No. 619,715. Patented Feb. 21, 1899.

T. C. BRIGHT.

STEAM POWER SYSTEM.

(Application filed May 1, 1897.)

(No Model.) 4 Sheets—Sheet 1.

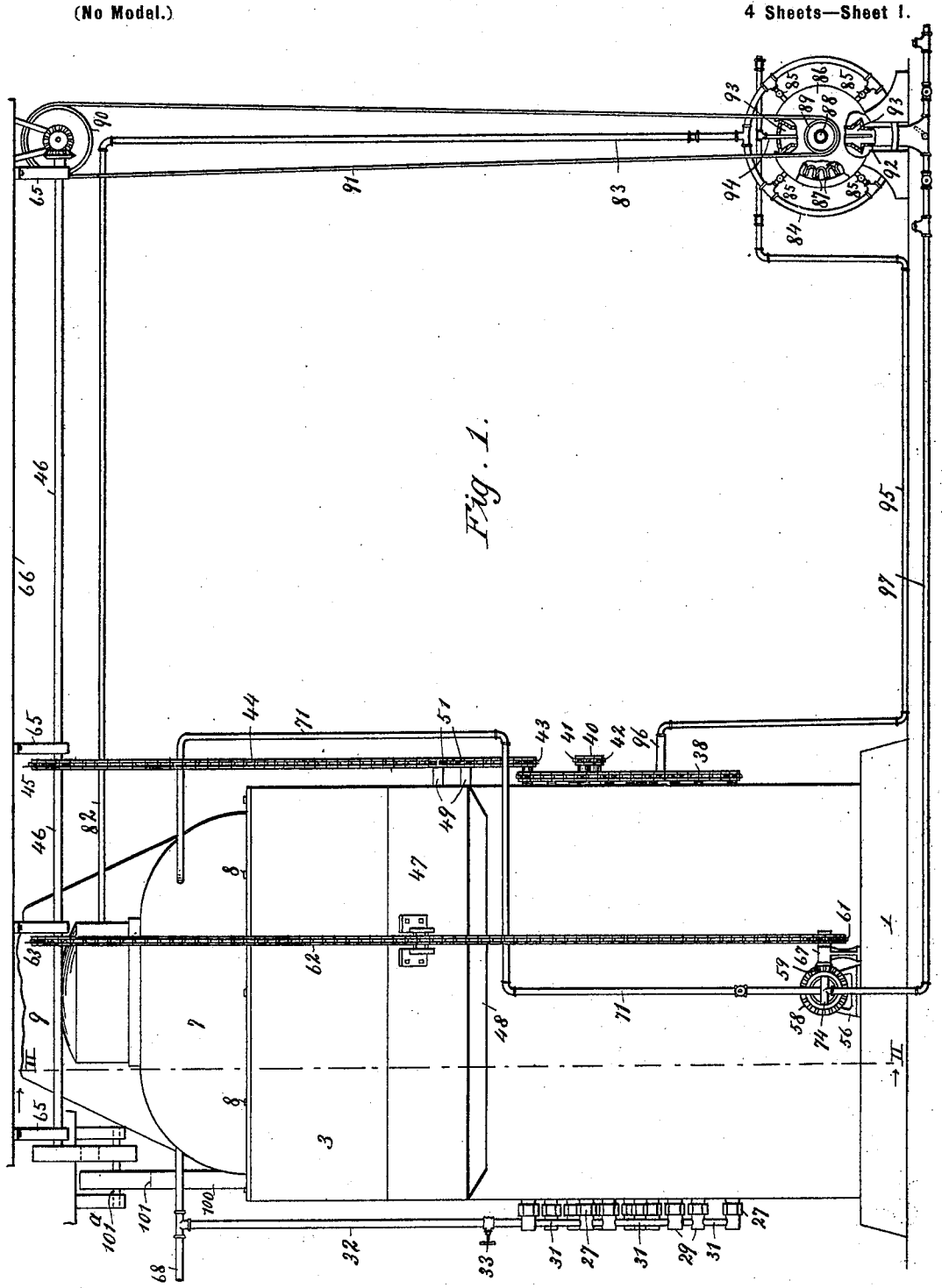


Fig. 1.

