W. J. MACK.

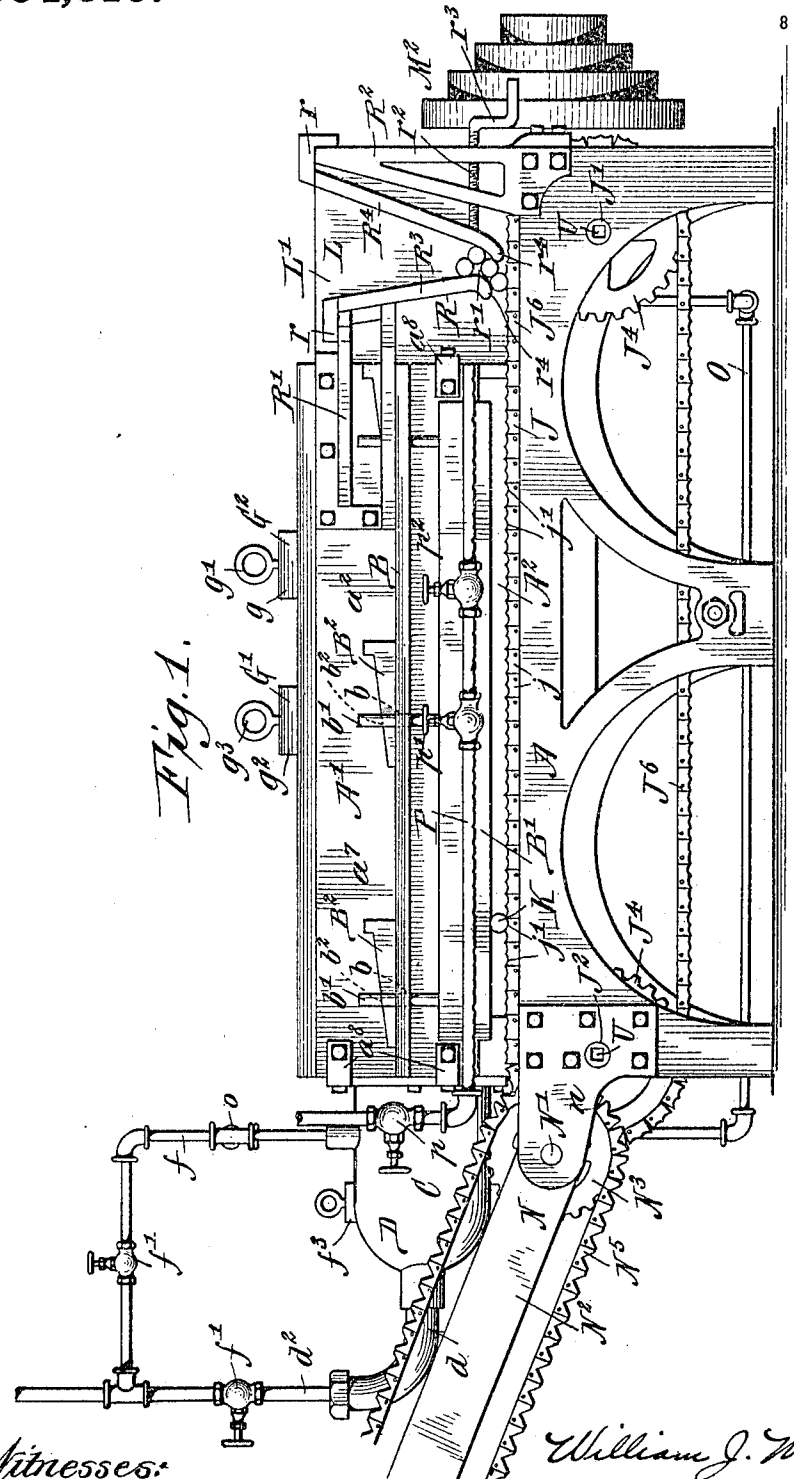
FURNACE FOR HEATING METAL BARS.

APPLICATION FILED APR. 15, 1907.

954,315. Patented Apr. 5, 1910.

