J. S. UNGER & A. E. MACCOUN.

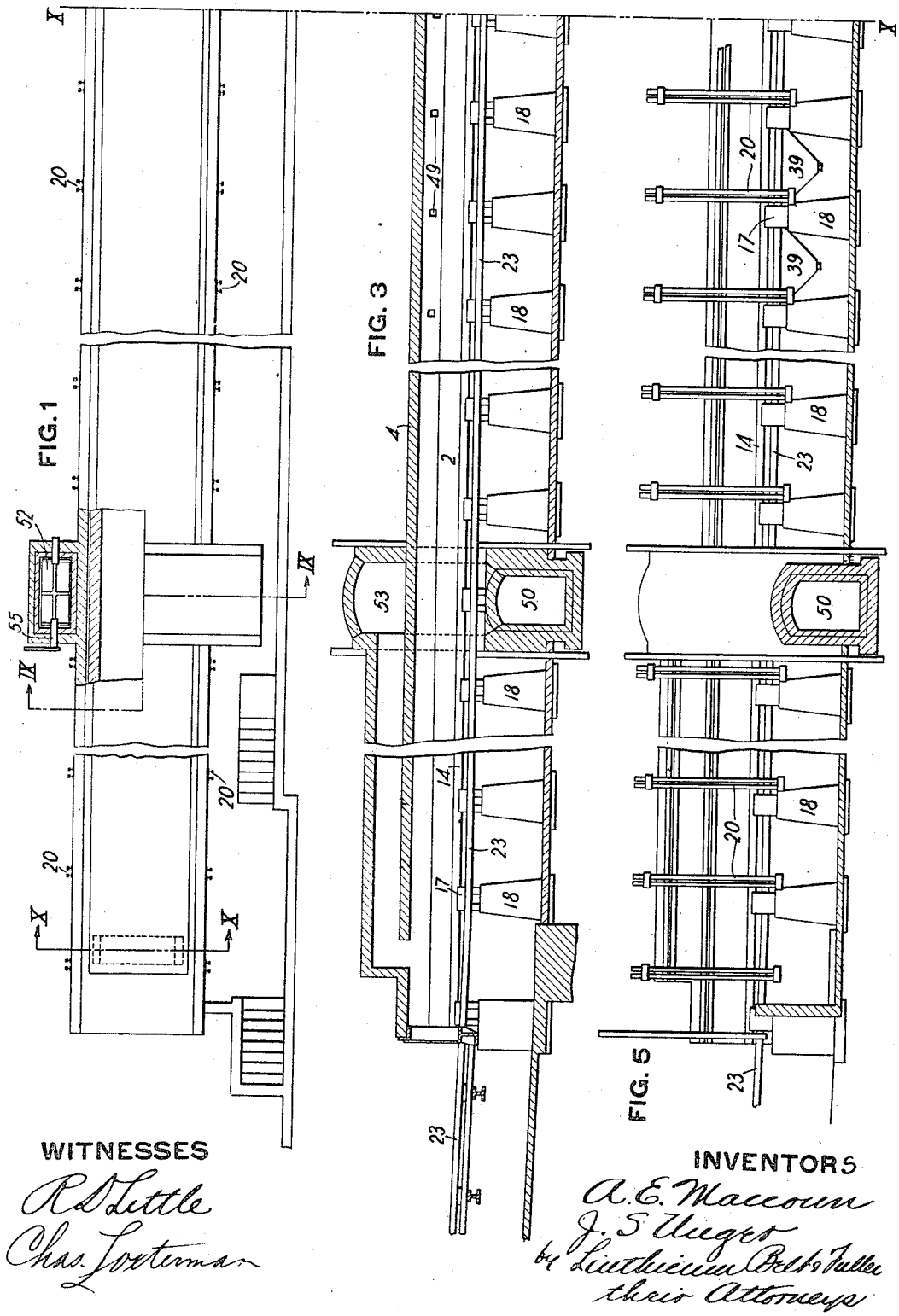
FURNACE.

APPLICATION FILED JUNE 22, 1912.

1,124,559.

Patented Jan. 12, 1915.