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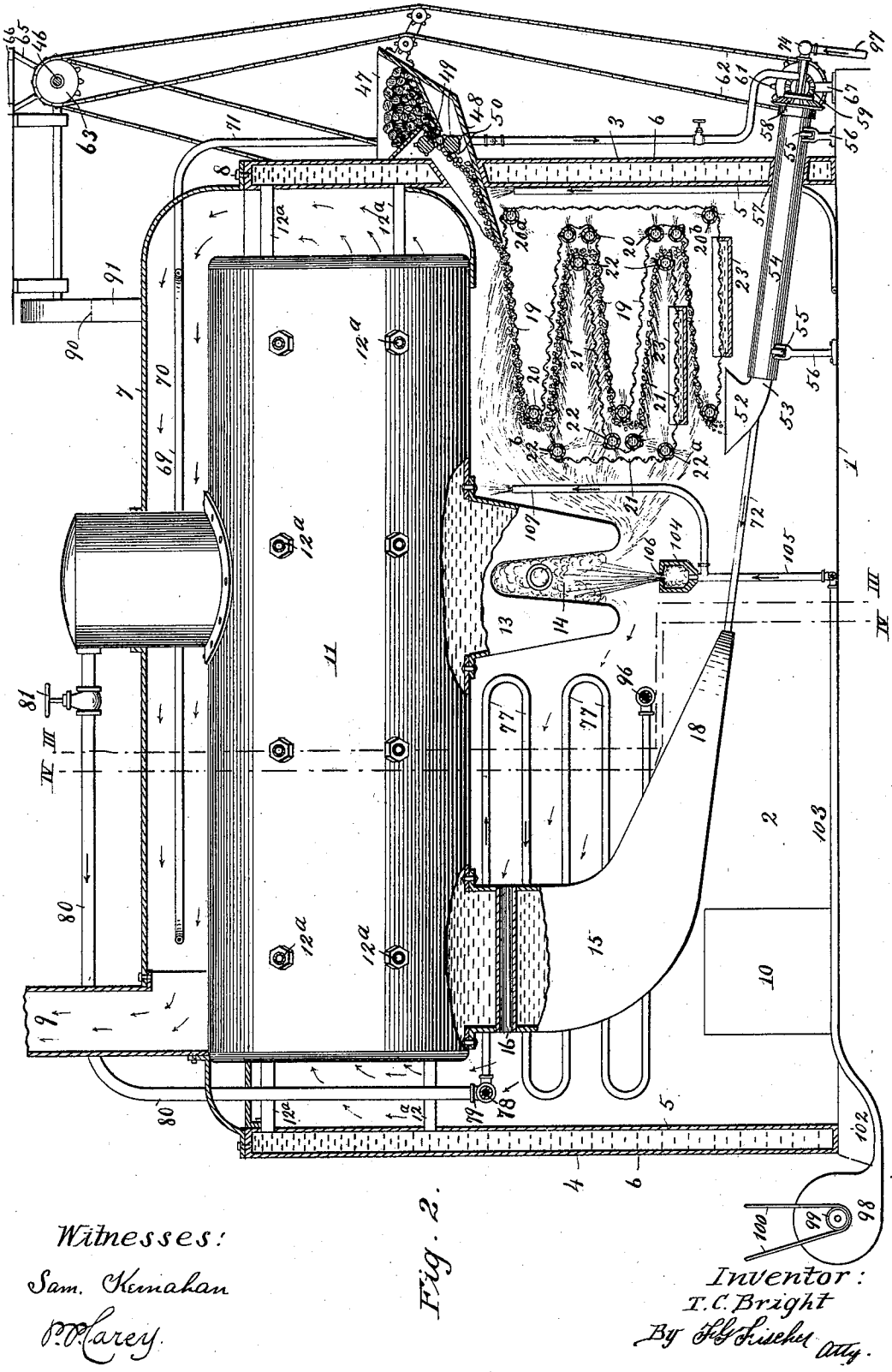


Fig. 2.

