A. SODERSTROM.

FURNACE DRAWING APPARATUS.

APPLICATION FILED SEPT. 17, 1917.

1,334,000.

Patented Mar. 16, 1920.

8 SHEETS—SHEET 1.

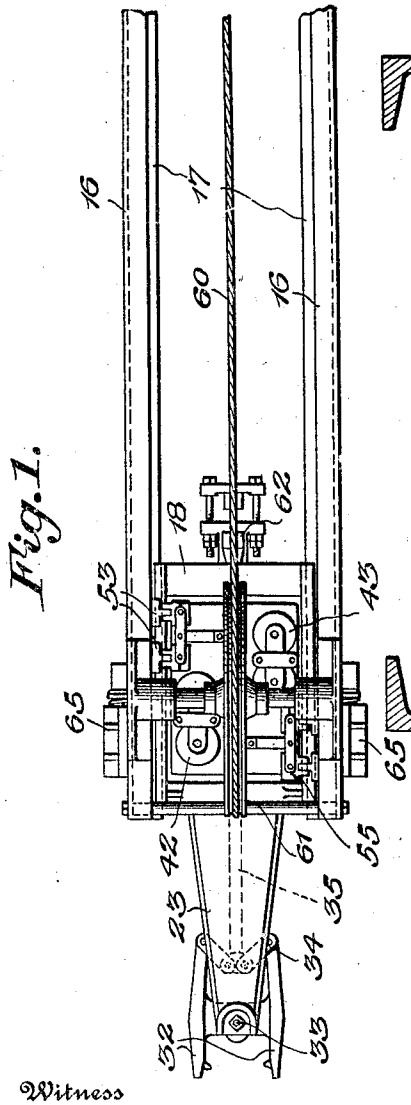


Fig. 1.

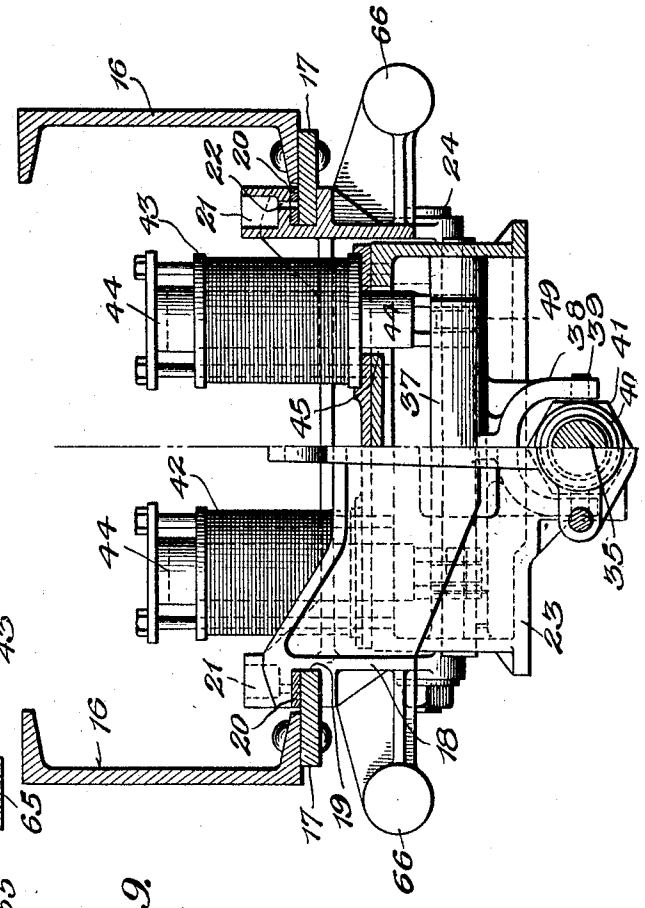


Fig. 2.

Witness

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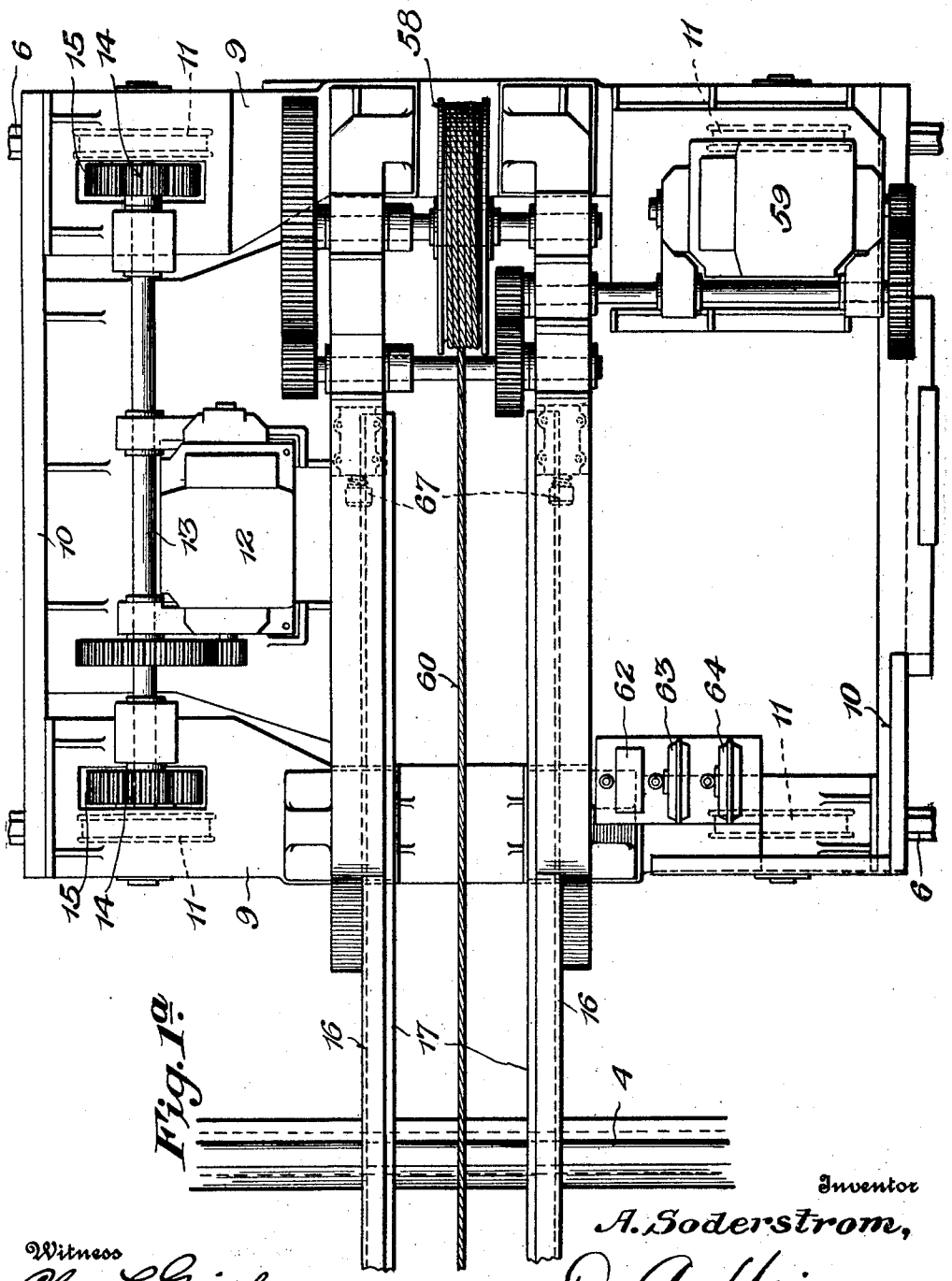