8 SHEETS—SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

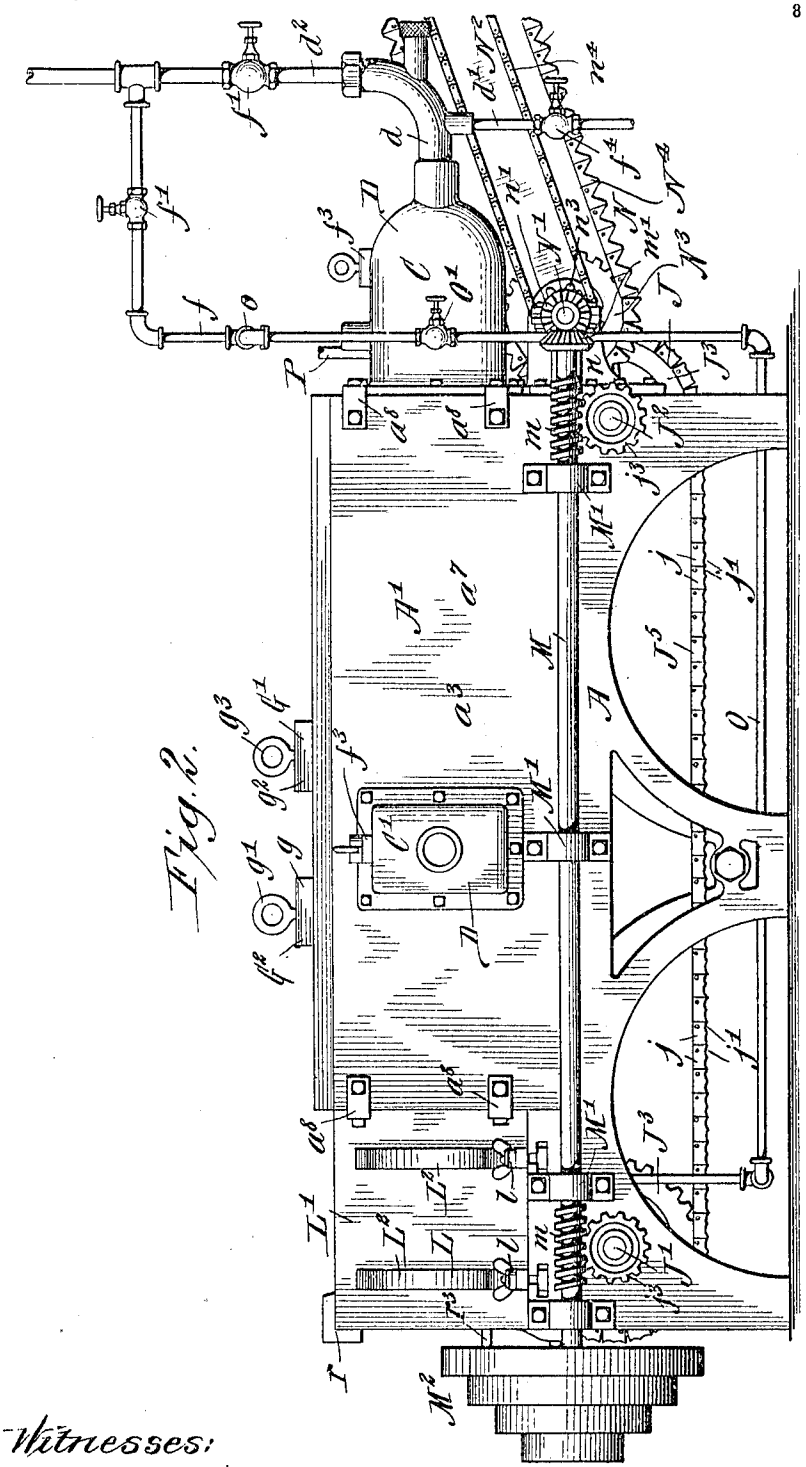

Fig. 2.

Witnesses:
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8 SHEETS—SHEET 3.

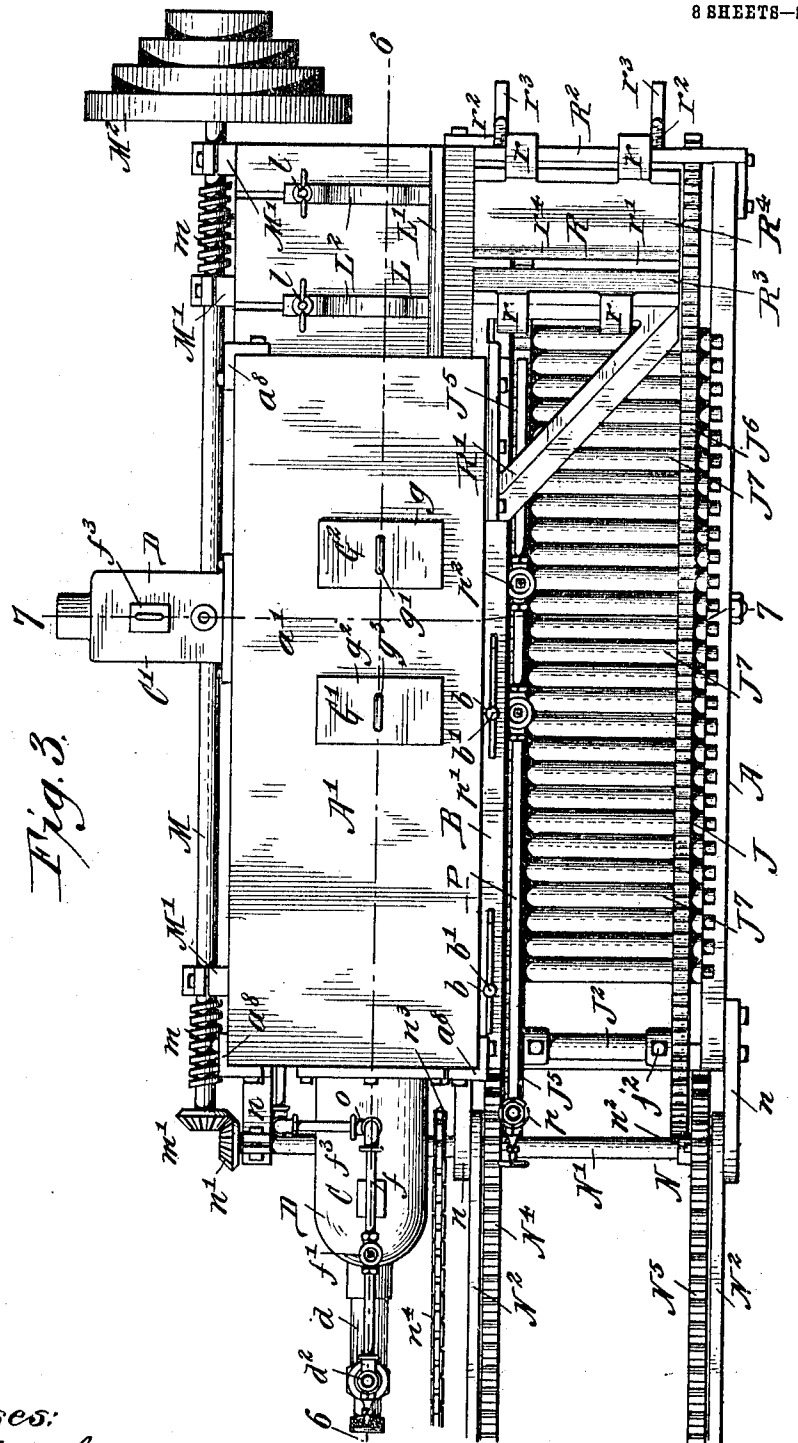

Fig. 3.

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8 SHEETS—SHEET 4.

Fig. 4.