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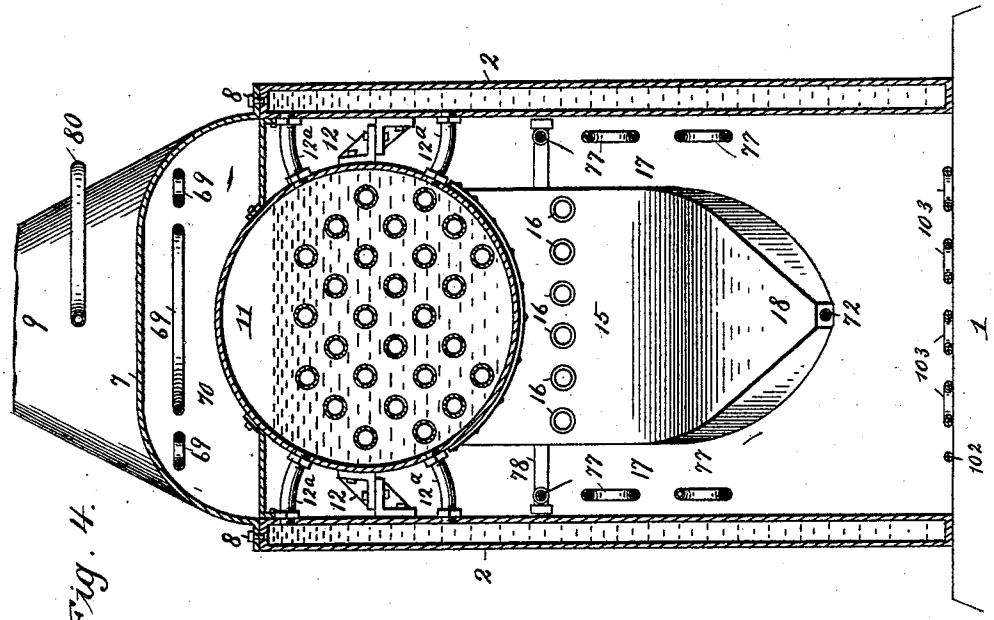


Fig. 4.

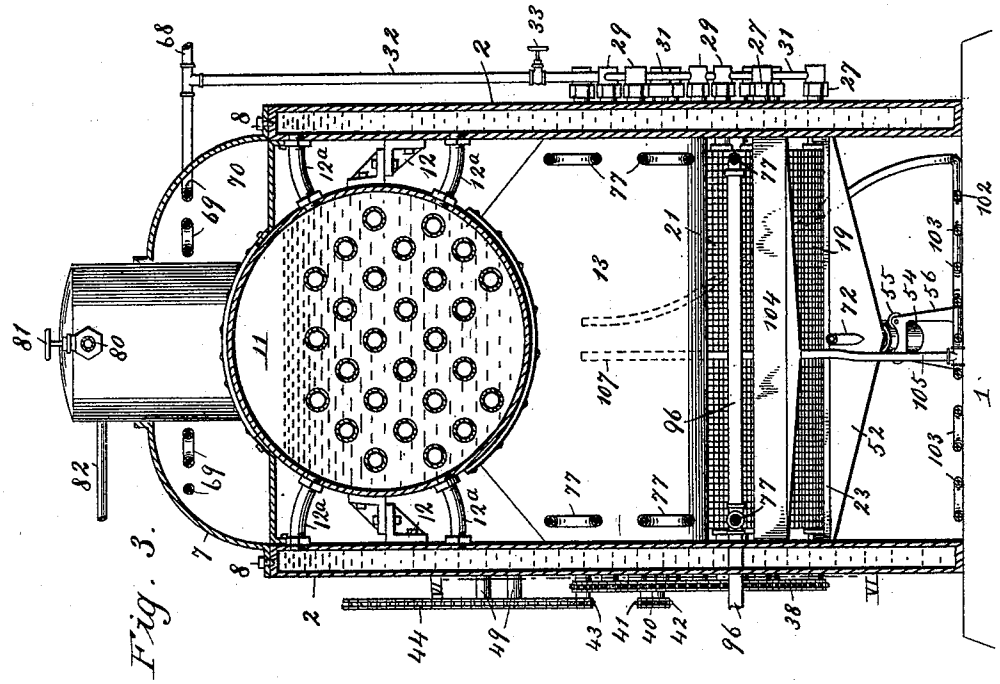


Fig. 3.