Fig. 1.

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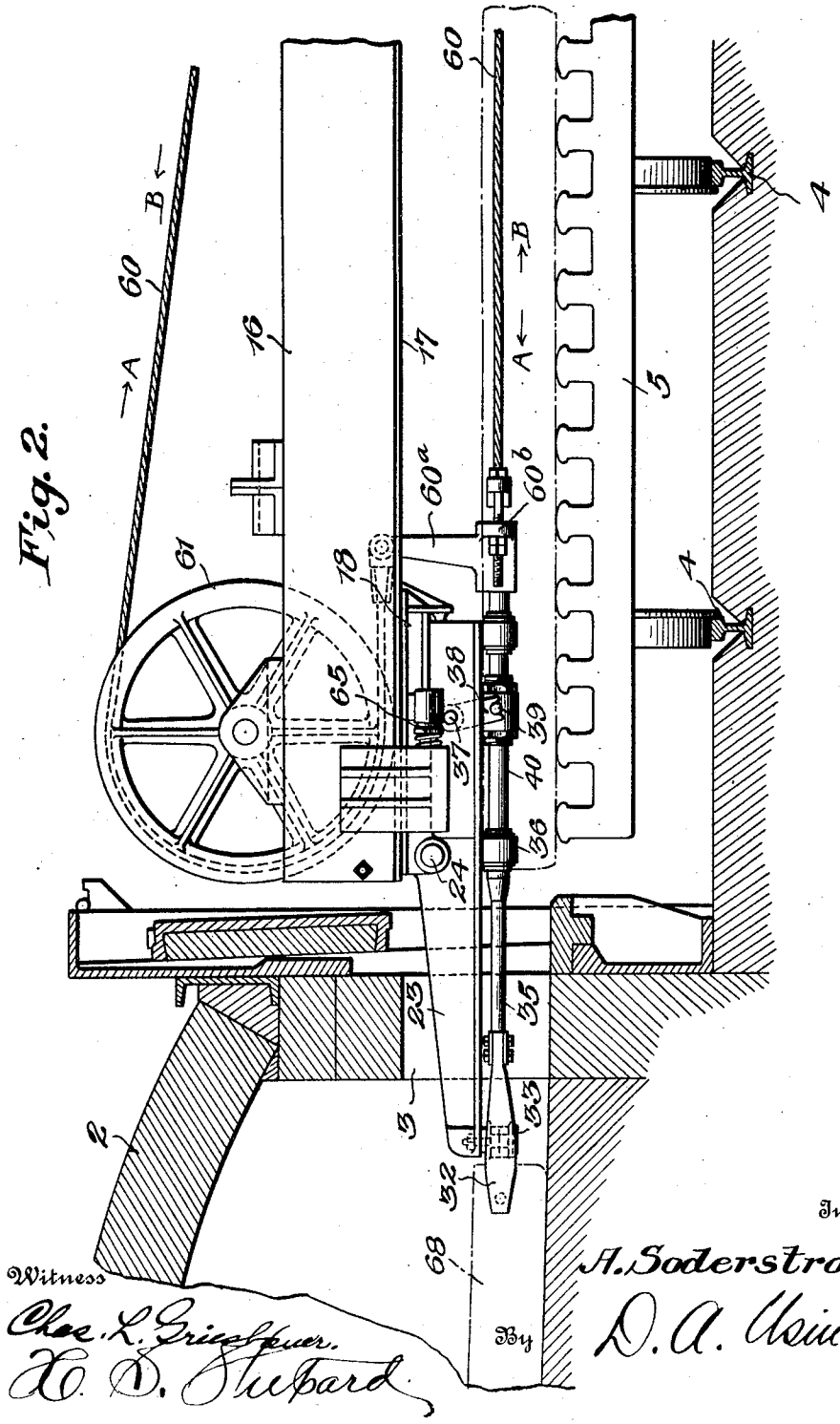
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8 SHEETS—SHEET 3.

Fig. 2.



Witness

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8 SHEETS—SHEET 4.

