operation of the structure. Fig. 8 is a section on the line A—B of Fig. 6. Fig. 9 is a section on the line C—D of Fig. 4.

The structure of the crane is large and massive designed for the handling of heavy weights, and the parts are, therefore, in the practical embodiment of the invention properly designed for standing strains incident to the operation of the crane. In the drawings

no attempt has been made to show proportions with any exactitude for this would necessitate some parts being shown very small, in fact too small to be intelligible, especially when it is considered that the swinging arm of the crane may be thirty or more feet in length and the upright member approaching forty feet in length. It will, therefore, be understood that for the sake of clearly illustrating some of the parts the proportions of these parts have been exaggerated.

Referring now to the drawings, there is shown a post 1 of suitable proportions mounted upon a base 2 which is assumed to be firmly anchored to a suitable foundation. The post 1 constitutes the stationary member of a hydraulic lift and also a pivotal support about which the crane as a whole is to be moved in a horizontal plane. Fitting the post 1 is a cylindrical casing 3 formed at the bottom with a bell 4 into which fits a packing gland 5 confining suitable packing 6 about the post 1 so that while the cylinder 3 is free to move both vertically and circumferentially with relation to the post 1 the gland 5 and packing 6 will prevent the escape of the fluid used in the hydraulic lift. Above the post 1 the cylinder 3 is closed by a cap-plate 7 firmly bolted to a flange 8 formed on the top of the cylinder 3. On top of the cap plate 7 is a short cylinder 9 also firmly secured to the cap-plate 7, and this cylinder 9 is formed at its upper end with an annular flange 10 receiving another cap-plate 11, on top of which is bolted a flange 12 on the lower end of a long tubular structure 13. Within the building in which the crane is erected there is formed a horizontal girder 14 at a sufficient height above the floor and which may constitute a member of one of the roof trusses or which may be otherwise supported. The girder 14 has fast therein a cylinder 15, the lower end of which is formed into a bell 16, and which cylinder receives the upper end of the tubular structure 13. The bell 16 is provided with a packing gland 17 to render the joint between the cylinder 15 and tubular structure or post 13 pressure tight, at the same time permitting the post 13 to slip within the cylinder 15. The upper end of the tubular post 13 is provided with a perforated annular flange 18 through the center of which is passed a pipe 19 extending axially downward through the tubular post 13 to the plate 11 through which the pipe 19 opens. The upper end of the cylinder 15 is formed with a gland 20 through which extends the pipe 19, and the latter terminates above the gland 20 in another packing gland 21 into which there is passed a smaller pipe 22 extending down into the pipe 19. The pipe 22 is carried by a yoke 23 fast on the girder 14, and this pipe 22 may come from any suitable source of water supply under pressure.

Fast upon the cylinder 3 is one end of a horizontally projecting crane arm 24 which may be made up of two parallel channel irons 25, 25, extending from the head 26 fast on the cylinder 3, and secured together in spaced relation by cross beams 27 wherever necessary.

Mounted upon the arm 24 at a suitable point, say by means of a support 28, is a three-way valve 29 of any ordinary construction and so small it is simply indicated in the drawings without any attempt to show the detail construction. From the valve 29 extend three pipes 30, 31 and 32. The pipe 30 leads to the interior of the tubular post 13. The pipe 31 leads to the interior of the cylinder 9 and the pipe 32 leads to the interior of the cylinder 3 above the post or standard 1.

If water under pressure coming through the pipe 22 and entering the pipe 19 is directed by the valve 29 into the upper end of the cylinder 3 through the pipe 32, then the reaction between the cap-plate 7 and the top of the post 1 will cause the cylinder 3 and parts carried thereby, including the crane-arm 24, to be lifted vertically, and this vertical movement will continue until the valve 29 is turned to the inactive position where no more water may enter the cylinder 3. When it is desired to cause the crane-arm to descend, then the valve 29 is moved to a position whereby the cylinder 3 and the inside of the post 13 are placed in communication, when the water from the cylinder 3 will escape through the perforated upper end of the pipe 13 into the cylinder 15 out of which latter it may flow through an exhaust pipe 33, shown in Fig. 3. As the water flows out the crane arm will gravitate to the desired position, when the outflow of water may be stopped by moving the valve 29 to the proper cut-off position.