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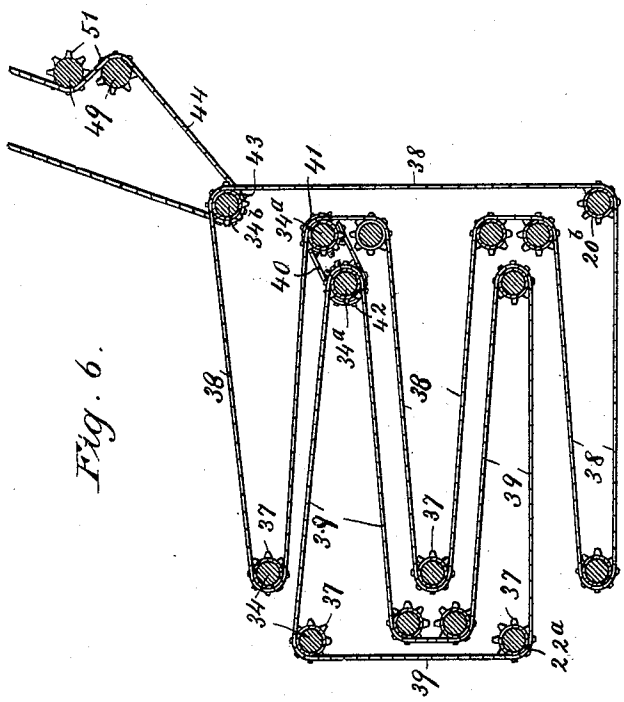


Fig. 6.

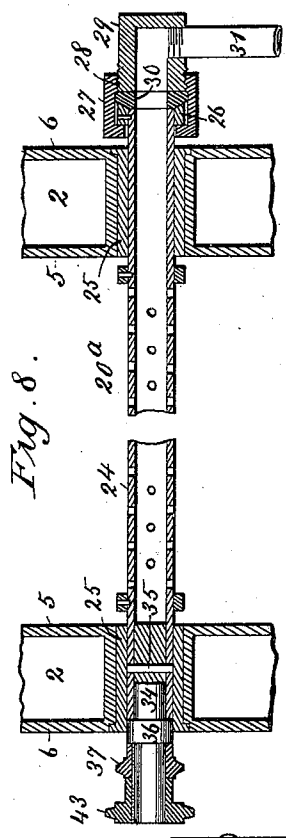


Fig. 8.

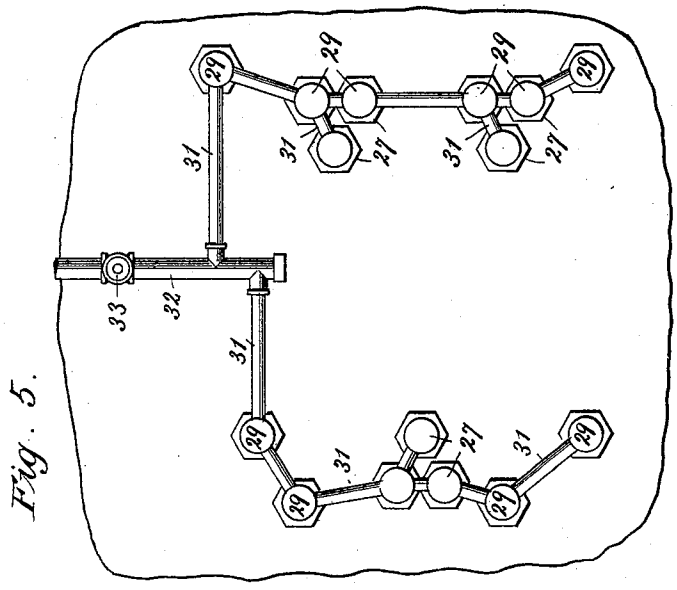


Fig. 5.

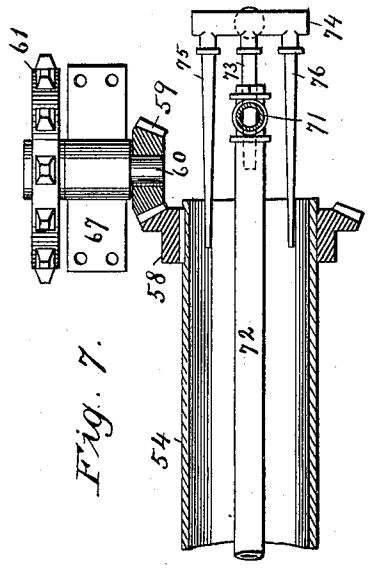


Fig. 7.

Witnesses:

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UNITED STATES PATENT OFFICE.

THOMAS C. BRIGHT, OF KANSAS CITY, MISSOURI.

STEAM-POWER SYSTEM.

SPECIFICATION forming part of Letters Patent No. 619,715, dated February 21, 1899.

Application filed May 1, 1897. Serial No. 634,786. (No model.)