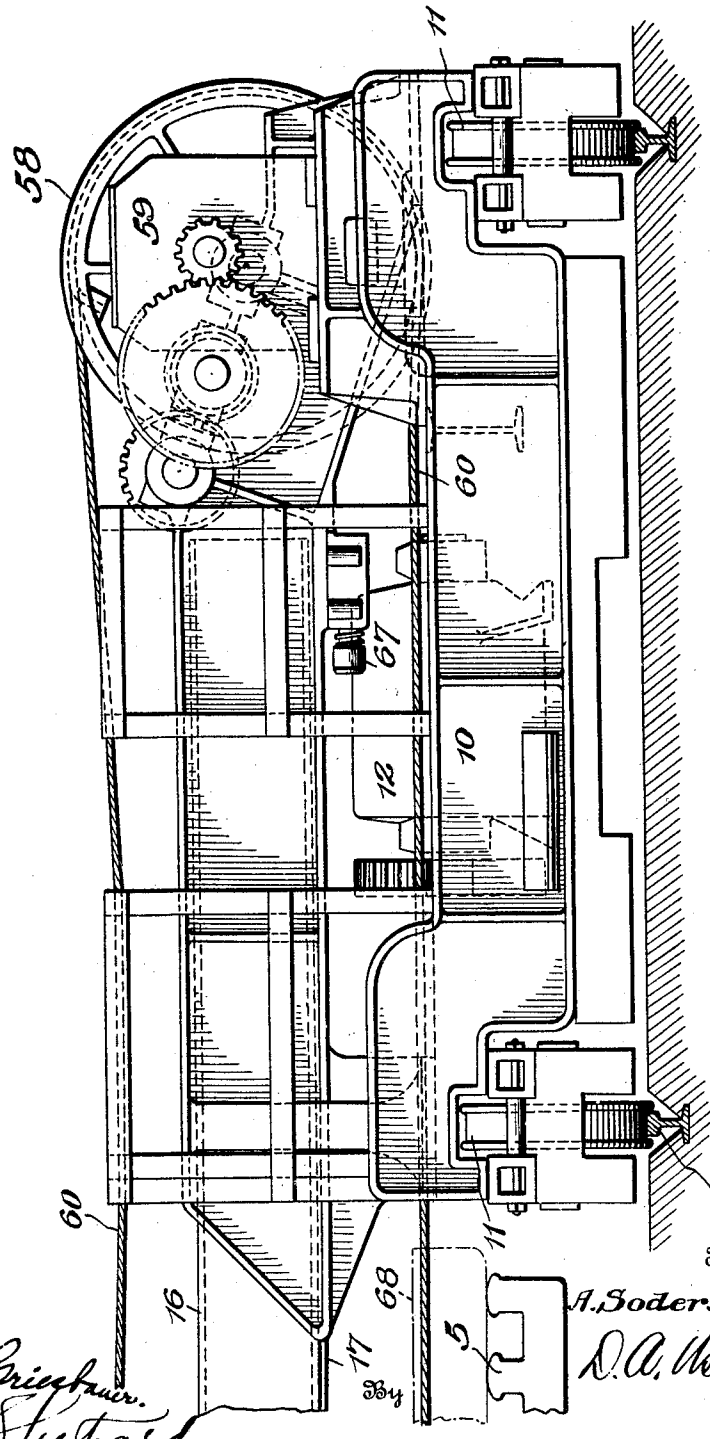


Fig. 2a.

Witness
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8 SHEETS—SHEET 5.

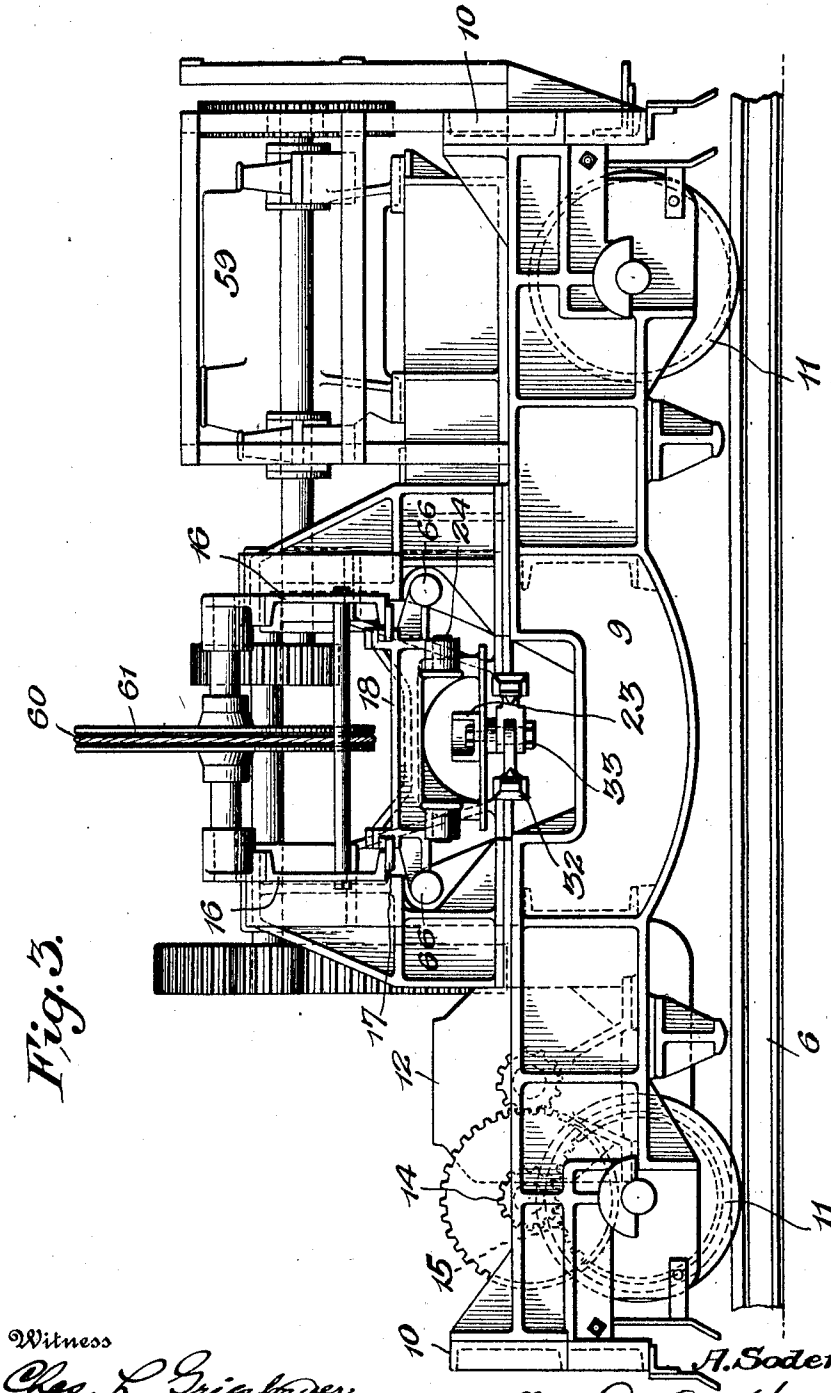


Fig. 5.

Witness

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8 SHEETS—SHEET 6.