5 SHEETS—SHEET 1.



WITNESSES

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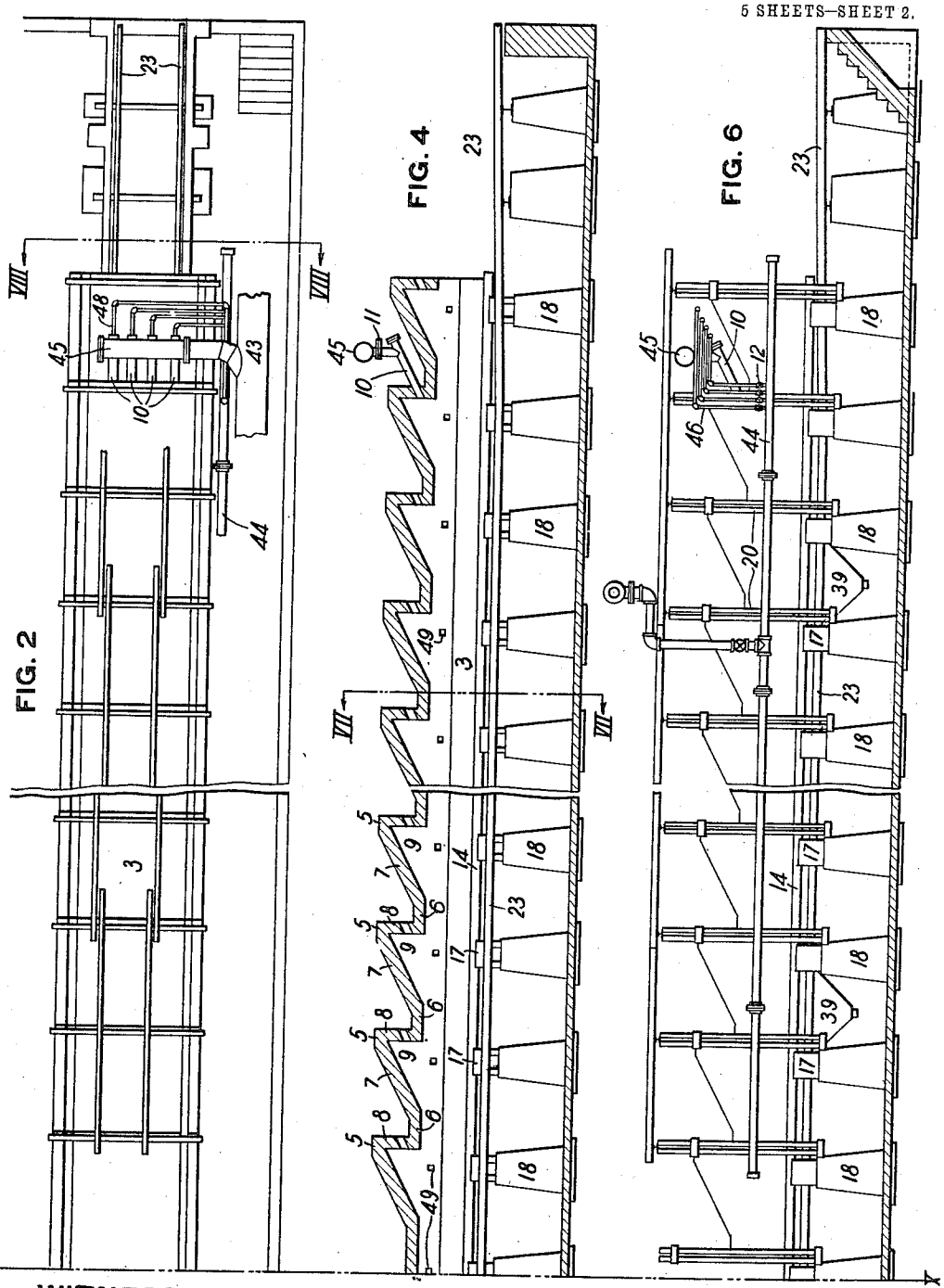
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5 SHEETS—SHEET 2.