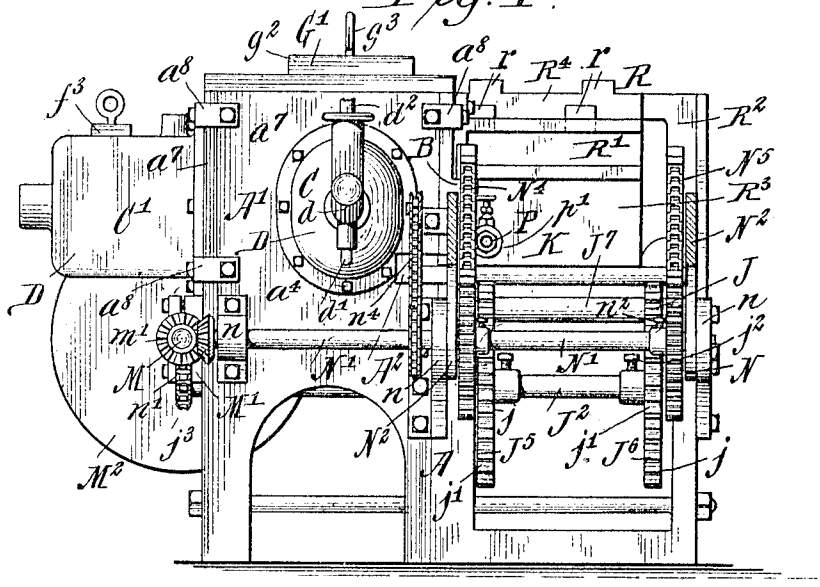
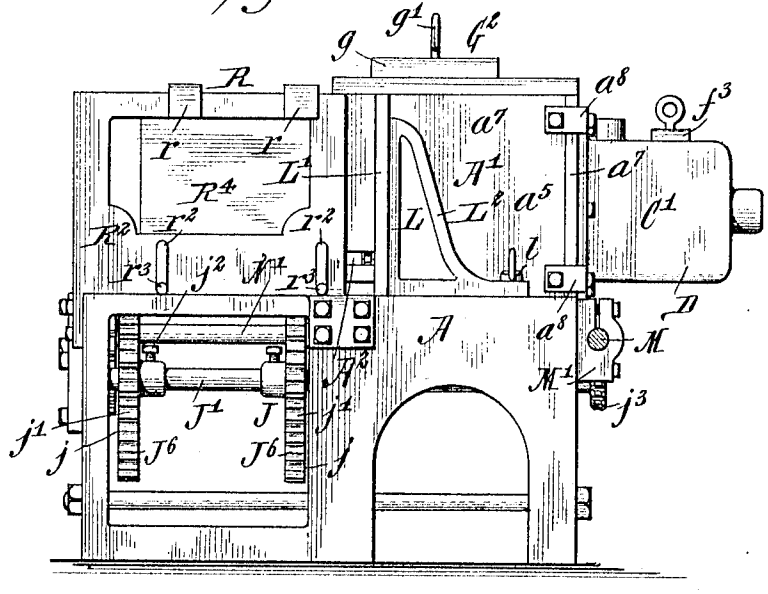


Fig. 5.



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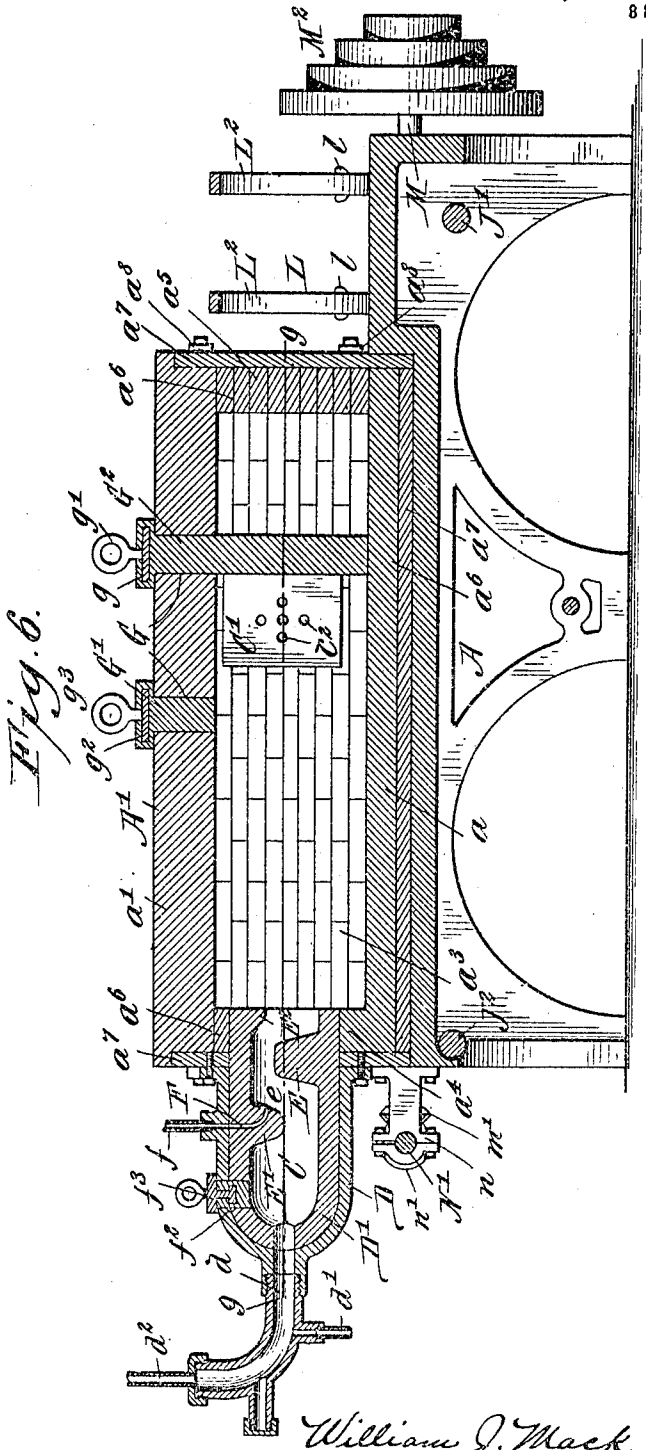
8 SHEETS—SHEET 5.

Fig. 6.



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8 SHEETS—SHEET 6.

Fig. 7.

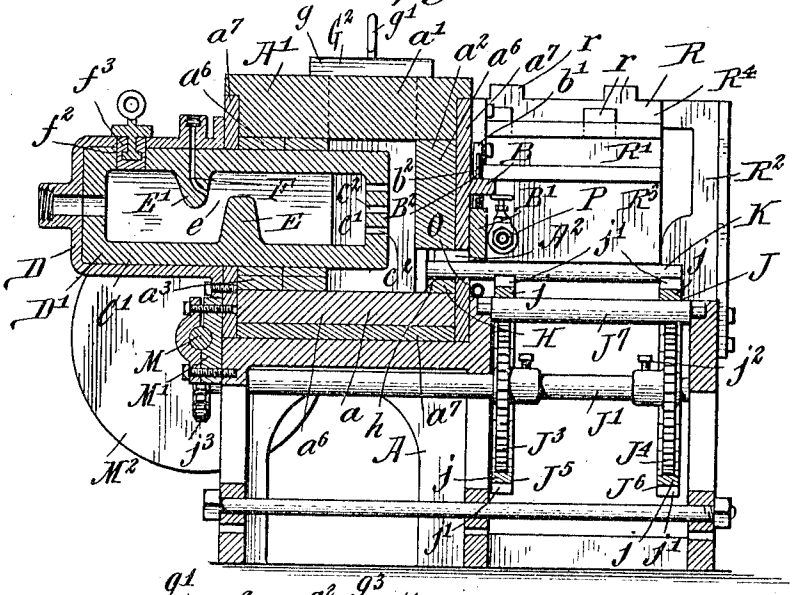


Fig. 8.