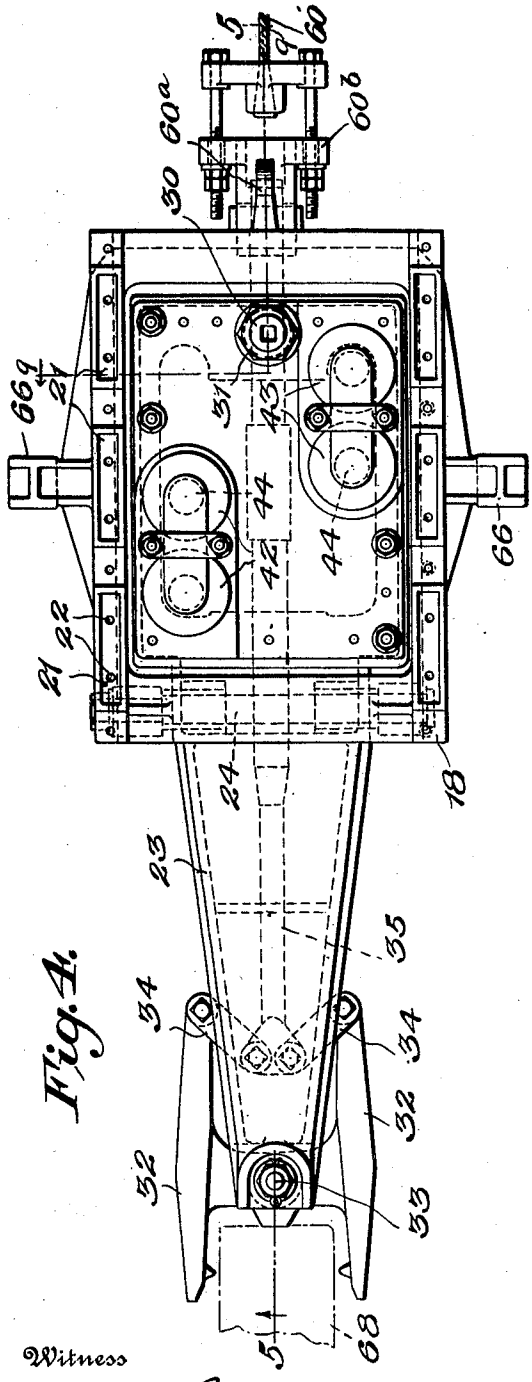


Fig. 4.

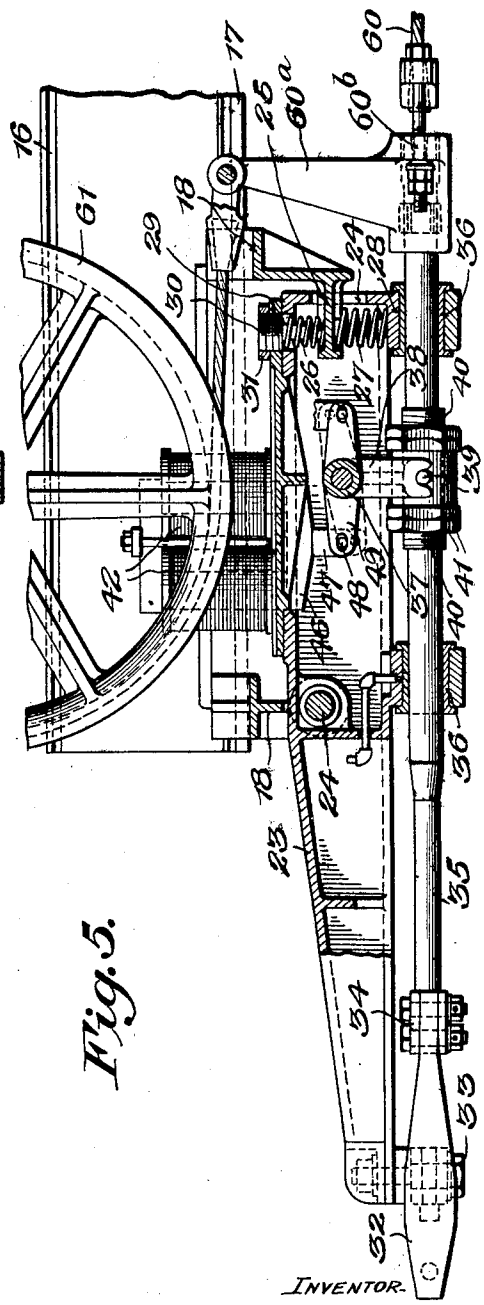


Fig. 5.

Witness

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Fig. 6.

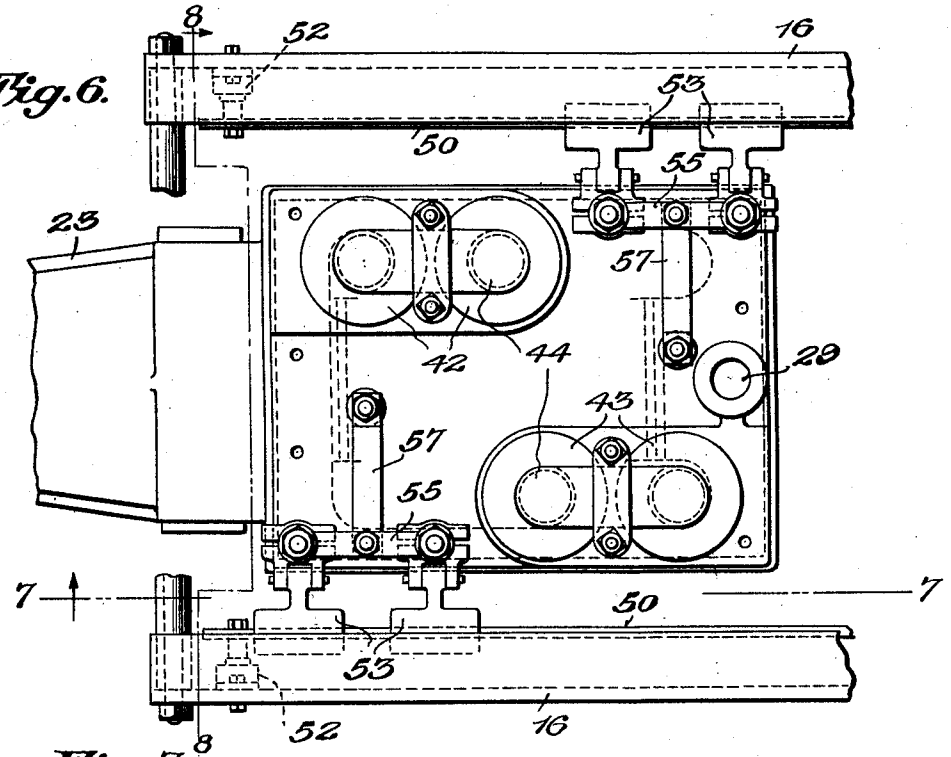
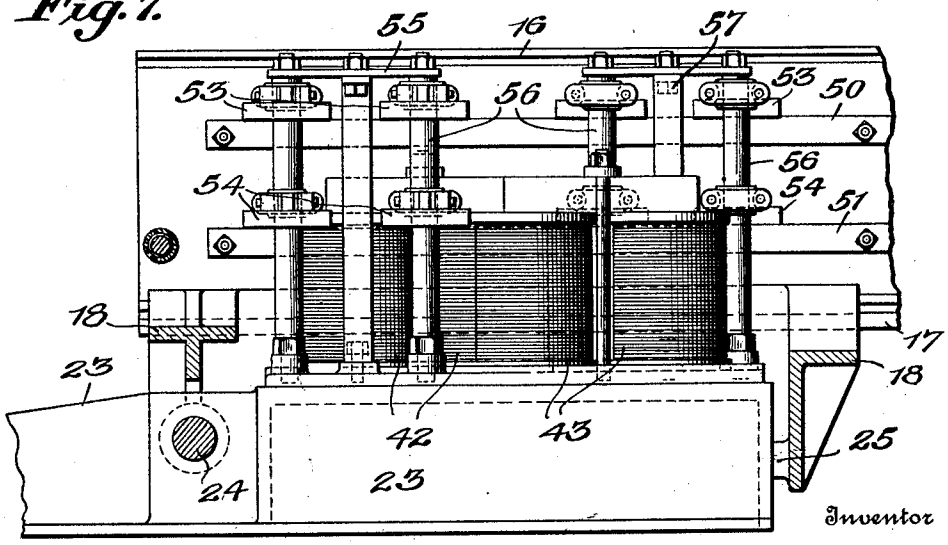