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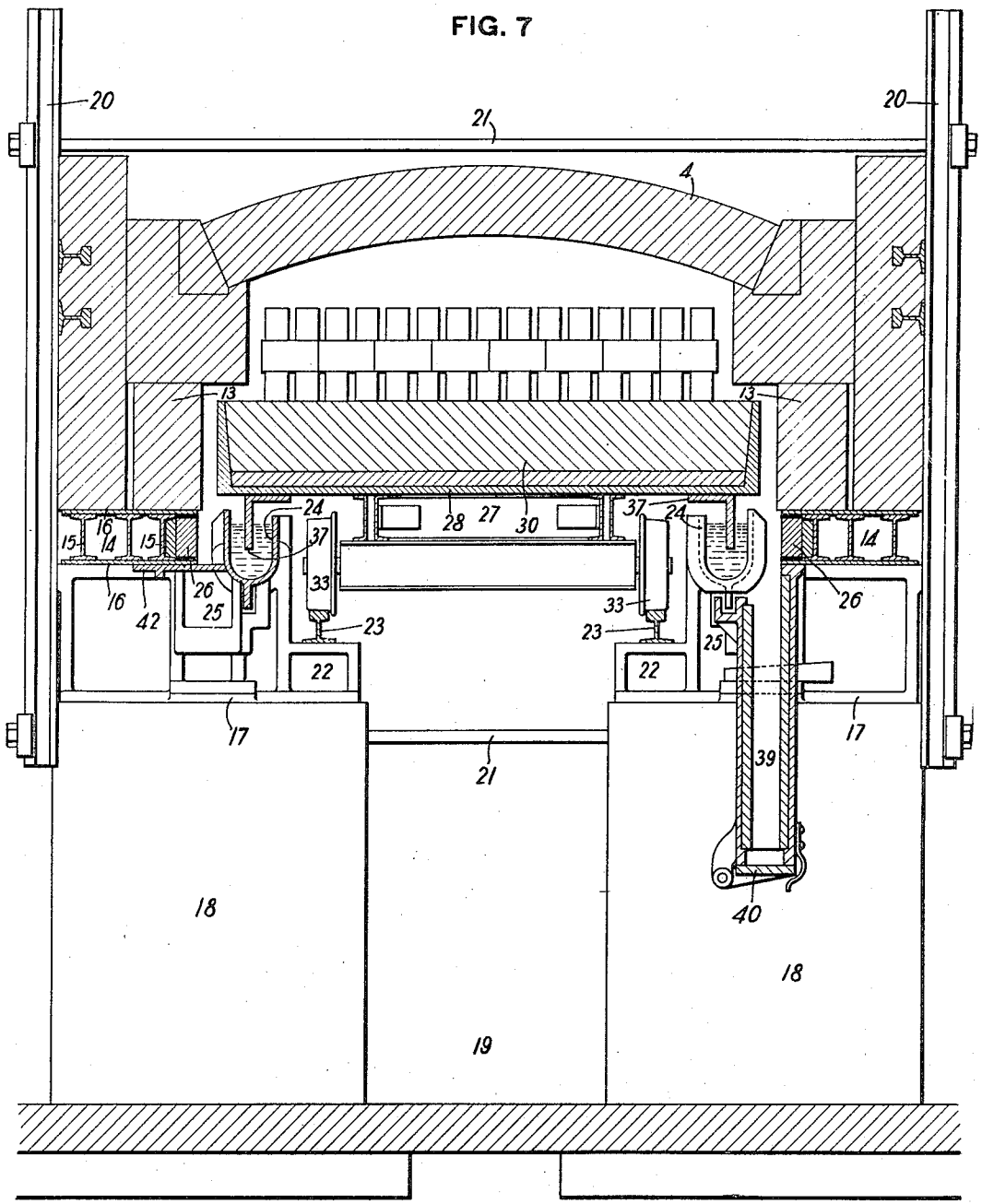
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5 SHEETS—SHEET 3.

FIG. 7



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5 SHEETS—SHEET 4.