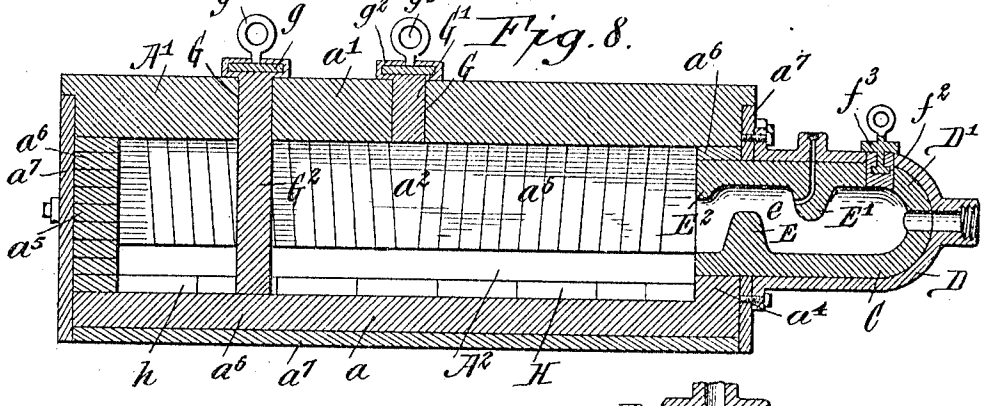
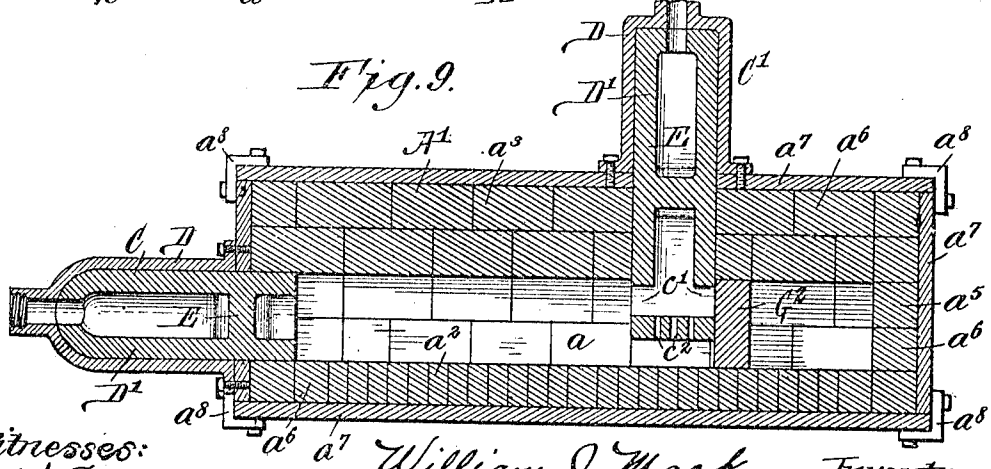


Fig. 9.



Witnesses:
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8 SHEETS—SHEET 7.

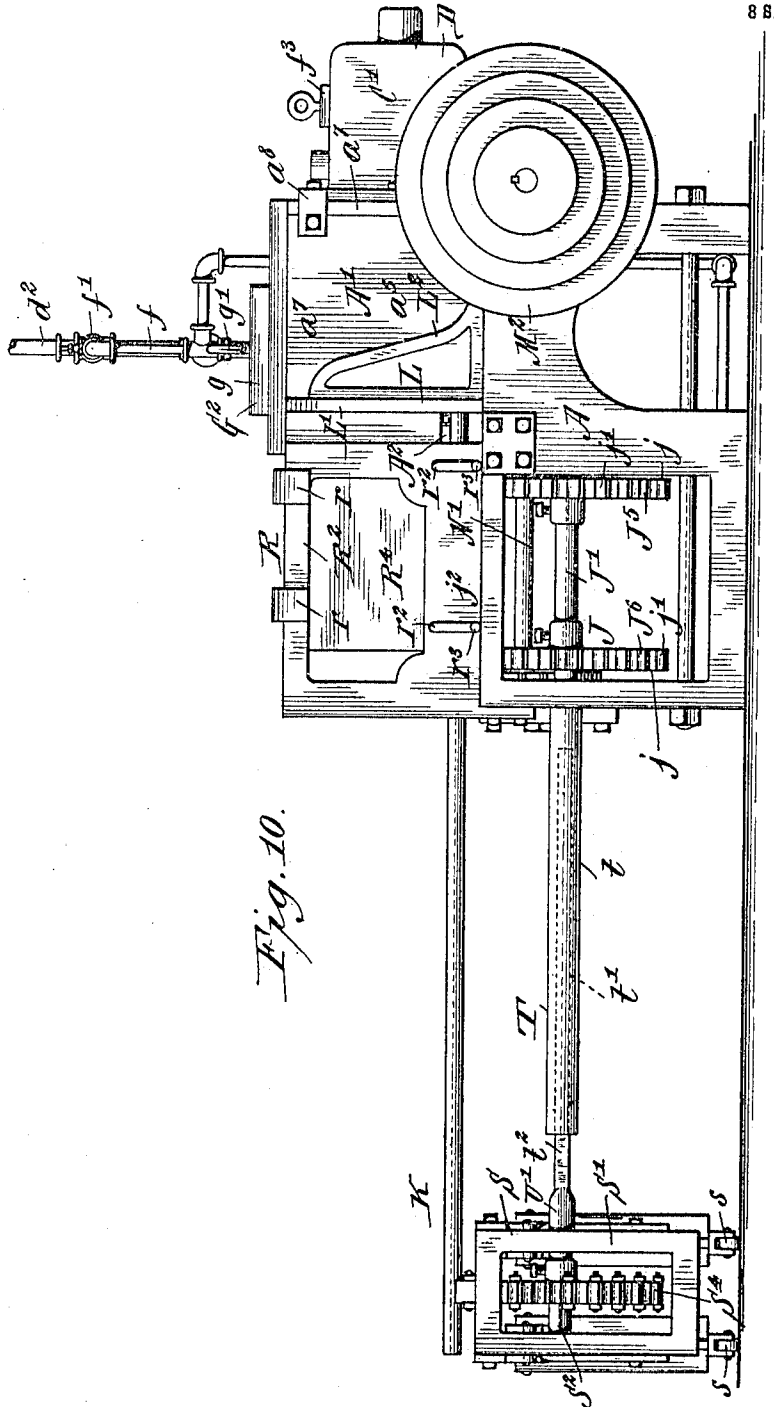

Fig. 10.