Fig. 7.



Witness

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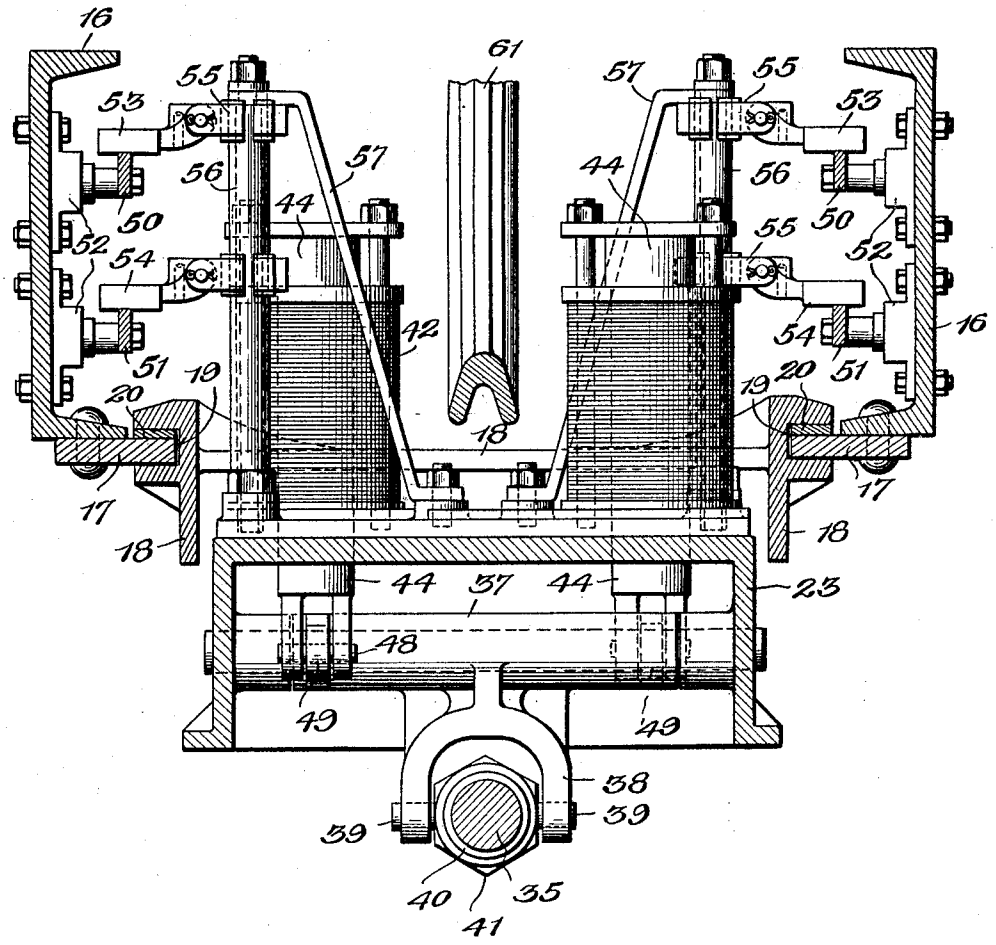
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Patented Mar. 16, 1920.

8 SHEETS—SHEET 8.

Fig. 8.



Witness

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UNITED STATES PATENT OFFICE.

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FURNACE-DRAWING APPARATUS.

1,334,000. Specification of Letters Patent. Patented Mar. 16, 1920.

Application filed September 17, 1917. Serial No. 191,819.

To all whom it may concern:

Be it known that I, ALBERT SODERSTROM, a citizen of the United States, and resident of Homestead, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Furnace-Drawing Apparatus, of which the following is a specification.

This invention relates to apparatus used in withdrawing blooms, billets or other heated metal from heating furnaces preparatory to the rolling operation in which the heated metal is to be rolled into a finished or semi-finished product.

One object of the present invention is to provide a furnace drawing machine with novel means for gripping the heated metal in withdrawing the metal from the heating furnace, and also to provide novel means for actuating the gripping mechanism in engaging and releasing the metal.

The means preferably employed for gripping the heated metal is a pair of tongs, and it is a further object of the present invention to provide novel means for connecting the tongs with the tongs-actuating means so as to obtain a positive and efficient opening and closing of the jaws of the tongs, and to hold the tongs in open or in closed position when found desirable or necessary.