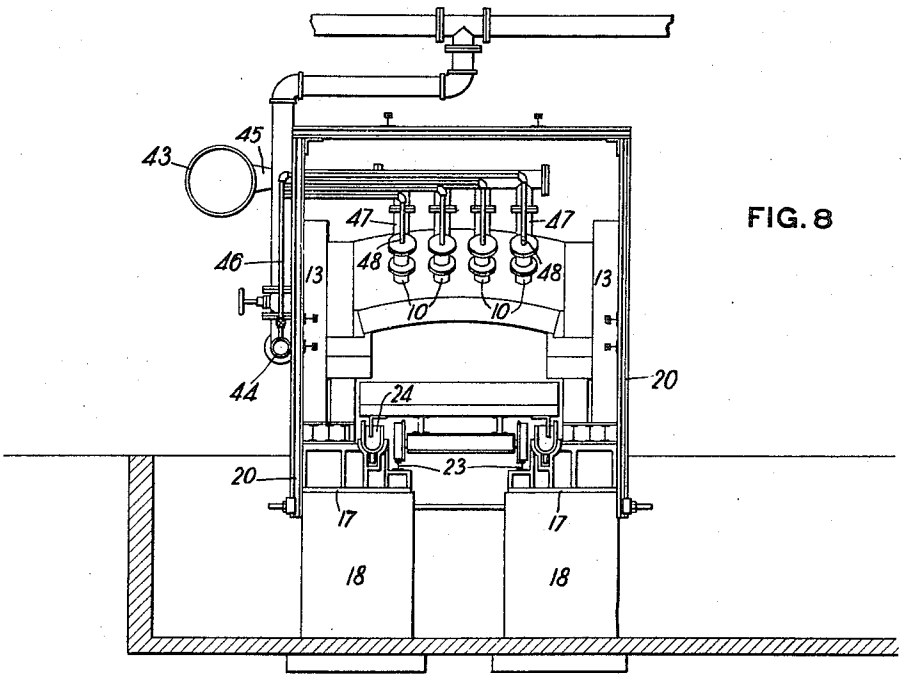


FIG. 8

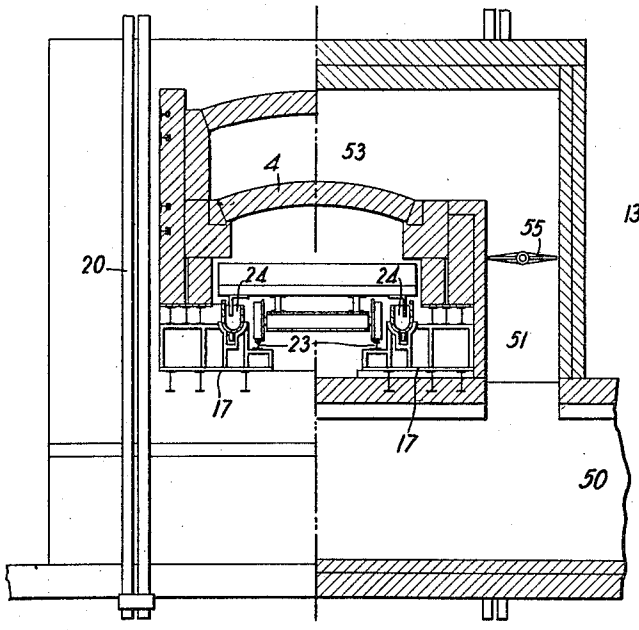


FIG. 9

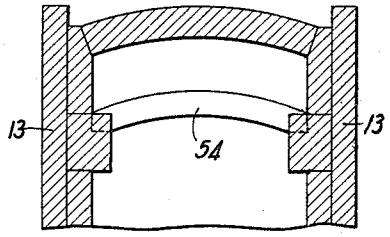


FIG. 10

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5 SHEETS—SHEET 5.

FIG. 12

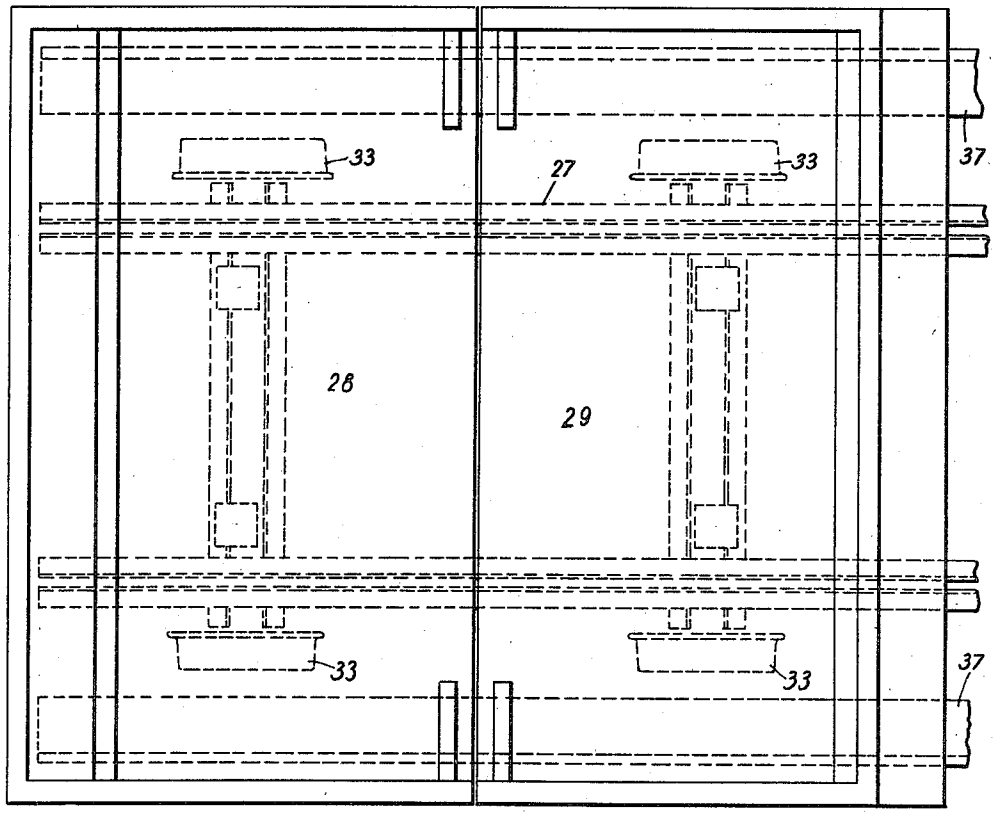
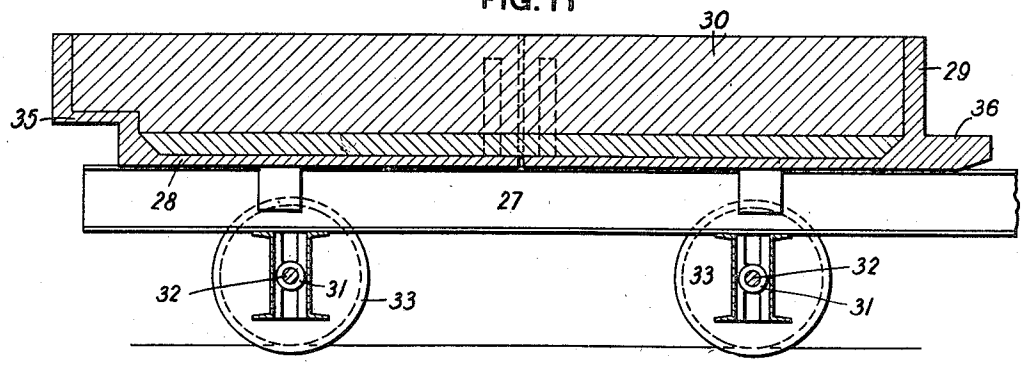