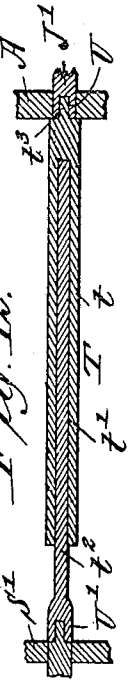

Fig. 12.

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8 SHEETS—SHEET 8.

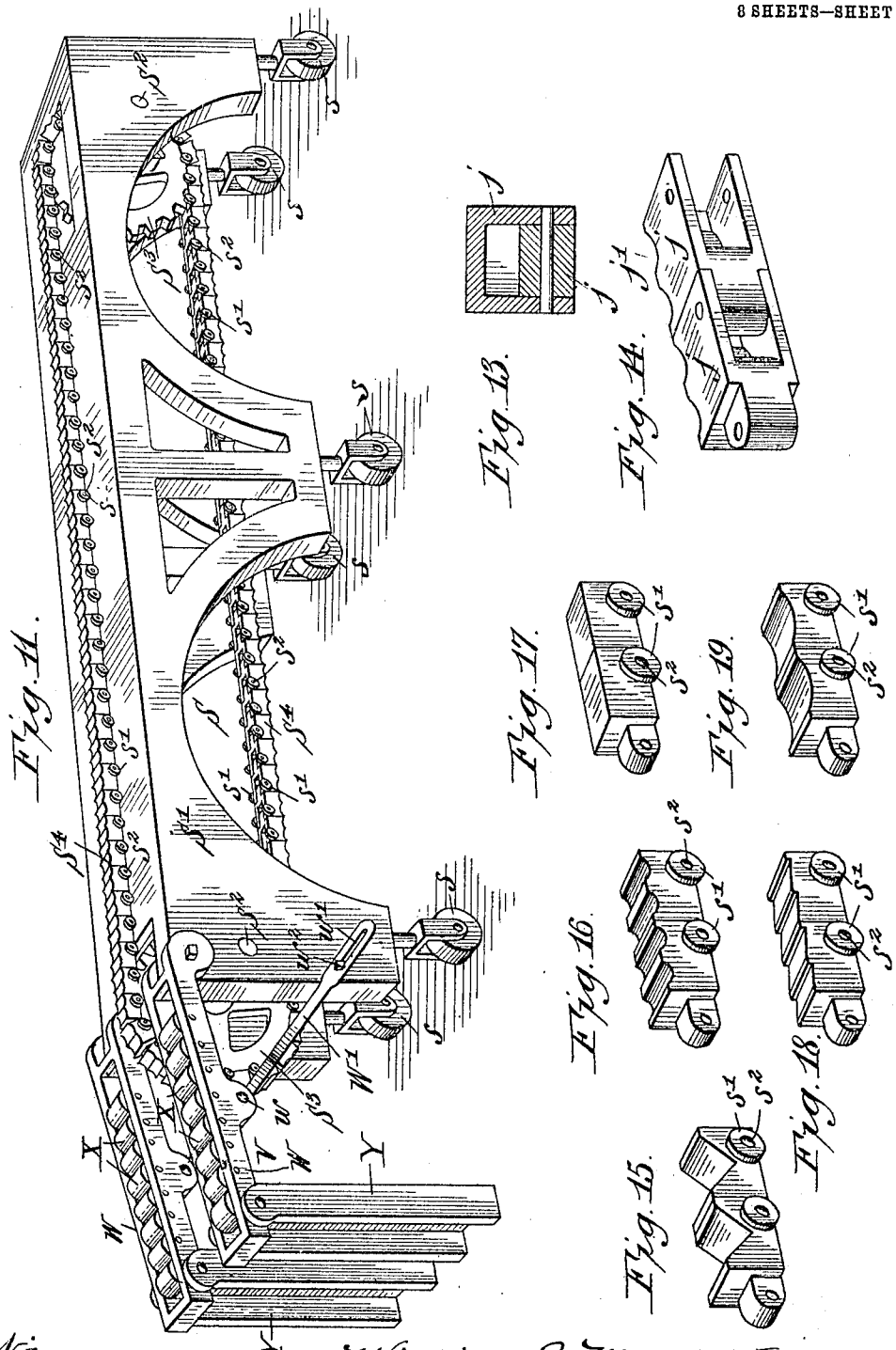

Fig. 11.

Fig. 13.

Fig. 14.

Fig. 17.

Fig. 19.

Fig. 16.

Fig. 18.

Fig. 15.

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UNITED STATES PATENT OFFICE.

WILLIAM J. MACK, OF BUFFALO, NEW YORK, ASSIGNOR OF ONE-HALF TO CARRIE D. DILLEMUTH, OF BUFFALO, NEW YORK, A COPARTNER WITH SAID MACK.

FURNACE FOR HEATING METAL BARS.

954,315. Specification of Letters Patent. **Patented Apr. 5, 1910.**

Application filed April 15, 1907. Serial No. 368,210.

To all whom it may concern:

Be it known that I, WILLIAM J. MACK, a citizen of the United States, and resident of Buffalo, in the county of Erie and State of New York, have invented certain new and useful Improvements in Furnaces for Heating Metal Bars, of which the following is a specification.

My invention relates to improvements in furnaces for heating metal bars and the like. Its primary object is the construction of a furnace in which the bars to be heated are automatically fed to the heating-chamber and passed through the same, and in which provision is made to diminish the heated area of the heating-chamber, when the bars passing therethrough will be heated to a less degree than at such times when the entire area of the chamber is heated.

It also has for its objects, the arrangement of the carrying-mechanism in such a manner that the bars are subjected to a uniform degree of heat owing to their being carried at a uniform speed and distance through the heating chamber; the equipment of gaging-means to govern the extent in the length of the bars to be heated; the equipment of automatic feeding-mechanism and the adjustability of the same so as to provide for the successive feeding of bars of different sizes; the removability of the feeding-mechanism to permit the placing of the bars upon the carrier by hand; the installation of delivery-mechanism at the forward end of the carrier; and the adjustability of the delivery-mechanism so that the heated bars may be delivered to heading or other machines arranged in different horizontal planes.