It is a common practice to have the furnace floor inclined downwardly from the charging opening to the withdrawing opening, and in that type of drawing apparatus which provides for moving the gripping mechanism in a horizontal plane only, the major portion of the weight of the heated metal is sustained by the drawing mechanism, because the forward portion of the heated metal is not supported by the inclined floor of the furnace as the metal is being drawn out of the furnace. In view of this objection, it is an important object of the present invention to provide for relieving the drawing apparatus of the weight of the metal as it is being withdrawn from the furnace. This object is accomplished by a mounting of the gripping mechanism so that it may move downwardly with the billet as the latter travels along and remains on the inclined floor of the furnace.

A still further object of the invention is the provision of a furnace drawing machine having the novel constructions, combinations, and arrangements of parts shown in the accompanying drawings, hereinafter fully described, and particularly pointed out in the appended claims, it of course being understood that various changes may be made, within the scope of the appended claims without departing from the spirit or sacrificing any of the advantages of the invention.

Figure 1 is a plan showing the front or tongs end of a furnace drawing machine embodying the novel features of my invention.

Fig. 1ª is a similar plan showing the rear end of the furnace drawing machine.

Fig. 2 is a side elevation on a larger scale of the part of the apparatus shown in Fig. 1.

Fig. 2ª is a side elevation showing on a larger scale that part of the apparatus illustrated in Fig. 1ª.

Fig. 3 is an end elevation of the apparatus viewed from the front or tongs end thereof.

Fig. 4 is a detail plan showing the tongs and tongs operating mechanism.

Fig. 5 is a side elevation, partly in section, of the apparatus illustrated in Fig. 4.

Fig. 6 is a plan showing details in the construction of the electro-magnets used in opening and closing the tongs.

Fig. 7 is a sectional side elevation of the apparatus shown in Fig. 6, the section being taken on the line 7—7 of Fig. 6.

Fig. 8 is a sectional elevation of the apparatus illustrated in Figs. 6 and 7, the section being taken on the line 8—8 of Fig. 6.

Fig. 9 is an end elevation, partly in section, of the apparatus shown in Figs. 4 and 5, the section being taken on the irregular line 9—9 of Fig. 4.

The present invention is primarily designed for withdrawing billets and the like from a heating furnace, a conventional type of which has been shown in Fig. 2 of the drawings, wherein 2 designates a horizontal heating furnace having a series of discharging or drawing openings in the opposite walls, each charging opening being in alinement with a drawing opening, as is common in this type of furnace. The drawing side only of the furnace has been shown in Fig. 2, and a single drawing opening is shown at 3.

On that side of the furnace which has a drawing opening or openings, there is a delivery track 4 disposed parallel with respect to the drawing side of the furnace and extending across the entire series of furnaces.

On this track is a wheeled transfer car 5, on which the heated billet is supported while being carried from the furnace or furnaces to the reducing rolls where the metal is to be rolled into a different form, or to some other place of use.

Disposed in parallelism with the delivery track 4 is a drawing machine track 6, the parallel relation being shown in Figs. 1ª and 2ª of the drawings. On this drawing machine track 6 is mounted the truck which carries the drawing machine embodying the features of the present invention.

The truck for supporting the operating parts of the present drawing machine includes side girders 9 and end girders 10. Flanged track wheels 11 support the truck and travel on the track 6. One set of these track wheels 11 is driven by an electric motor 12, which is suitably geared to the countershaft 13, and the latter being geared to each of the adjacent flanged wheels 11 by suitable gearing, such for instance as shown in Figs. 1ª and 3, wherein 14 designates a pinion on the shaft 13, and 15 designates a gear associated with the flanged track wheel 11. The electric motor 12 is a reversing motor so that the truck may be moved in either direction upon the track 6.

Inasmuch as the furnace drawing truck is located remote from the drawing side of the furnace or furnaces, and as it is necessary to reach into the furnace and grip the heated metal in order to draw the latter out of the furnace, the tongs or metal gripping mechanism is mounted to travel upon a jib or guideway, preferably made up of spaced channel beams 16 suitably secured across the top of the truck at the middle thereof and extending laterally therefrom almost to the furnace, and at a height to overhang the track 4 on which is mounted the transfer car 5. As best shown in Fig. 8, it will be seen that the channels 16 have their webs vertical and their flanges extending inwardly, the lower flanges constituting a track, or to be more correct, a support for track rails 17, on which the tongs and their controlling means are mounted so as to travel back and forth in a direction toward and away from the drawing opening of the furnace.

The tongs carriage consists preferably of a rectangular open frame 18, best shown in Fig. 4 of the drawings, which frame is of a size to fit between the channels 16, and is provided at each of its longitudinal sides with a groove or guideway 19 which receives the adjacent track 17, whereby the carriage is supported upon the jib and may slide back and forth on the track members 17. If desired, a removable liner or wear plate 20 may be provided upon the upper side of the groove or guideway 19, and the carriage may be provided with one or more oil pockets 21 having outlet openings 22 extending through the bottoms thereof and through the wear plates 20 so as to provide for effectively lubricating the track on which the tongs carriage reciprocates. A tongs supporting arm 23 underlies the carriage and extends a suitable distance in front thereof. This arm is mounted to rock or tilt vertically upon a transverse shaft 24 located across the front of the tongs carriage and about midway of the length of the arm. The arm is in the form of a hollow ribbed casting and is provided at its rear end with a horizontal opening 24 to accommodate a horizontal abutment 25 extending forwardly from the rear end of the tongs carriage 18. Buffer springs 26 and 27 are provided above and below the abutment 25 so as to cushion the tilting movement of the arm 23. The lower spring 27 bears at its lower end against an abutment 28 extending forwardly from the rear end of the arm 23.

The upper spring 26 extends through an opening 29 in the top of the arm and engages the vertically adjustable abutment 30 in the form of a screw plug fitting in the threaded portion of the opening 29 and provided with a lock nut 31, whereby the tension of the upper spring 26 may be adjusted. By reference to Fig. 4 of the drawings, it will be seen that the threaded abutment 30 is provided in its top with a wrench seat for convenience in turning the abutment.

The jaws 32 of the arms are pivoted intermediate of their ends, as at 33, upon the under side and at the forward end of the arm 23, the forward gripping ends of the jaws projecting a suitable distance in front of the arm. At their rear ends, the jaws are connected by suitable toggle levers 34 which are in turn pivotally connected at the front end of the thrust bar 35, which is mounted to reciprocate in suitable bearings 36 provided on the under side of the arm 23 and located beneath the tongs carriage. It will be quite apparent that a forward movement of the bar 35 will separate the forward ends of the jaws 32, while a rearward movement of the bar will force said ends of the jaws together, thereby providing for releasing and gripping the metal which is to be hauled by the apparatus.