FIG. 11



WITNESSES

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UNITED STATES PATENT OFFICE.

JOHN S. UNGER, OF DUQUESNE, AND ANDREW E. MACCOUN, OF BRADDOCK, PENNSYLVANIA.

FURNACE.

1,124,559. Specification of Letters Patent. Patented Jan. 12, 1915.

Application filed June 22, 1912. Serial No. 705,156.

To all whom it may concern:

Be it known that we, JOHN S. UNGER and ANDREW E. MACCOUN, citizens of the United States, residing at Duquesne and Braddock, respectively, both in the county of Allegheny and State of Pennsylvania, (whose post-office addresses are, respectively, care of Duquesne Steel Works, Duquesne, Pennsylvania, and Edgar Thomson Steel Works, Braddock, Pennsylvania,) have invented a new and useful Furnace, of which the following is a specification.

Our invention relates to the construction of furnaces used in heating various materials and, while not restricted to such uses, more particularly relates to the construction and arrangement of furnaces used in briqueting ores, flue-dust and similar finely divided materials having a burning chamber formed integrally with and connecting a preliminary heating chamber with a cooling chamber and having means whereby the briquets are caused to pass successively into the preliminary heating chamber and then into and through the burning and cooling chamber and out of the furnace. Such furnaces are of very considerable length relative to their width and height and heretofore great difficulty has been experienced in uniformly heating the long burning chamber of such furnaces and the materials passing therethrough in the treatment thereof.

One object of our invention is to provide a furnace construction having novel means whereby the burning and cooling chamber is heated and the temperature of the chambers is regulated and controlled.

Another object of the invention is to provide a furnace having a movable bottom, made in sections and having novel means whereby the life of the bottoms is lengthened and overheating of the running gear of such bottoms is avoided and overcome.

A further object of this invention is to provide a furnace having a roof of improved construction and having novel means whereby the desired uniform heating of the furnace is obtained.

Another object of our invention is to provide a furnace having a bottom movable into and out of the furnace and having a water seal between the stationary furnace and the removable bottom constructed and arranged to form a water sealed joint between the side walls of the furnace and the furnace bottom, and having novel means whereby the sections of the furnace bottom are caused to enter and leave the water seal.

A further object of the invention is to provide a furnace having novel means whereby the running gear by which the bottoms are mounted on the track extending through the furnace is cooled, and excessive heating of the axles and bearings of the running gear is avoided and prevented.

A still further object of this invention is to provide a furnace of novel construction having improved means whereby the circulation of a current of air is secured and is maintained under the furnace bottom.

Referring to the accompanying drawings forming part of this specification, Figure 1 is a plan, showing the heating chamber end of a furnace constructed and arranged in accordance with our invention. Fig. 2 is a plan showing the burning and cooling chamber forming the remaining portion of the furnace. Fig. 3 is a longitudinal sectional elevation of the portion of the furnace shown in Fig. 1. Fig. 4 is a longitudinal sectional elevation of the portion of the furnace illustrated in Fig. 2. Fig. 5 is a longitudinal side elevation of the part of the furnace illustrated in Figs. 1 and 3. Fig. 6 is a longitudinal side elevation of the portion of the furnace shown in Fig. 2 and in Fig. 4. Figs. 1, 3 and 5 when joined to Figs. 2, 4 and 6 along the lines X—X illustrates the whole length of the furnace. Fig. 7 is a sectional end elevation on an enlarged scale, the section being taken on the line VII—VII of Fig. 4. Fig. 8 is an end elevation of the furnace on the line VIII—VIII of Fig. 1 showing the relative arrangement of the gas burners in the combustion chambers. Fig. 9 is a sectional end elevation taken on the irregular line IX—IX of Fig. 1. Fig. 10 is a sectional elevation on the line X—X of Fig. 1. Fig. 11 is a detail sectional side elevation showing a section of the movable furnace bottom and the manner in which the ends of the sections overlap in forming the joints between the abutting ends of the sections of the furnace bottom. Fig. 12 is a plan of the apparatus shown in Fig. 11.