Other objects are, to so construct the carrier or carrying-mechanism and the delivery-mechanism that they may be adjusted in width to support bars of different lengths; to provide the heating-chamber with an elongated opening of a height admitting and allowing the passage therethrough of the maximum size of bars to be heated; to provide means for closing said opening to any desired extent when smaller bars are to be heated, thereby preventing the unnecessary escape of heat and flame from the chamber; to provide a supplemental carrier to be used in conjunction with the main carrier; and to so connect both carriers that they travel at a uniform speed and that the supplemental carrier may be positioned at different distances from the main carriers so as to conveniently support and carry the outer ends of long bars; and to otherwise improve on furnaces of this type now in use.

The invention consists in the construction, arrangement, and combination of parts and devices to be hereinafter described and particularly pointed out in the subjoined claims.

In the accompanying drawings, corresponding letters of reference refer to corresponding parts in the several figures.

Figure 1 is a front elevation of the complete furnace. Fig. 2 is a rear view of the same. Fig. 3 is a plan view. Figs. 4 and 5 are end elevations viewed from opposite ends. Fig. 6 is a vertical longitudinal section taken on line 6—6, Fig. 3. Fig. 7 is a transverse section taken on line 7—7, Fig. 3. Fig. 8 is a central vertical longitudinal section through the heating-chamber and its end combustion chamber, looking forward. Fig. 9 is a horizontal section taken on line 9—9, Fig. 6. Fig. 10 is an end view of the furnace showing the supplemental carrier used in conjunction therewith. Fig. 11 is a perspective view of the supplemental carrier. Fig. 12 is a longitudinal section through the telescoping shaft and the adjacent ends of the carrier-shafts connected thereby. Fig. 13 is a transverse section through the connection of two links used on the supplemental carrier. Fig. 14 is a perspective view of two connected links used on the main carrier. Figs. 15 to 19 are perspective views of two connected links of different types of carrier chains which may be used with or without rollers for bars of different forms.

The reference letter A designates the frame of the furnace on which is supported the heating-chamber A^1 which is preferably rectangular in shape and comprises a bottom wall a, a top wall a^1, a front wall a^2, a rear wall a^3, and end walls a^4 and a^5. These walls, with the exception of the top wall, consist of fire-brick a^6 or other heat-resisting material faced with metal plates a^7 connected at the ends by angle pieces a^8; and if desired, the top wall may be likewise constructed, but I have shown the same without the metal plate facing, as it is not subjected to as much strain and wear as the remaining walls. The front wall of this chamber has an opening A^2 which extends from end to end and is of sufficient height to allow the

maximum size bar to be heated to be passed through the same. It is desirable that this opening be closed somewhat when a bar of smaller than maximum size is passed therethrough, and for this purpose the front wall has a longitudinal flange B thereon which is located a short distance above the opening and provided with apertures b through which extend studs b^1 formed on the upper end of a closure-plate B^1 adapted to be raised or lowered to close the said opening to the extent desired. Said studs have slots b^2 formed therein into which are inserted retaining and adjusting wedges B^2 that bear against the upper side of flange B, and thus hold the closure plate in any adjusted position.

The heating-chamber has one or more combustion-chambers in communication therewith, and the arrangement herein shown is that now thought best adapted for use under ordinary conditions. In the particular arrangement shown, two combustion-chambers C, C^1, are removably affixed to the walls of the heating-chamber so that either combustion-chamber can be removed. The opening in which the removed chamber was located may be closed by a suitable cover, such, for instance, as conforms in construction to the wall of which it will form part. The combustion-chamber C at the end of the heating-chamber is ordinarily considered sufficient for heating bars, but when bars of large cross-sectional area are passed through the furnace, the combustion-chamber C^1 may also be placed into use. In some cases, the use of the combustion-chamber C^1 at the side of the heating-chamber without the use of the end combustion-chamber, will give good results. Each of said combustion-chambers consists preferably of a shell of cast-iron D lined with fire-brick D^1 or other similar material; the lining extending into the wall of the heating chamber. At the outer end of each chamber is a burner tube d in which any burner of approved type may be placed. As the burner forms no part of my invention and is common in the art, I have omitted the same from the drawings. Entering the burner tube is a fuel-supply-pipe d^1 and an air supply pipe d^2 so arranged that the fuel is ignited by the burner and the flame fed with the air entering pipe d^2, and forcibly directed toward the heating-chamber. The burners used are preferably hydro-carbon burners, and the lower wall of each combustion-chamber has an upstanding ridge E thereon which serves primarily to prevent the fuel remaining unconsumed entering the heating-chamber, and in conjunction with a depending extension E^1 on the top wall, provides an irregular or circuitous passage through which the flame is compelled to pass before entering the heating-chamber. The fuel lodging behind the ridge E is therefore ignited by the flame from the burner which is deflected downward by the extension E^1 against the bottom of the chamber, after which it passes upward through a passage e between extension E and ridge E^1 and over and in front of the latter into the heating-chamber. At the mouth of the end combustion-chamber, a deflector in the form of a rib E^2 is provided on the top wall to direct the flame downward in front of the ridge E and toward the bottom of the heating-chamber so as to come in contact with the bars passing through the opening A^2 in said chamber.

Passing through the top wall of each combustion-chamber and through the depending extension E^1 thereof is an air-passage F which opens into the chamber from the front of said extension and through which air under pressure enters to forcibly direct the flame into the heating-chamber. Connected to said passage is an air-pipe f which is connected with the pipe d^2; both pipes having hand-valves f^1 to shut off the supply of air to the combustion-chamber. A hand-hole f^2 is provided for each combustion-chamber, which is closed with a plug f^3 or other suitable closure, and when said closure is removed, the burner may be conveniently lighted, the flame being regulated by the valve f^1 in pipe d^2 and a valve f^4 in the fuel supply-pipe d^1, see Fig. 2. Air-pipe d^2 may receive its air-supply from a compressed air-tank, blower, or any other source.

The combustion-chamber C^1 at the side of the heating-chamber has its inner end extending into the latter, and its sides provided with openings c^1; the end being closed to cause the flame to be directed through said openings lengthwise of the heating-chamber and in opposite directions, thereby heating the said chamber at all points on opposite sides of the combustion-chamber. The closed end is provided with perforations c^2 to permit the heat to be directed against the front wall of the heating-chamber directly in front of the combustion-chamber.