Extending laterally from one side of one of the channel beams 25 is a platform 34 upon which there are mounted in a suitable framework 35 a series of manipulating levers 36. One of these levers is connected by a link 37 to a bell-crank 38 which in turn is connected by another link 39 to the handle 40 of the valve 29. This connection between the respective lever 36 and valve 29 is to be taken as merely illustrative, since any desired connection may be employed and may be changed to suit the particular conditions present in the crane when modified to suit different locations. Mounted upon the platform 34 in suitable relation to the levers 36 is an operator's seat 41.

Carried by the platform 34 by a number of standards 42 upon the ends of which are secured electric controllers 43, are the levers 44 each of which is connected by a link 45 to a respective manipulating lever 36. These controllers may be of any ordinary type used

for the proper control of electric motors and so simply indicated in the drawings without any attempt to show their working parts.

Mounted on the cylinder 3 is a gear wheel 46 with which meshes a pinion 47 upon an upright shaft 48 journaled in suitable bearings 49 on one of the channel beams and at the end of a post 50. The upper end of the shaft 48 carries a bevel pinion 51 meshing with another bevel pinion 52 on an electric motor 53, which is assumed to be coupled up by a sufficient source of power to one of the controllers 43. The electrical connections are of the simplest kind and being readily apparent to the electrical engineer they have been omitted from the drawings as unnecessary to the understanding of the present invention. Nor is it necessary that the exact arrangement of the motor 53 and gear-wheel 46 with the intermediate parts should be as indicated in the drawings, it only being necessary that the motor should be so coupled up to the cylinder 3 that when the motor is energized the crane arm 24 will be swung about a vertical axis. The gear wheel 46 is not fast on the cylinder 3 but simply mounted thereon and is held against rotation by a pin or post 54 which may be suitably fixed to the base 2 or other removable structure and extends through the gear wheel 46. The gear-wheel being held against rotation the motor will then cause the swinging of the crane arm around the post 1 as a pivot.

Carried by the outer ends of the channel irons 25 is a slidable carriage 55, which as best shown in Fig. 9 may be made of two L-irons 56 joined by a cross plate 57. Above the L-irons are wearing strips 58 so that the carriage will fit snugly yet easily within the channel irons 25 for longitudinal movement therein. The carriage 55 is provided near one end with a longitudinal central slot 59, at one end of which is formed an abutment 60 fixed to the plate 57 and at the other end the entire abutment 61 may be made up of two plates engaging the opposite sides of the plate 57 and held together by a bolt 62 so that this last-named abutment 61 may be adjusted longitudinally with reference to the slot 59. Between the abutment 60 and the other end of the carriage are perforations 63 through the plate 57, one for the reception of a pin block 64 and the other for the reception of a perforated block 65. Each of these blocks are of sufficient length to extend a distance below the plate 57, and each is provided with an annular flange 66 normally resting on the upper face of the plate 57. The purpose of these two blocks will appear hereinafter.

The carriage 55 has fast to its rear end a screw rod 67 extending through a nut 68 mounted between two ears 69 rising from a cross piece 70 fast to the two channel irons 25. The nut 68 is formed with exterior gear teeth 71 engaged by a pinion 72 on one end of the shaft 73 journaled in suitable cross pieces 74 joining the channel irons 25 on their upper faces. The end of the shaft 73 remote from the pinion 72 carries another pinion 75 meshing with a pinion 76 on the armature shaft of the motor 77 mounted on a suitable cross piece 78 adjacent to the head 26 of the crane arm. The motor 77 is coupled up to one of the controllers 43. The channel irons 25 are connected beyond the cross pieces 74 by other similar cross pieces 79, 80.