In the drawings, the numeral 2 designates the preliminary heating chamber, located at the left hand end of the furnace, and 3 the burning and cooling chamber of our im-

proved furnace formed at the opposite end thereof. The roof 4 of the preliminary heating chamber is arched in the usual manner and the burning and cooling member is provided with a saw tooth roof construction which also is arched transversely. The saw tooth roof construction of the burning and cooling chamber, in a longitudinal direction, has high portions 5 and low portions 6 connected by inclined portions 7, this roof construction resembling longitudinally the teeth of a saw.

Each of the vertical walls 8 and intermediate inclined roof portions 7 forms a separate and independent combustion chamber 9 within the furnace and a series of separate independently operated burners 10 are provided for each of the individual combustion chambers, so that the temperature of each combustion chamber 9 can be regulated and controlled independently of that of the others. By a proper adjustment of the air valves 11 and gas valves 12 on each of the burners 10 in the combustion chambers 9 formed in the roof of the outer end of the furnace which forms the cooling end of the chamber, the temperature in this part of the furnace can be kept as much lower than that of the burning end of said chamber as is found necessary or desirable.

The two side walls 13 of the furnace are supported upon horizontal box girders 14 formed of beams 15 and top and bottom plates 16. The girders rest upon base plates 17 positioned on the top of the piers 18, a series of which extend upwardly in rows from the bottom of the pit 19 below the furnace side walls 13.

Buckstaves 20 are provided at intervals in the length of the furnace on each side thereof which are connected at their top and bottom ends by tie rods 21 to stay the side walls and resist the thrust of the arches in the usual manner.

The base plates 17 on top of the piers 18 have feet or extensions on one end thereof forming supports 22 for the track rails 23 upon which the wheeled sections of the furnace bottom are mounted so as to be readily moved into, through and out of the furnace.

Between each track rail 23 and the inner face of the adjacent side wall 13 of the furnace is a water trough 24, made of sections of suitable length, with the open ends of the trough sections fastened together. The troughs are mounted in brackets or supports 25 formed for that purpose on the base plates 17, the top or upper edge of the water troughs being located at about the level of the bottom edge of the refractory side walls 13 of the furnace.

The bottom cover plates 16 on the longitudinal girders 14 which support the side walls 13, 13 of the furnace project inwardly beyond the flange of the innermost beam 15 of the girders and form supports for the refractory lining 26 which is placed between the cover plate and the lower end of the walls to protect the metal girder 14 from the heat of the furnace. The space between the face of the bricks forming the lining 26 and the web of the adjacent beam in the girder 14 is filled preferably with clay, loam, or other refractory material.

The furnace bottom is formed by a plurality of sections, each section comprising a metal framework 27 forming a truck with castings 28, 29 mounted on the truck, a refractory lining 30 on the upper surface of the castings 28, 29, protecting the truck from the heat and forming a support for the briquets. The framework forming the truck is provided with suitable bearings 31 by which each section of the bottom is mounted on the axles 32 for the wheels 33 of each truck which travel on the track rails 23 extending lengthwise through the furnace. The ends of the castings 28 and 29 have horizontally extending flanges or lips 35 and 36 which overlap so that a joint is formed between the abutting ends of the sections forming the furnace bottom, when the sections of the bottom are within the furnace.

On the under side, at each side of the metal framework of the trucks for the furnace bottom, an angle 37 is secured with one flange projecting vertically downward, this vertically extending leg of the angle 37 projecting downwardly below the level of the water in the troughs 24 supplied to form a water seal between the side walls of the furnace and the adjoining side edges of the furnace bottom.

The rails 23 which form the track through the furnace, are inclined upwardly lengthwise toward the ends of the furnace so that the angles 37 on the sections of the furnace bottom will move into and out of the ends of the water troughs 24 without necessarily lowering the level of the water maintained in the troughs and break the water seal maintained between the side edges of the furnace bottoms and the furnace side walls. The inclination of the track rails at the ends of the furnace is such that the bottom edge of the angle rises above and clears the upper edge of the closed ends of the water troughs.

The burners 10 which extend through suitable openings in the vertical walls 8 connecting the high end 5 of one combustion chamber with the low end 6 of the adjoining combustion chamber, are inclined downwardly and inwardly at the same angle as the inclination of the connecting inclined roof 7 of the combustion chamber to which the burner is applied.

At intervals in the length of the furnace, on each side thereof, vertical dust hoppers 39 are provided to collect the dust and finely

divided solids in the furnace as deposited within the furnace (see Fig. 7). These dust hoppers 39 have open lower ends which are closed normally by hinged doors 40 held in closed position by a spring catch 41, so as to be readily opened and closed when it is desired to empty the dust hoppers. The dust hoppers 39 have inclined side walls and are arranged to rest on the base plates 17 mounted on adjacent piers 18. The dust pockets are provided at intervals in the length of the furnace, and in the spaces between any piers which are not equipped with these dust pockets, flat dust plates 42 are inserted, which extend between adjoining base plates 17 with their inner edges in engagement with the sides of the water troughs 24 so as to prevent the escape, at such points in the length of the furnace, of gases and finely divided solids from the furnace (see Fig. 7).