In order that the interior heating space may be reduced in area, which is desirable when bars of small cross-sectional area are to be heated, I provide one wall—preferably the top wall—of the heating furnace with one or more openings G in which are placed plugs G^1 when the entire interior of the chamber is to be heated. These openings may be placed at any desired points, but I have found in practice that an opening placed midlength of the chamber and another at one-quarter the length will answer all practical purposes. When the heat is to be shut off from a portion of the heating-chamber, the plug G^1 is removed from the opening at the point where the heat is to

shut off and a removable partition G^2 inserted through said opening so that the portion of the chamber only, between said partition and the end combustion-chamber C is heated. Said partition is preferably made of fire-brick and has at its outer or upper end an enlargement g resting upon the wall and an eye g^1 by means of which it can be easily removed or set into place. The plugs G^1 also have their upper ends enlarged to provide flanges g^2 and each has an eye g^3 so that they may also be conveniently removed from or inserted into the opening G.

The bottom of the opening A^2 through which the bars to be heated are inserted into the chamber, is a short distance above the bottom of the latter, forming substantially a ridge H along the front edge of said bottom sloping from its top inwardly to the bottom, as at h, see Fig. 7. This permits the slag loosened from the heated ends of the bars to drop onto the bottom where it accumulates and consequently leaves a free passage for the bars through said opening.

The frame A is extended forward of the furnace proper, to support bar-carrying mechanism J. The latter consists of shafts J^1, J^2, mounted transversely in the frame, each having two chain-wheels J^3, J^4, secured thereto in a manner permitting their being adjusted lengthwise on said shafts. The chain-wheels J^3 form one pair of wheels around which an endless chain J^5 passes, and the chain-wheels J^4 form a second pair of wheels around which an endless chain J^6 passes. The upper stretches of these chains are supported at points between the chain-wheels by a series of rollers J^7 which are journaled in the frame and form a roller supporting-bed. Said chains are formed of connected links j having their outer or bearing faces grooved, as at j^1, in which are placed the bars K to be moved forward and have their ends passed through the heating-chamber. The style of link herein shown as forming the said chains is best adapted for use in carrying round bars, but as bars of different cross-sectional shape are to be carried through the furnace, the types of links shown in Figs. 15 to 19, or any other form best adapted for the particular form of bars to be heated, may be used.

For certain kinds of work, such as in the forming of enlargements on the ends of bars, it is desirable that the bars be heated to a uniform length, and for this purpose I arrange a gaging-device L at the entrance end of the heating-chamber, which consists of an upright gage-plate L^1 secured to brackets L^2 adjustable on the frame by means of nuts l. By adjusting this gage-plate the desired distance from the front wall of the heating-chamber, the extent to which the bars are to be inserted into the heating-chamber as they are carried forward by the carrier chains, is easily governed, it being simply necessary to place the bars upon the chains with the end thereof placed against the gage-plate after which the bars are moved forward and the portions traveling through the heating-chamber are heated uniformly and to the same length.

For heating the ends of short bars, the outer carrier chain J^6 may be moved toward the carrier chain J^5, by loosening the set-screws j^2 by means of which chain-wheels J^4 are secured to their supporting-shafts, and sliding said wheels along the shafts toward the chain-wheels J^3.

Shafts J^1 and J^2 extend beyond the rear face of the frame A and have secured to their projecting ends, worm-wheels j^3 which mesh with and are actuated by worms m secured to a driving-shaft M journaled in brackets M^1 at the rear of the frame. At one end, said driving-shaft has a cone-pulley M^2 onto which a belt may be placed to revolve the shaft at the desired speed. Therefore, owing to the shafts J^1, J^2, being driven by the shaft M, the length of time required for the bars to move through the heating-chamber may be regulated by said cone-pulley, as the speed at which the carrier-chains travel is governed thereby.

At the delivery end of the bar-carrying mechanism, a delivering apparatus N is provided which is adapted to deliver the heated bars to an elevated point. It consists of a transverse shaft N^1 journaled in bearing-brackets n secured to the frame and having a bevel-gear n^1 which meshes with a bevel-gear m^1 at the adjacent end of the driving shaft. Supported on shaft N^1 is a pivoted frame comprising two plates N^2, and on said shaft between said plates and outside of the adjacent chain-wheels J^3, J^4, are chain-wheels N^3 over which pass delivery-chains N^4, N^5, whereby the bars are carried to a high elevation. Said delivery-chains may be raised and lowered with the plates N^2 swinging on the shaft N^1 as their pivotal center, and when short bars are to be delivered thereon, chain N^5 may be moved toward chain N^4 by loosening the set-screw n^2 by means of which the chain-wheel carrying chain N^5 is secured to the shaft. In this manner the width of the delivering apparatus may be reduced to conform to the length of the bars. By reason of the shaft N^1 being driven by bevel-gearing from the driving-shaft M, while the shafts of the carrying-mechanism are driven by worm-gearing, the chains of the delivery apparatus travel at a faster speed than, the chains of the bar-carrying mechanism and consequently, the bars are delivered for final action before becoming cooled. This arrangement also prevents piling up of the bars at the receiving end of the delivery-chains. Shaft N^1 also has a sprocket-wheel

n^3 secured thereto over which passes a sprocket-chain n^4 that may drive a shaft at the other end of the delivery-apparatus so that the delivery-chains are driven at both ends.

In rear of the upper stretch of the inner bar-carrying chain J^5, a perforated air-pipe O is located; its purpose being to keep said chain cool as it travels along close to the opening A^2 in the front wall of heating-chamber. This pipe is connected with the air-pipe *f*, as at *o*, and it has a hand-valve O^1 whereby the supply of air to the chain may be shut off when desired.

Arranged lengthwise of the heating-chamber, and above the opening therein, is a perforated water-pipe P which may lead to a suitable source of water supply, and it has a hand-valve *p* therein by means of which the flow of water may be regulated or shut off. The perforations of said pipe are arranged to direct the water downward onto the bars directly without the opening A^2 in the heating-chamber so as to prevent the heating of the bars beyond the extent they enter said chamber, and also to aid in keeping the inner bar-carrying chain J^5 cool.