To all whom it may concern:

Be it known that I, THOMAS C. BRIGHT, a citizen of the United States, residing at Kansas City, in the county of Jackson and State of Missouri, have invented certain new and useful Improvements in Steam-Power Systems, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to improvements in steam-power systems; and one of my objects is to so construct and arrange the several parts as to economically generate steam, conduct it to the point of use, and after it has performed its duty to return a large proportion of it to the generator and inject it therein without the assistance of steam-traps, pumps, or all other complicated mechanical appliances requiring more or less attention from the fireman and often necessitating expensive repairs.

A further object is to combine highly-heated gases with the carbon of the fuel, which ignite in the combustion-chamber and are transformed into a pure flame free from smoke.

Another object is to dispense with all masonry work except the foundation in inclosing the steam-generator and substitute therefor hollow walls or water-jackets, which surround the boiler and assist in utilizing all the units of heat radiated from the fire.

My system may also be said to consist in the novel arrangement and combination of parts hereinafter described, and pointed out in the claims.

Referring now to the drawings, which illustrate the invention, Figure 1 represents a front elevation of the system. Fig. 2 is a vertical longitudinal section of the furnace with the generator shown in full. Fig. 3 is a vertical cross-section of same, taken on line III III of Fig. 2. Fig. 4 is a vertical cross-section taken on line IV IV of Fig. 2. Fig. 5 is a broken side elevation of one of the water-jackets, showing the water-pipe connections to the ends of the grate-rollers. Fig. 6 repsents a vertical cross-section of the grate-rollers, taken on line VI VI of Fig. 3. Fig. 7 is a broken longitudinal section of the coke-discharge pipe, showing in plan the steam-jets projecting in one end thereof. Fig. 8 is a longitudinal section of one of the grate-rollers and its connecting parts.

In constructing my system I provide a suitable foundation or base 1, the upper surface of which is preferably raised above the floor-level. Arranged upon said base are hollow side walls 2 and hollow front and rear walls 3 and 4, all of which communicate with each other and consist of inner and outer shells 5 and 6, respectively. The walls are covered by a movable sheet-metal top portion 7, secured to the upper portion of the walls by set-screws 8 and is provided near its rear end with a stack 9.

Access may be had to the interior of the furnace for kindling the fire, making repairs, &c., through a doorway 10, located in one of the side walls.

11 indicates the steam generator or boiler, supported from the upper portion of the side walls by brackets 12. The generator has water-pipe connections 12^a with the walls of the furnace to permit the water to circulate between the generator and the water-jackets.

Communicating with the under side of the boiler just in the rear of the grate is a water-leg 13, which extends to the opposite side walls of the furnace and has a central cavity 14, open at its lower portion to form a combustion-chamber in which all of the available gases generated are ignited and pass out beneath the boiler in the form of a clear flame.

Secured to the rear under side of the boiler and communicating therewith is another water-leg 15, having flues 16 arranged in its upper portion for the passage of the flame, so it may prove more effective in heating the water therein. Spaces 17 are left between the side walls and the water-leg to permit the flame to impinge against the opposite sides thereof and more quickly heat the water it contains. This water-leg projects downwardly from the boiler in a vertical direction a suitable distance and then curves and extends forward obliquely toward the base of the furnace and terminates a proper distance above said base. The four sides of the oblique portion 18 converge toward its lower point, which receives a pipe connection hereinafter described.

The fire is kindled and maintained on an endless grate 19, operatively located on tubular rollers 20, a number of which are so disposed as to cause the grate to pursue a zigzag course from the uppermost roller 20^a down to the lowest roller 20^b, from which it extends upwardly in a vertical direction to roller 20^a.

In order to catch the fuel as it drops from the under zigzag portions of grate 19, I provide another endless grate 21, operatively

mounted on rollers 22, similar in construction to those above mentioned. These rollers are also disposed so as to cause the grate to follow a zigzag course parallel to the zigzag portion of grate 19 and like said grate to extend up vertically from the lower roller 22^a to an upper roller 22^b.

The grates may consist of heavy wire mesh, links, or other material of a pliable nature or having flexible connections and are prevented from burning out by water located in receptacles 23, extending to the opposite side walls and through which the lower sections of the grates pass.

The grate-rollers consist of perforated tubes 24, extending through the opposite side walls of the furnace and having bearings 25, in which the rollers are journaled.

Rigidly secured to one end of the rollers are collars 26, having couplings 27, loosely embracing the collars. Said couplings are provided at their outer ends with internal threads 28 to receive externally-threaded hollow plugs 29.