A blast pipe 43 and a gas main 44 are arranged to extend lengthwise along one side of the furnace, air outlets 45 and gas outlets 46 being provided at suitable intervals in the length of the pipe 43 and main 44 for the branch air pipes 47 and gas pipes 48 connecting into each of the four burners 10 provided on each of the series of separate combustion chambers 9, formed in the saw tooth roof of the furnace.

The gas burners 10 are formed to have an air jet therein so that a mixture of gas and air is caused to emerge from the burner into the combustion chamber 9 on which the gas burner is mounted.

Located at suitable intervals in the side walls of the furnace are openings or holes 49 through which the interior of the furnace can be observed.

On account of the very great length of furnaces, formed in accordance with this invention, expansion joints preferably are provided at suitable intervals in the length thereof. The expansion joints, which may be old and well known constructions, and which are not claimed, are not shown.

The ends of the furnace ordinarily are provided with suitable doors, usually of the type which are counterweighted and which lift vertically in opening to permit the cars forming the sections of the furnace bottom to enter and to pass out of the furnace although in some cases the use of the doors will be found to be unnecessary.

At an intermediate point in the length of the preliminary heating chamber 2, below the furnace is a conduit 50 leading to the furnace stack and vertical flues 51 and 52 (see Figs. 1 and 9) located on opposite sides of the furnace connect the conduit 50 with one end of the horizontal flue 53 on top of the furnace, the bottom of the flue 53 being formed by the arched roof of the furnace chamber 2. The furnace roof has an opening 54 therein through which the products of combustion enter the flue 53 from the furnace. Damper valves 55 in the vertical flues 51 and 52 afford means for regulating and controlling the passage of the burned gases from the furnace to the furnace stack.

In the operation of our improved furnace, the trucks forming the sectional furnace bottom, provided with a lining formed of a suitable refractory material are loaded and water or other liquid is supplied to the channels or water troughs 24 located on the interior of the furnace at each side thereof.

Sufficient sections of the furnace bottom are placed in the furnace to provide a bottom throughout its length, preparatory to lighting the furnace. The gas burners are then ignited, and the furnace gradually becomes heated. After the furnace is heated to the proper temperature a truck forming a section of the furnace bottom, which has been loaded with a series of formed and unburned briquets, is then introduced into the preliminary heating chamber. This furnace bottom section, when moved into the preliminary heating chamber 2, causes the truck forming the end section of the furnace bottom to emerge from the cooling chamber 3 at the opposite end of the furnace. Successive loaded sections of the bottom are then passed into the preliminary heating chamber end of the furnace, until the first loaded section of the furnace bottom has been passed successively through the preliminary heating chamber and the burning and cooling chamber, and is caused to emerge from the cooling chamber. The briquets or other materials thereon will then have been burned and cooled to the desired low temperature. The further admission of sections of the furnace bottom, loaded with unburned briquets causes a step-by-step movement of the cars in the furnace forming the sectional bottom, the above described operations then being continued as is required or found necessary.

In the operation of the furnace it will be obvious that a series of the sections of the bottom may be moved into the furnace instead of singly when desired.

The advantages of our invention will be apparent to those skilled in the art. The apparatus is simple and is easily kept in repair.

The use of the separate combustion chambers in the burning chamber permits of the temperature being regulated in the furnace, and insures uniform heating throughout the length of the burning chamber, a condition which has not been found possible with the furnaces as constructed heretofore.

By supporting the burning chamber of the furnace upon piers, a free circulation of air is maintained in under the furnace, to the end that the difficulties heretofore ex-

perienced in keeping the running gear of the cars forming the furnace bottom in operable condition are avoided and overcome.

The provision of the saw-tooth roof on the burning chamber, forming a series of separate combustion chambers, affords a cheap and durable construction, and enables a more uniform heating of the burning chamber.

The water seal and the peculiar construction of the abutting ends of the sectional furnace bottom prevents escape of the burned or burning gases from the furnace and avoids undue heating of the rolling parts of the cars forming the sectional furnace bottom, and also prevents ingress of air to the furnace.

Modifications in the construction and arrangement of the furnace may be made without departing from our invention. The length and width of the furnace may be changed, the relative length of the preliminary heating, burning and cooling chambers may be varied, the number of combustion chambers employed may be lessened or increased, the location of the stack flue outlet in the furnace may be changed, and other variations may be made without departing from our invention as defined in the appended claims.