When the removable partition is placed within the heating-chamber, the bars carried forward on the carrying-mechanism are not subjected to the heat of the furnace until they reach a point in line with said partition, and therefore, it is not necessary to moisten the bars until they reach this point. I therefore place within pipe P, hand valves p^1, p^2, at points coincident with the openings G in the chamber through which the removable partition may be inserted into the chamber, and when said partition is inserted through either of said openings, the valve in line therewith is closed to prevent the water entering the pipe beyond such point, and when the entire interior of the heating-chamber is heated, both said valves are opened to allow the water to flow to the end of the pipe. In this manner the bars and inner carrying-chain J^5 are moistened and cooled only where and when needed, resulting in a saving of considerable water and rendering the furnace cleaner to operate, when heating of the bars throughout the length of the furnace is not necessary.

Although the bars may be placed upon the traveling carrier by hand, I have equipped the furnace with an automatic feeding-device R, comprising a bracket R^1 secured to the entrance end of the furnace proper, a support or standard R^2 removably affixed to the frame A, and depending plates R^3, R^4, arranged at an angle to each other and suspended from said bracket and standard to form a hopper-like receptacle into which the bars to be heated are placed. The upper ends of the said plates are equipped with hook *r* by means of which they are removably supported. Plate R^4 has its lower end adjustable toward and from plate R^3 to increase or diminish the width of the throat r^1 through which the bars contained in said receptacle are fed successively onto the carrying-chain; the lower end of plate R^3 terminating a short distance above said chains to permit the bars to pass underneath it, while the plate R^4 terminates in close proximity to said chains. Plate R^4 is adjusted by means of screws r^2 threaded through standard R^2 and bearing against the rear face of said plate near the lower end thereof; said screws having their outer ends formed into cranks r^3 to conveniently manipulate them. Both plates have their lower ends curved forwardly, as at r^4, to feed the bars onto the traveling-chains in the direction of their travel, which greatly aids in the free discharge of the bars from the hopper-like receptacle.

When the ends of bars that are considerably longer than the traveling bar-carrier is wide, are to be heated, a supplemental carrier S is used in conjunction with the main carrier. Said supplemental carrier comprises a frame S^1 having casters *s* whereby it may be conveniently moved into operative relation with the main carrier; transverse shafts S^2 rotatable in said frame; chain-wheels S^3 secured to said shafts; and a chain S^4 passing around said chain-wheels. The top of the frame S^1 is flat and the links forming the said chain have rollers s^1 which rotate on pins s^2 that connect said links. Said rollers ride on said top of the frame and the links of the chain support the ends of the bars K, as shown in Fig. 10. In order that the supplemental frame may be placed any desired distance from the main frame A so as to properly support various lengths of bars while retaining operative connection with the main carrier J, telescoping-shafts T are provided, each comprising a tube member *t* having a square bore t^1 fitting slidably into said tube member. The ends of said telescoping shafts are removably connected with the shafts J^1, J^2, of the main carrier and the shafts S^2 of the supplemental carrier. The forward ends of the shafts J^1, J^2, of the main carrier have square sockets U which receive the square outer ends t^3 of the tube members *t* of the telescoping shafts, and the opposing ends of the shafts S^2 of the supplemental carrier are made square to fit square sockets U^1 in the outer ends of the solid members t^2 of said telescoping shafts. When using the supplemental carrier, it is positioned to bring the shafts thereof in line with the shafts of the main carrier, and by reason of their connection, they travel in unison and both carriers cause the bars to be carried along evenly.

When the ends of long bars are to be heated, the end of the supplemental carrier

frame may be equipped with a delivery device similar to that shown on the frame A and hereinbefore described, or both frames may be equipped with a delivery-device, such as shown at V in Fig. 11, in which inclined channeled rider-bars W are pivotally secured to the frame and are supported by braces W^1 having their upper ends pivotally secured to said channeled bars, as at *w*, and their lower ends provided with slots w^1 through which are passed bolts w^2 that take into the frame, and when loosened, permit the bars W to be adjusted to the desired inclination. In the channels of said bars are rollers X over which the bars leaving the carrier-chain ride. Pivotally attached to the ends of said rider-bars are inversely channeled cover-plates Y that may be swung over the top of the rider-bars to cover the rollers when round bars are carried on the carrier.

The operation of the furnace will be understood from the foregoing description, as the purpose and action of the various parts and devices have been clearly stated therein.

Having thus described my invention, what I claim is,—

1. A furnace comprising a chamber having an opening in one of its walls, removable means to close said opening, a partition adapted to be inserted into the chamber through said opening to reduce the internal area of said chamber, and a heating device for said chamber.

2. A furnace comprising a chamber having a plurality of openings in one of its walls, closures for said openings, a removable partition to be inserted into the chamber through either of said openings, and a heating-device for said chamber.

3. A furnace comprising a chamber having an opening in its top wall, a plug entering said opening and having an enlarged head bearing on said wall, a removable partition adapted to be inserted into said chamber through said opening when said plug is removed therefrom and having an enlarged head bearing against said top wall.

4. A furnace comprising a heating-chamber, a combustion-chamber entering the side of said heating-chamber and having openings in opposite side walls, and a hydro-carbon burner at the outer end of said combustion-chamber.

5. A furnace comprising a heating-chamber, a combustion-chamber entering the side of said heating-chamber and having an inner perforated end wall and openings in its side walls to provide communication between the two chambers, and a hydro-carbon burner at the outer end of said combustion chamber.

6. A furnace comprising a heating-chamber having an opening for the insertion of the product to be heated and an exterior extension adjacent said opening provided with an aperture, a plate having a stud adjustable in said aperture and adapted to close said opening to the extent desired, and a combustion chamber opening into said heating-chamber.

7. A furnace comprising a heating-chamber having an opening arranged lengthwise thereof for the insertion of the product to be heated and having also a flange on its outer side above said opening provided with apertures, a closure provided with slotted studs extending through said apertures, wedges bearing against the upper sides of said flange and fitting into the slots of said studs, and a combustion-chamber.

8. A furnace comprising a heating-chamber, a combustion-chamber at one end of the heating-chamber, a second combustion-chamber entering the side of the heating-chamber and having openings in opposite side walls, a hydro-carbon burner in each combustion-chamber, and a removable partition adapted to close one of the openings in said second-mentioned combustion-chamber.

9. In a furnace for heating metal bars and the like, the combination with a heating-chamber having a removable partition to diminish the heating area thereof and an opening in one side through which the portions of the bars to be heated enter the chamber, of a perforated water-pipe above said opening having a stop-valve in line with said removable partition, and a traveling carrier upon which the bars to be heated are delivered and adapted to carry the bars forward, as set forth.

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

WM. J. MACK.

Witnesses:
ELLA C. PLUECKHAHN,
EMIL NEUHART.