30 indicates rubber gaskets interposed between the adjacent ends of the stationary plugs and revolving collars to insure watertight joints when drawn together by the couplings 27. The several plugs are connected by pipes 31, the two uppermost of which connect with a vertical water-supply pipe 32, controlled by means of a valve 33. Pipes 31 are larger than the combined area of the perforations in the rollers to keep the latter filled with water when in operation. The opposite ends of the grate-rollers are closed by solid plugs 34, held therein by pins 35. These plugs have shoulders 36 interposed between the ends of the rollers and the hub portions of sprocket-wheels 37, keyed upon the outer ends of the plugs.

Sprocket-wheels 37 are revolved by endless sprocket-chains 38 and 39, respectively, which follow the course of the grate. Motion is imparted to chain 39 by a short endless chain 40, working around sprocket-wheels 41 and 42, keyed to the ends of plugs 34^a, which extend beyond wheels 37 in order to receive the sprocket-wheels 41 and 42. Plugs 34^b in roller 20^a also extend beyond sprocket-wheels 37 to receive a sprocket-wheel 43, operated by an endless chain 44, driven by a larger sprocket-wheel 45, keyed on a shaft 46.

Fuel is fed to the grates from a hopper 47, extending across the front of the furnace, and is provided at its lower portion with an apron 48, which conducts the fuel through an opening in the front wall of the furnace down upon the grate. When coal is used for fuel, the larger lumps are reduced to a uniform size by rollers 49, journaled in the opposite ends of the hopper. The peripheries of the rollers have projections 50 to assist in breaking up the lumps as they pass between the rollers to the grate. Rollers 49 project through one end of the hopper and are provided with rigidly-secured sprocket-wheels 51, arranged in the path of the sprocket-chain 44, which engages the opposite sides of said wheels and rotates them in opposite directions. As the coal is carried down by the grates and its gases are extracted it is converted into coke and discharged into a hopper 52, secured to the opposite side walls of the furnace. The bottom of the hopper slants downwardly toward its central portion and terminates in an elbow 53, which extends a slight distance into a revolving chute 54, consisting of a large pipe, which slants downwardly toward its front end, that projects through the front wall of the furnace and terminates a suitable distance therefrom. This chute is rotatably mounted upon roller-bearings 55, journaled in standards 56, arranged upon opposite sides and near the terminals of said chute, which is prevented from leaving the rollers by the elbow 53 and a circular aperture 57, located in the front wall and through which the chute extends. Said chute is provided at its forward end with a fixed bevel-wheel 58, engaging a pinion-wheel 59, keyed on one end of a shaft 60, which is provided at its opposite end with a sprocket-wheel 61, operated by an endless chain 62, extending upwardly and around a driving sprocket-wheel 63, rigidly mounted upon a shaft 46, journaled in hangers 65, extending down from beams 66. Shaft 60 is rotatably mounted in a bearing 67, secured to the base of the furnace. By thus rotating the chute the coke or other products of combustion are prevented from clogging therein.

68 indicates a water-supply pipe for replenishing the boiler from time to time. It is connected to a coil of pipes 69, located in a heating-chamber 70 above the boiler, in order that the water may become heated and more quickly transformed into steam on entering the latter. After the feed-water has become heated by passing through coil 69 it is conducted downwardly through a vertical valve-controlled pipe 71, connected at its upper end to the heating-coil and at its lower end with a pipe 72, extending upwardly at an oblique angle through the center of the revolving chute and connecting with the reduced terminal of water-leg 15.

73 indicates a steam-nozzle connected at one end to a manifold-pipe 74, its reduced end entering the rear of pipe 72 and extending therein a short distance beyond the point where the vertical pipe 71 connects with pipe 72 in order to create a suction and inject the water into the water-leg. Manifold-pipe 74 is also provided with two other nozzles 75 and 76, which enter the lower end of the revolving chute a suitable distance and discharge steam therethrough into the furnace to mix with the other gases therein and insure more perfect combustion and also automatically relieve the injecting-nozzle 73 of any excess of steam, which might interfere with its proper function.

As it is not always desirable to carry high-pressure steam in the boiler, I generate super-

heated steam for such purposes as required in coils 77, extending along near the opposite side walls from the combustion-chamber to a point adjacent to the rear wall of the furnace. The upper terminals of these pipes are connected by a horizontal cross-pipe 78, provided with a centrally-disposed T 79, having communication with a supply-pipe 80, which is connected at its opposite end to the steam-dome of the boiler. The flow of steam through this pipe 80 is controlled by a valve 81. By thus directing the low-pressure steam from the boiler through the highly-heated coils in the furnace it is more quickly converted into superheated steam than it could possibly be in the boiler.