For moving the thrust bar 35 back and forth, there is a rock shaft 37 mounted transversely across the under side of the tongs carrying arm 23 and about midway of the length of the tongs carriage. From the middle of this rock shaft there depends a crank arm 38 in the form of a yoke, as best illustrated in Figs. 8 and 9 of the drawings. This yoke straddles the bar 35, and each arm of the yoke engages a pin 39 extending outwardly from the bar 35. It is preferred to mount the pins 39 upon a sleeve 40, capable of adjustment longitudinally upon

the bar 35, and held rigidly in its adjusted position by means of suitable nuts 41 engaging threaded portions on the bar. It is quite apparent that by rocking the shaft 37 the thrust bar 35 may be moved in either direction to open and close the tongs, and that when held against rocking movement, the rock shaft 37 will prevent opening or closing movement of the tongs jaws 32.

An electric control is provided for the rock shaft 37 and includes two pairs of solenoids 42 and 43 mounted on top of that part of the arm 23 which lies beneath the tongs carriage 18. These pairs of solenoids are located at opposite sides of the longitudinal center of the carriage, one pair being at the front and the other at the rear of the carriage. Each solenoid has a core 44 which works through an opening 45 in the top of the tongs arm 23. The lower ends of the cores of each pair of solenoids are connected by a cross head 46 shown in Fig. 5 of the drawings, from which depends an arm 47 having a loose pivotal connection 48 with a crank arm 49 extending laterally from the rock shaft 37. As one set of solenoids is located at one side of the rock shaft 37, and the other pair of solenoids is located at the other side of the rock shaft 37, it will be seen that by energizing one pair of solenoids and deënergizing the other pair of solenoids, the rock shaft 37 may be rocked or swung in either direction, and the thrust bar 35 moved forward or back in the bearings 36, as desired, and at any position of the sliding tongs carriage 18 on the jib formed by the beams 16. It also will be apparent that while the solenoids 42 or solenoids 43 are energized, the thrust bar 35 will be held against longitudinal movement in the bearings 36, and that without movement of the bar 35, the tongs will be held in their open or closed position, as the case may be.

For supplying the solenoids with current, upper and lower conductor bars 50 and 51 are provided for each pair of solenoids. Each of these bars is mounted upon the adjacent channel bar 16 by suitable insulated support 52 and extends rearwardly to the wheeled truck 10 where it is connected by a suitable trolley, not shown, to a source of electricity. Traveling upon the conductors 50 and 51 are contacts 53 and 54, respectively, each of which is pivotally connected to a bracket 55 carried by an insulated post 56 rising from the top of the tongs-carrying arm 23. (See Figs. 6 and 7). Appropriate wirings, of course, connect the contacts to the solenoids, such wiring not having been shown, as the specific arrangement thereof does not form part of the present invention. Each post 56 is provided with a suitable brace 57 rising from the top of the arm 23. The purpose of pivoting the traveling contacts 53 and 54 to the brackets 55 is to permit of the up and down movement of the rear end of the arm 23 without breaking the connection between the solenoids and the conductor bars 50 and 51.

For the purpose of moving the tongs-carriage back and forth on the jib formed by the channel bar 16, there is a cable arrangement consisting of a winding drum 58 mounted upon the truck 10 and driven by a suitable electric motor 59. (See Fig. 1[a]). A cable 60 has an intermediate portion wound around this drum. One end portion of the cable extends forwardly and around a sheave or pulley 61 suitably mounted at the forward end of the jib. The extremity of this portion of the cable is connected to the upper end of the vertical arm 60[a] on the rear end of the thrust bar 35, adjacent to the rear portion of the tongs-carriage. (See Figs. 1 and 2). The other end portion of the cable extends forwardly and is adjustably connected to the lugs or ears 60[b] on the arm 60[a] located at the rear portion of the tongs-carriage and, through the medium of the thrust bar, is connected to the tongs-carriage, so that by rotating the winding drum 58 the thrust bar 35 may be moved in its bearings 36 to open or close the tongs without the aid of the solenoids and the carriage may be moved back and forth on the jib.

Suitably located upon the truck 10 is a controller 62 for the solenoid. Another controller 63 is provided for the drum motor 59, while the motor 12 is controlled by a controller 54. These three controllers are mounted on the truck 10 adjacent one another in order to be under the immediate control of the operator.

For the purpose of stopping the movement of the tongs-carriage at each end of the jib, a pair of spring buffers 65 is provided upon the forward end of the jib in the path of rigid bumpers 66 projecting laterally from the frame 18 of the carriage. Other spring buffers are located at the opposite end of the jib, as indicated at 67 so as to stop the carriage at the opposite limit of its movement, the stationary bumpers 66 on the carriage, as well as the spring buffers, underlying the jib 16, as will be readily understood by reference to Figs. 2 and 9 of the drawings.

In operating the present apparatus the solenoids will only be used to open the tongs, the tongs, ordinarily, being closed by the relative movement of the tongs and tongs supporting carriage or frame 18. When found necessary or desirable, however, the solenoids 43 will be used in moving the tongs into closed position.

In the ordinary operation of the apparatus, the controller 63 is set to cause the motor 59 to rotate so as to move the rope or cable 60 in the direction of the arrows A, of

Fig. 1, and such movement of the cable is continued until the tongs are in position within the furnace 2, in readiness to grasp the end of a bloom 69. The controller 63 is then set to reverse the motor 59, and movement of the motor in this direction causes a pull on the rope 60 in the direction of the arrows B of Fig. 1.

At the beginning of the movement of the cable 60 in this direction the thrust bar 35 is caused to move longitudinally in its bearings 36, 36 on the carriage 18, and such movement of the thrust bar relative to the carriage causes the toggle links 34 to close the jaws of the tongs 32 on the bloom 68. Continued movement of the cable 60 in the direction of the arrows B causes the carriage or frame 18 to also move in this direction, so that the bloom 68 is pulled from the furnace.

As the tongs approach the end of this backward movement, and after the heated bloom 68 has cleared the furnace and is in a position above the transfer car 5, the controller 62 is moved into position to energize the solenoids 43. The cores of these solenoids then move the thrust bar 35 forwardly in its bearings 36, 36 so as to open the tongs jaws 32 and release the bloom 69. The movement of the carriage or frame 18 is then continued until the tongs are clear of the end of the bloom 68 which now rests on the transfer car 5.