Mounted in sliding bearings in one of the cross pieces 74 and in the cross pieces 79 and 80, and capable of moving in the central longitudinal plane of the crane arm is a rectangular bar 81, although the bar may be otherwise shaped if so desired, it being, however, important that the bar should not turn on its longitudinal axis. This bar terminates beyond the cross piece 80 in a socket head 82, one member of which has a laterally-extending ear 83 to which reference will presently be made. The bar 81 carries between the cross pieces 74 and 79 a laterally-extending block 84 in which is formed an internally threaded passage for the reception of a threaded rod 85 journaled at each end in the cross pieces 74 and 79 and extending beyond the said cross piece 74 toward the other cross piece 74, where it is also journaled. Between the two cross pieces 74 the rod is reversely threaded from that portion engaging the block 84, as indicated at 86, and this reversely threaded portion extends through an internally threaded block 87 fast on the end of a sliding bar 88 of rectangular or other suitable shape mounted to slide in suitable bearings in the cross piece 79 and adjacent cross piece 74. The bar 88 is parallel to the bar 81 and its outer end 89 beyond the cross piece 79 is turned outward and is there secured to another bar 90 parallel with the bar 81 but spaced therefrom to a greater extent than is the bar 88. The bar 89 is also preferably rectangular in cross section and has a sliding bearing in the cross piece 80, which is extended laterally to one side of the corresponding channel iron 25 for the purpose of supporting the bar 90. The outer end of the bar 90 is appropriately curved and bent to form a jaw 91 opposed to the head or jaw 82 on the end of the bar 81. The two jaws 82 and 91 constitute the clamping and holding means for a bloom which is simply indicated at 92. The jaw 91 has its free end extended laterally, as shown at 93, and there formed with a conical tooth 94.

Mounted at one end in the ear 83 is a shaft 95 having a spur head 96 beyond the ear 83 in line with the tooth 94. This shaft is continued backward parallel with the bar 81 and extends through a collar 97 journaled in the

cross piece 79. The shaft 95 is provided with an elongated spline 98 whereby the shaft is capable of sliding movement through the collar 97 but is constrained to rotate with said collar. The collar 97 carries a gear wheel 99 meshing with a pinion 100 on the armature shaft of a motor 101 suitably mounted on the adjacent channel beam 25. This motor is coupled up to one of the controllers 43. The screw rod 85 beyond its journal bearing in the cross piece 74 nearest to the pivot end of the crane arm carries a pinion 102 meshing with another pinion 103 on the armature shaft of a motor 104 suitably mounted on the cross piece 78 and which is under the control of one of the controllers 43. The cross pieces 79 and 80 each carry uprights or standards 105 and 106, respectively, and in the upper ends of these two standards is journaled a shaft 107 best shown in Figs. 6, 7 and 8, and this shaft between its journal bearings carries a gear wheel 108 meshing with a pinion 109 on the arm shaft of the motor 110 suitably supported on a post 111 fast on one of the journal beams 25. The outer ends of the shaft 107 carry worms 112 in suitable housings 113 on top of the standards 105, 106. The worms 112 each engage a worm-gear 114 on an upright vertical shaft 115 extending downward to a journal bearing in the corresponding cross piece 79 or 80. Below the worm-gear 114 the shaft 115 is threaded and passes through a suitably threaded perforation in a block 116 sliding in channels 117, 118, on opposite sides of the standards 105 or 106. The blocks 116 are formed with sliding bearings for a bar 119 immediately over the clamp bar 81. This bar 119 has its outer end formed into an eye 120 for the reception of a punch block 121 formed with a suitable head resting on the eye and with an extension 122 constituting the punch end of the block. Between the standards 105 and 106 the bar 119 is provided with a downwardly-extending arm 123 reaching into the slot 59 of the plate 57 and in the path of the abutments 60 and 61. This arm 123 is also slotted, as indicated at 124 for the passage of the bar 81, the said arm straddling the bar 81.

The outer or free end of the arm 24 is supported by brace rods 125 extending to a collar 126 fast on the tubular post 13.

Let it now be supposed that it is desirable to operate the crane for the purpose of carrying a bloom from one hammer to another hammer, the anvil 127 and hammer head 128 of which is diagrammatically represented in Figs. 6 and 7. For this purpose the operator upon the seat 41 will manipulate the proper levers 36 to withdraw the carriage 55 to its fullest extent into the swinging arm of the crane. When this occurs the abutment 60 engages the arm 124 on the bar 119 and withdraws the eye 120 until in engagement with the standard 106. The motor 110 is energized in the proper manner to cause the bar 119 to be lifted to its fullest extent carrying the block 120 with it. The motor 104 is also energized to cause the intermediate jaws 82 and 91 to open to the requisite extent. Now, the motor 53 is energized to cause the crane to swing about its pivot support until in proper relation to the hammer, and a bloom brought out from the furnace is then moved between the jaws 82 and 91 and the motor 104 is caused to be actuated in a suitable manner to bring the jaws toward each other and so properly grasp the bloom 92. Either before or after this has occurred, the valve 29 has been so manipulated as to cause the crane arm to be lifted to the proper elevation. Now the carriage 55 is moved outwardly until the block 64 or 65 is brought immediately under the bloom and because of the engagement of the arm 123 with the abutment 61 the block 121 is moved into coincidence with the block 65, if that be the block then under the bloom. If it be desired that the block 64 be the active block, then the carriage is moved backward until the said block 64 is directly under the bloom, the other block 121 remaining quiescent because of the slot 59 in the carriage 55 permitting said carriage to move without engaging the arm 123. The crane is swung around by the action of the motor 53 until the desired block 64 or 65 is immediately over the anvil 127 of the steam hammer. Now, the crane arm is permitted to drop until the block 65, if that be the active block, is engaged by the anvil 127 and pushed upward above its seat on the carriage. The rod 119 is now lowered by the action of the motor 110 until the active end of the block 121 is resting on the bloom and the eye 120 is just above the bloom. If it be designed to punch a hole in the bloom then the steam hammer is brought down with the requisite force upon the block 121 and the end 122 will punch a hole through the bloom, the block 65 acting as a die, it also being assumed that the bloom is not too thick. When the block 64 is utilized then the bloom is entered from both directions toward the center when the steam hammer is brought into operation.