Steam for power purposes is taken from the dome of the boiler through a valve-controlled supply-pipe 82, having a vertical valve-controlled pipe connection 83 with a circular pipe 84, which is connected to the inlet-ports 85 of an engine 86. This engine may consist of any usual or preferred type; but in this instance I show one provided with a rotary piston 87 of central bore to receive a shaft 88, having a fly-wheel 89. Said fly-wheel imparts motion to a pulley 90, rigidly mounted upon the main shaft by an endless belt 91.

92 indicates an exhaust-pipe having connections with the outlet-ports 93 of the engine. A vacuum is created in said exhaust-pipe by superheated steam discharged through a nozzle 94, having connection through a valve-controlled pipe 95 to a transverse pipe 96, communicating with the lower ends of the superheated coils in the furnace.

When the superheated steam mixes with the exhaust-steam from the engine, the temperature of the latter is increased, and it enters the boiler at the maximum temperature consistent with the proper operation of the injector.

97 indicates a valve-controlled pipe connected at one end to exhaust-pipe 92 and at its opposite end to the manifold-pipe 74 for the purpose of conducting the steam back from the engine to the boiler and supplying the nozzles on the manifold-pipe with steam, as above described.

Superheated air is introduced into the furnace under pressure by blower 98, located in the rear of the furnace and operated by a pulley 99, keyed on the shaft of the blower. Motion is imparted to said pulley by an endless belt 100, extending upwardly and around a drive-pulley 101, rigidly mounted on a shaft 101ª. The discharge end of the blower is connected to a pipe 102, which enters the furnace and connects with a superheating-coil 103, arranged upon the bottom of the furnace. The discharge end of said coil extends to the front wall of the furnace, where it curves and continues upwardly, terminating within a short distance of apron 48. Another portion of the superheated air is discharged through a transverse nozzle 104, connecting with the superheated air-coil by a vertical pipe 105. This nozzle consists of a trough located beneath the combustion-chamber and extending to the opposite sides of the boiler, and its upper portion is provided with a narrow slot 106, extending the entire length of the trough. The area of the slot is only equal to that of pipe 105 in order that it may create a back pressure, and thus insure a uniform discharge of the air through the entire length of the slot. The superheated air is also mixed with the gases in the furnace by a nozzle 107, which connects at one end with vertical pipe 105 just below the transverse nozzle and terminates at its upper end just in the rear of the grate.

Operation: Fire is kindled on the grate in the usual manner, and when steam is generated the valve in the supply-pipe leading to the engine is opened and the piston is set in motion. This motion is communicated to the feed-rollers in the hopper by the intermediate mechanism between the engine and said rollers, which thereafter continue to feed coal down upon the grate in a regular and uniform manner. The grate-rollers being started simultaneously with the feed-rollers carry the fuel down over the tortuous path pursued by the grate until its gases are extracted and it is discharged into the hopper, from which it is carried through the revolving chute, that finally discharges it in front of the boiler. The valve controlling the nozzles entering the revolving chute is then opened and a portion of the return steam from the engine is discharged into the furnace through said revolving chute and commingles with the gases extracted from the fuel in its passage over the grates. The blower is also set in operation and air is forced through the heating-coils and discharged into the furnace through the hot-air nozzles. As the transverse nozzle with its slotted upper side discharges a sheet of superheated air upwardly into the combustion-chamber all of the other gases are drawn therein and thoroughly mixed, when they ignite and pass out from the combustion-chamber beneath the boiler transformed into a pure flame.

After the system has been properly started it requires but little attention from the attendant, and as a large proportion of the steam is returned to the boiler after use by the engine only a small quantity of water is necessary to replenish the boiler and insure the proper operation of the injector.

As the steam from the engine is returned direct to the boiler by the superheated steam without passing through any intermediate mechanism except the return-pipes, its temperature is slightly increased above that which leaves the boiler. Consequently the fire does not have to be pushed in order to generate a fresh supply of steam.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a steam-power system, the combina-

tion of a furnace provided with an automatic stoker, in the form of a hopper provided with crushing and feeding rolls, and an endless grate geared to said rolls; a hopper arranged to receive the discharge of said grate; a rotatable chute to receive such discharge from the hopper and carry it out of the furnace, and a motor or engine geared to said stoker and chute to operate the same, substantially as described.