We claim:—

1. A furnace comprising a roof, stationary side walls, and a sectional furnace bottom forming the furnace chamber, said furnace bottom being movable into and out of the furnace, co-acting means on the furnace side walls and movable furnace bottom sections whereby escape of gas between the side walls and furnace bottom is prevented, and a track below the furnace on which the furnace bottom sections are moved into and out of the furnace, the furnace side walls and track being elevated to form a passage thereunder whereby to maintain a circulation of air beneath the furnace below the movable furnace bottom.

2. A furnace comprising a roof, stationary side walls and a sectional furnace bottom forming the furnace chamber, the sections of said bottom being movable through the furnace, a water seal between the side edges of the sectional furnace bottom and side walls of the furnace whereby escape of gases therebetween is prevented, and a track below the furnace on which sections of the furnace bottom are moved into and out of the furnace, the ends of said track being inclined upwardly from beneath the furnace to a point beyond the end of the furnace to thereby permit passage of the sectional furnace bottom through the furnace without lowering the level of the water in said water seal.

3. A furnace comprising a roof, stationary side walls, and a sectional furnace bottom forming the furnace chamber, the sections of said furnace bottom being movable through the furnace, co-acting means on the furnace side walls and sides of the furnace bottom whereby escape of gases between the side walls and bottom is prevented, and a track below the furnace on which the sectional bottom is moved through the furnace, the furnace side walls and track being elevated to form a passage thereunder whereby to maintain the circulation of cooling air beneath and across the width of the furnace below the furnace bottom.

4. A furnace comprising a roof, stationary side walls, and a sectional furnace bottom forming the furnace chamber, the sections of said furnace bottom being movable through the furnace, co-acting means on the furnace side walls and sectional bottom whereby escape of gases between the side walls and furnace bottom is prevented, a track below the furnace on which the sectional bottom is moved through the furnace, the furnace side walls and track being elevated to form a transverse passage thereunder whereby to maintain a circulation of air below the furnace bottom, and dust pockets at intervals in the length of the furnace adjacent to the side walls thereof having sloping sides to receive and collect dust deposited from the interior of the furnace.

5. A furnace comprising a stationary roof, side walls, and a movable furnace bottom forming the furnace chamber, said furnace bottom being formed in sections movable into and out of the furnace, co-acting means on the furnace side walls and the movable sections of the furnace bottom whereby escape of gases therebetween is prevented, a track below the furnace on which the wheeled trucks forming the sectional bottom are moved into and out of the furnace, the furnace side walls and track being elevated to form a passage thereunder whereby to maintain a circulation of air below the furnace beneath the furnace bottom, dust pockets at intervals in the length of the furnace adjacent to the side walls thereof having sloping sides to collect and remove dust from the interior of the furnace, said pockets having openings in the bottom thereof through which the dust is discharged from the furnace, and having means for normally closing said openings.

6. A furnace comprising a stationary roof, side walls, and a movable furnace bottom forming the furnace chamber, said furnace bottom being formed in sections, the ends of the sections overlapping, co-acting means on the furnace side walls and the movable sections of the furnace bottom whereby escape of gases therebetween is prevented, a track below the furnace on which the wheeled trucks forming the sectional bottom are moved into and out of the furnace, the

furnace side walls and track being elevated to form a transverse passage thereunder whereby to maintain a circulation of air below the furnace beneath the furnace bottom.

7. A furnace comprising a stationary roof, side walls, and a movable furnace bottom forming the furnace chamber, said furnace bottom being formed in sections, the ends of the truck frames forming the sectional bottom having overlapping flanges, co-acting means on the furnace side walls and the movable sections of the furnace bottom whereby escape of gases therebetween is prevented, a track below the furnace on which the wheeled trucks forming the sectional bottom are moved into and out of the furnace, the furnace side walls and track being elevated to form a transverse passage thereunder whereby to maintain a circulation of air below the furnace beneath the furnace bottom.

8. A furnace comprising in combination side walls and a serrated roof having inclined portions forming a heating chamber having a series of separated combustion chambers in the top thereof, said inclined roof portions extending downwardly toward the end of said chamber, means for independently heating said combustion chambers, and a series of wheeled trucks forming a sectional furnace bottom movable lengthwise through the furnace to bring materials supported on the sections of the furnace bottom beneath the successive combustion chambers.

9. A furnace comprising in combination side walls and a serrated roof having downwardly inclined portions forming a heating chamber having a series of separated combustion chambers in the upper portion thereof, means for independently heating said combustion chambers and a series of wheeled trucks forming a sectional furnace bottom movable lengthwise through the furnace to thereby bring materials supported thereon beneath the successive combustion chambers.

10. A furnace comprising in combination side walls and a serrated roof with inclined portions forming a heating chamber having a series of separated combustion chambers, a series of burners in each combustion chamber, and a series of wheeled trucks forming a sectional furnace bottom movable lengthwise through the furnace to thereby bring materials supported on the furnace bottom beneath the successive combustion chambers.

In testimony whereof, we have hereunto set our hands.

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Witnesses:
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