Suppose, now, that it be desirable to turn the bloom over either partially or wholly, then in order that the bloom may be grasped by a suitable crane or by the withdrawal of the carriage and parts acting in conjunction therewith the bloom may be permitted to rest upon the anvil of the steam hammer. When the bloom is properly supported the jaws 82 and 91 are moved apart and the crane arm is swung to one side until the tooth 93 and center 96 are in diametric relation to the bloom, when its jaws may be again brought together until the tooth 93 engages one side of the bloom and the spur cen-

ter 96 engages the other side of the bloom. Now, the crane arm is elevated sufficiently and the motor 101 is put into motion causing the bloom to rotate because of the rotation of the spur center 96. After the bloom has been turned to the proper extent it may be again grasped by the jaws 82 and 91, as before, and further operation be performed upon the bloom, as desired.

It will be seen that with a structure such as described a bloom may be carried from the furnace to the steam hammer and brought by the latter, as designed, with all the operations, so far as the crane is concerned, under the control of one operator.

Since the jaw 91 is of considerable length it is liable to spring between the bearings in the cross pieces 79 and 80, and for this reason the lateral extension 89 has fast thereon a downwardly-directed member 129, which member is again extended horizontally, as shown at 130, and moves in guideways 131 fast on the corresponding channel 25.

It is advisable that the operator should have some means of determining the exact position of the blocks 64 and 65. For this reason there is formed on the under side of the carriage 55 two teeth 132, 133. In the path of these teeth is a pivoted hook 134 fast in the fixed portion of the crane arm, and this hook is under the control of the pivoted pawl 135 connected by a link 136 to a bell-crank 137 and the latter is connected by a link 138 to a presser head 139 within reach of the foot of the operator seated in the seat 41. When the operator's foot is pressed upon the head 139 then the hook 134 is moved upward into the path of one of the teeth 132 or 133. If the carriage be in its retracted position then the hook will engage the tooth 133 and stop the carriage when the block 64 has reached the operative position. If the operator desires to stop the carriage when the block 65 has reached the operative position, then the hook 134 is moved into position and into the path of the tooth 132 after the tooth 133 has moved beyond operative relation to the hook 134.

What is claimed is:—

1. A foundry crane movable about a vertical axis in a horizontal plane and also movable bodily in a vertical plane, said crane being provided with clamping jaws, tool holders above and below said jaws and movable into and out of operative relation thereto, said tool holders and jaws being carried by the crane.

2. A foundry crane provided with oppositely movable clamping jaws and means for actuating the same, a tool carriage movable under different operative positions with relation to the jaws, and means for operating said carriage, and another tool carrier movable to and from the carriage, and means for operating said tool carrier, all the parts being carried upon the swinging arm of the crane.

3. A foundry crane having its swinging arm provided with clamping jaws, and a tool carriage movable into and out of operative relation to the jaws.

4. In a foundry crane, a longitudinally-movable carriage mounted upon the swinging arm of the crane, said carriage being provided with receptacles for suitable tools, and another carrier also mounted upon the swinging arm of the crane and provided with means for the reception of a suitable tool, said last-named carrier being movable longitudinally by engagement with the carriage, and the carriage also having an extended movement without engaging said tool carrier.