The transfer car 5 is then moved on its track to deliver the bloom to a feed table or other place of delivery.

When desired, however, the controller 62 is moved from its neutral position into position to energize the solenoids 43, and as when the controller is in this position the solenoids 42 are deënergized, the cores of the solenoids 43 will be thrust downwardly and the shaft 37 will be caused to rock and move the thrust bar 35 forwardly in its bearings 36, and thereby open the tongs jaws 32 into their open position before starting the motor 59 to move the tongs toward the furnace 2.

In such case, the tongs are opened by manipulation of the controller 62 so as to energize the solenoids 43 and deënergize the solenoids 42, whereby the cores of the solenoids 43 will be thrust downwardly and the shaft 37 rocked so as to move the thrust bar 35 forwardly, thereby separating the tongs jaws 32. When this has been done, the controller 53 is manipulated so as to start the motor 59 to move the cable 60 in the direction of the arrows A and move the tongs carriage forwardly and thereby thrust the tongs through the drawing opening 3 of the furnace.

When the tongs have thus been thrust into the furnace astraddle of the heated billet, shown in dotted lines at 68 in Fig. 2 of the drawings, the controller 62 is manipulated to deënergize the solenoids 43 and energize the solenoids 42, thereby to move the thrust bar 35 rearwardly and close the tongs jaws upon the billet, whereupon the controller 63 is manipulated to reverse the motor 59 and thereby move the cable 60 in the direction of the arrows B and move the tongs carriage rearwardly upon the jib 16 to draw the heated billet 68 out of the furnace and onto the transfer car 5. The motor 59 is then stopped and the solenoids 42 are energized which opens the tongs and releases the bloom 68. The backward movement of the carriage and tongs is then continued until the tongs are clear of the end of the bloom.

The transfer car, with the heated billet thereon, may then be run off to any desired point, and the furnace drawing apparatus may be shifted to another drawing opening of the same furnace or to another furnace by manipulating the controller 64 to start the motor 12 which causes the truck 10 to travel on the track 6.

It is customary to have the bottom of a heating furnace inclined downwardly from the charging opening to the drawing opening, and in such drawing apparatus as always maintains the tongs in the same horizontal plane, it is quite apparent that a large portion of the weight of the heated billet is sustained by the drawing apparatus, because the forward end of the billet is moved by the tongs in a horizontal direction and consequently is not supported by the inclined bottom of the furnace. In the present apparatus, the billet 68 is permitted to travel upon and be entirely supported by the inclined bottom of the furnace, for the reason that the tongs carrying arm 23 is permitted to rock or tilt vertically on the shaft 24 under the weight of the billet. When the billet has been drawn out of the furnace and onto the transfer car 5, the jaws of the tongs are released from the billet, and thereupon the tongs carrying arm 23 automatically resumes its normally horizontal position under the influence of the spring 27. The two springs 26 and 27, of course, cushion the arm and prevent any undesirable jar when the arm returns to its normal position.

Having thus described the invention, what I claim, is:—

1. In a furnace drawing apparatus, the combination of a support, a reciprocating carriage mounted to travel thereon, metal gripping mechanism, and means connecting the metal gripping mechanism with the carriage and permitting vertical movement of the metal gripping means under the weight of the metal which is being withdrawn from the furnace.

2. In a furnace drawing apparatus, the

combination of a support, a reciprocating carriage mounted to travel thereon, metal gripping mechanism mounted upon the carriage for vertical movement thereon, and a tension device permitting depression of the metal gripping mechanism under the weight of the metal being handled and also operating to restore the metal gripping mechanism to its normal elevation when released from the metal being handled.

3. In a furnace drawing apparatus, the combination of a reciprocatory carriage, an arm pivoted thereon, metal gripping mechanism carried by the arm, and a tension device yieldably maintaining the arm in its normal position on said carriage.

4. In a furnace drawing apparatus, the combination of a reciprocatory carriage, an arm pivoted to tilt vertically thereon, metal gripping mechanism carried by the arm, and a spring tension device yieldably maintaining the arm in its normal position on said carriage.

5. In a furnace drawing apparatus, the combination of a reciprocable carriage, an arm pivoted at an intermediate point in its length to tilt vertically thereon, metal gripping tongs carried by one end of the arm, and tongs actuating means carried by the opposite end of said arm.

6. In a furnace drawing apparatus, the combination of a carriage, an arm thereon, metal gripping tongs carried by the arm, and tongs actuating means including a thrust bar connected to the tongs and carried by the arm, a rock shaft mounted upon the tongs carrying arm and provided with a crank arm associated with the thrust bar to move the latter endwise, and means mounted on the tongs carrying arm associated with the rock shaft for rocking the latter.

7. In a furnace drawing apparatus, the combination of a carriage, a tongs carrying arm mounted to tilt vertically thereon, metal gripping tongs carried by the arm, a thrust bar carried by the arm and connected to the tongs for actuating the same, a rock shaft carried by the arm and provided with a yoke straddling the thrust bar, a sleeve adjustable longitudinally upon the thrust bar and provided with pins engaging the arms of the yoke, and means carried by the tongs carrying arm for actuating the rock bar.

8. In a furnace drawing apparatus, the combination of a carriage, a tongs carrying arm mounted to tilt vertically thereon, metal gripping tongs carried by the arm, solenoids mounted on the arm and associated with the tongs for opening and closing the same, an electric conductor in parallelism with the path of the carriage, and a vertically movable traveling contact associated with the conductor and the solenoids.

9. In a furnace drawing apparatus, the combination of a wheeled truck, a jib carried thereby, a carriage mounted to travel upon and underlying the jib, a tongs carrying arm hung upon the under side of the carriage and mounted to tilt vertically thereon, metal gripping tongs hung from the arm, means on the arm for opening and closing the tongs, and a tension device yieldably maintaining the tongs carrying arm in its normal position.

10. In a furnace drawing apparatus, the combination of a wheeled truck, a jib carried thereby, a carriage mounted to travel on the jib, metal gripping tongs carried by the carriage, an electrically actuated tongs controlling device upon the carriage, an electric conductor on the jib in parallelism with the path of the carriage, and a traveling contact associated with the conductor and with the electric controlling means.

In testimony whereof I have hereunto set my hand.

ALBERT SODERSTROM.

Witnesses:
L. C. EDGAR,
G. E. F. GRAY.