2. In a steam-power system, a boiler provided near its central under portion with a water-leg having a combustion-chamber arranged therein, substantially as set forth.

3. In a steam-power system, a boiler provided at its under side with a water-leg, the sides of which converge toward each other and terminate in a reduced end portion; and flues extending through the upper portion of said water-leg, substantially as described.

4. In a steam-power system, a boiler, a furnace for generating steam therein; a suitable engine, a supply-pipe for conducting steam from the boiler to the engine, an exhaust-pipe for conducting steam from the engine back to the boiler; a water-supply pipe communicating with the exhaust-pipe; a superheating steam-coil communicating at its opposite ends with the boiler and exhaust-pipe; a manifold-pipe communicating with the exhaust-pipe, and provided with overflow-nozzles, and an injecting-nozzle for supplying the boiler with feed-water and the exhaust from the engine, substantially as described.

5. In a steam-power system, the combination with a furnace, a boiler located therein and provided with a depending tapering water-leg, a pipe connected to the attenuated end thereof, a water-supply pipe connecting with the water-leg pipe; of an engine, a steam-supply pipe connecting the same with the dome of the boiler, an exhaust-steam pipe leading from the engine, a manifold-pipe communicating with the exhaust-pipe and provided with overflow-nozzles and an injecting-nozzle which enters the water-leg pipe; and a superheating steam-coil communicating at its opposite ends with the boiler and exhaust-pipe, for the purpose of maintaining the circulation between the engine and boiler, substantially as described.

6. In a steam-power system, a furnace of suitable construction; a generator located therein; a water-leg arranged upon the bottom of the generator and provided with a combustion-chamber; a blower located adjacent to the furnace; an air-heating coil arranged in the furnace and connecting at one end to the blower and terminating at its opposite end in a vertical nozzle; a transverse nozzle arranged beneath the combustion-chamber and provided with a longitudinal slot through which the hot air exhausts into the combustion-chamber; a pipe connection between the nozzle and heating-coil; and an auxiliary nozzle which connects at its lower end with said pipe connection and terminates at its upper end in the rear of the grate, substantially as set forth.

7. In a steam-power system, a furnace of suitable construction; a rotatable grate journaled therein; a transverse hopper arranged beneath the discharge end of the grate, the bottom of said hopper terminating in an elbow; a revolving chute communicating at its upper end with the elbow and projecting through the furnace-wall at its lower end; antifriction-bearings upon which the chute is mounted; a bevel-gear rigidly secured to the lower terminal of the chute; another bevel-wheel operatively engaging therewith; and a sprocket-wheel keyed to the shaft of the last-mentioned bevel-wheel, for the purpose set forth and described.

8. In a steam-power system, a furnace consisting of hollow walls inclosed by a suitable top portion; a hopper arranged across one end of said furnace and communicating with the interior thereof; longitudinal feed-rollers journaled in the opposite ends of the hopper; hollow grate-rollers journaled in the walls of the furnace; flexible grates rotatably arranged in a zigzag manner upon the rollers; and water-receptacles located in the path of the grates, substantially as described.

9. In a steam-power system, a furnace; rollers journaled in the side walls of said furnace, consisting of perforated tubes; water-tight joints arranged upon one end of the rollers; water-pipes connecting with said joints; a valve-controlled supply-pipe communicating with the water-pipes; sprocket-wheels rigidly secured to the opposite ends of the rollers; endless sprocket-chains arranged upon the sprocket-wheels; means for imparting motion to the chains; and flexible grates arranged in a zigzag manner upon the rollers, substantially as specified.

10. In a steam-power system, a furnace, a movable grate located therein, a hopper arranged beneath the discharge end of the grate, and a revolving chute communicating at one end with the hopper, and projecting through a wall of the furnace, at its opposite end, substantially as described.

11. In a steam-power system, a furnace of suitable construction; a flexible grate rotatably journaled therein; a hopper arranged beneath the grate, its bottom portion terminating in an elbow; a revolving chute communicating at its upper end with said elbow and projecting through the furnace at its lower end; roller-bearings adapted to receive the chute; and means for rotating said chute, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

THOMAS C. BRIGHT.

Witnesses:
MARY D. LAWRENCE,
JOHN RURGEN.