5. In a foundry crane, a swinging arm formed with sides made of channel irons, a carriage mounted in said channel irons and movable longitudinally therein, said carriage being provided with means for the support of suitable tools, and means for moving said carriage longitudinally in said channel irons, said means also being carried upon the swinging arm of the crane.

6. In a foundry crane, a swinging arm movable on a vertical axis and also movable in a vertical direction, and a carriage movable longitudinally with reference to the swinging arm and mounted therein, said carriage being provided with holders for suitable tools.

7. In a foundry crane, a swinging arm movable vertically and also about a vertical axis in a horizontal plane, a carriage on said arm movable longitudinally with reference to the same, a tool holder movable longitudinally in said arm and also to and from the carriage, and clamping jaws also on the swinging arm and positioned between the longitudinally-movable carriage and the tool carrier.

8. In a foundry crane, clamping jaws movable to and from each other, and clamping means carried by the jaws and capable of imparting a rotative movement to the bloom engaged by said clamping means.

9. In a foundry crane, means for clamping and rotating a bloom upon a horizontal axis and mechanical means by the crane arm for effecting the rotative movement of the bloom.

10. In a foundry crane, a pair of clamp jaws one provided with a suitable tooth and the other provided with a rotatable center in operative relation to the tooth, and means for rotating said center.

11. In a foundry crane, a pair of jaws movable to and from each other, one of said jaws being provided with a central tooth and the other with a rotatable center in operation with the tooth and the first-named jaw, a shaft carrying the rotatable center and mov-

able with the corresponding jaw, and means on the crane for imparting rotative movement to the shaft without interference of the clamping movement of the jaws.

12. In a foundry crane, a crane arm, a tool carriage mounted on the movable crane arm and movable longitudinally with reference to said arm, and another tool carrier mounted on and movable longitudinally with reference to said arm and also movable to and from the first-named tool carriage.

13. In a foundry crane, a crane arm, a tool carriage mounted thereon and movable longitudinally with reference to the crane arm, said tool carriage being provided with a longitudinal slot, and a tool carrier also mounted on the crane arm and provided with an arm extending into the slot in the tool carriage.

14. In a foundry crane, a crane arm, a tool carriage movable longitudinally with reference to said arm and provided with a longitudinal slot, a tool carrier also mounted on said crane arm and provided with an arm extending into the slot in the tool carriage, and means for moving the tool carrier to and from the tool carriage.

15. In a foundry crane, a crane arm, a tool carriage mounted on and movable longitudinally with reference to said crane arm, said carriage being provided with a longitudinal slot, movable clamp jaws mounted on said crane arm above the carriage, and a tool carrier also mounted on said crane arm and movable to and from the tool carriage, said tool carrier being provided with an arm entering the slot in the tool carriage.

16. A foundry crane provided with a swinging arm movable about a vertical axis, means carried by said arm for causing the arm to swing about its vertical axis, means for raising and lowering the arm in a vertical plane, controlling means on the arm for regulating the means for raising and lowering said arm, a tool carriage on and movable longitudinally with reference to said crane arm, means on said crane arm for causing the longitudinal movement of the tool carriage, a clamp on said crane arm, means for actuating said clamp carried by said crane arm, a tool carrier on the crane arm, connections between the tool carrier and the tool carriage for moving the carrier longitudinally of the arm by the movement of said carriage, means on the crane arm for moving the tool carrier to and from the tool carriage, and means within a circumscribed zone on the crane arm for controlling the movements of the several mechanisms carried by the crane arm.

17. A foundry crane provided with a swinging arm movable about a vertical axis, means carried by said arm for causing the arm to swing about its vertical axis, means for raising and lowering the arm in a vertical plane, controlling means on the arm for regulating the means for raising and lowering said arm, a tool carriage on and movable longitudinally with reference to said crane arm, means on said crane arm for causing the longitudinal movement of the tool carriage, a clamp on said crane arm, means for actuating said clamp carried by said crane arm, a tool carrier on the crane arm, connections between the tool carrier and the tool carriage for moving the carrier longitudinally of the arm by the movement of said carriage, means on the crane arm for moving the tool carrier to and from the tool carriage, means on the clamp jaws for imparting rotative movement to the bloom carried by the clamp jaws, means for effecting said rotative movement, and means within a circumscribed zone on the crane arm for controlling the movement of the several mechanisms carried by the crane arm.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

FRANCIS B. UNCAPHER.

Witnesses:
JAS. M. WALKER,
F. T. CHAPMAN.