G. A. FOWLER.

WATER OR OTHER FLUID HEATING APPARATUS.

APPLICATION FILED JUNE 25, 1909.

955,393. Patented Apr. 19, 1910.

2 SHEETS—SHEET 1.

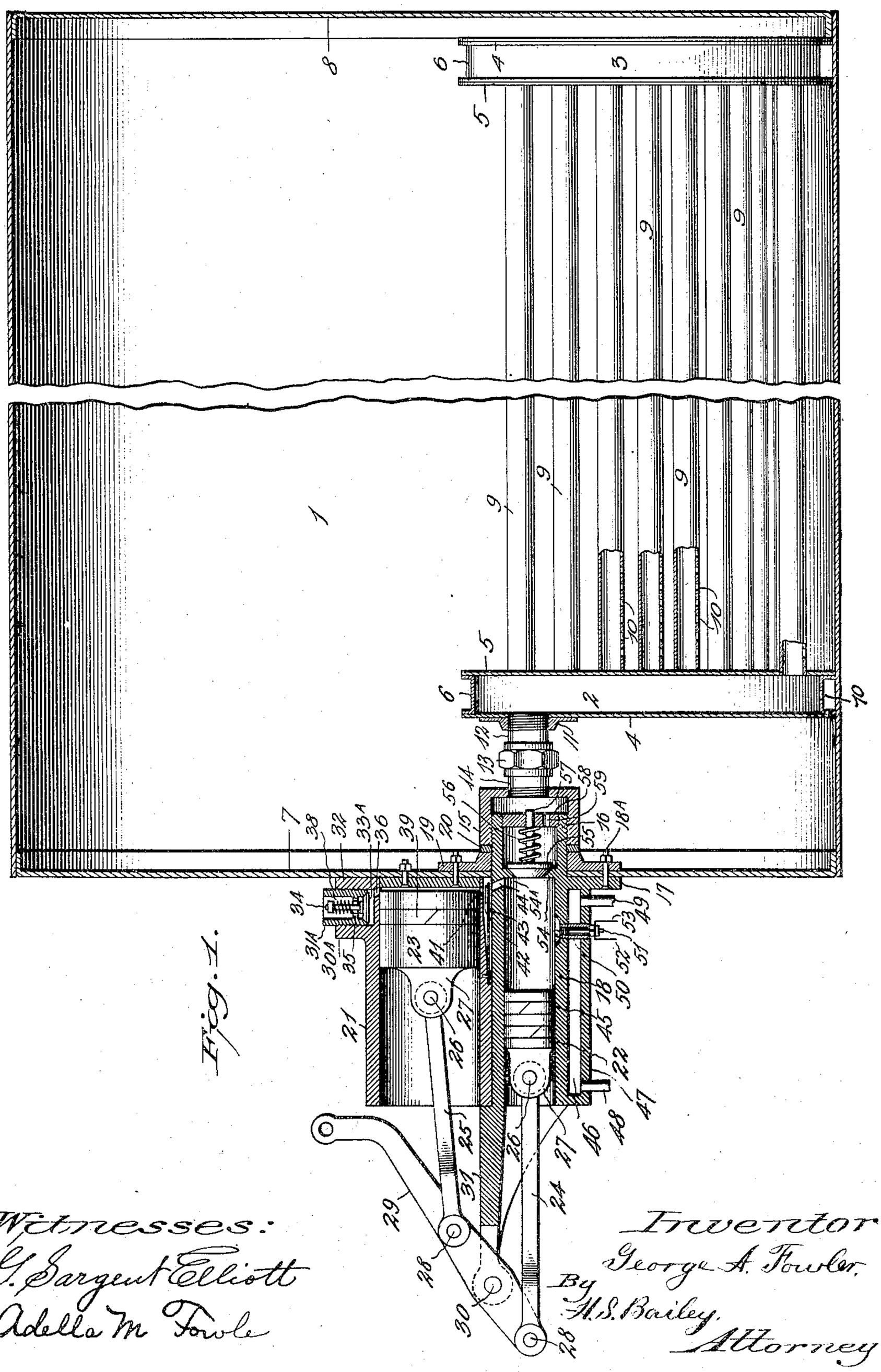

Fig. 1.

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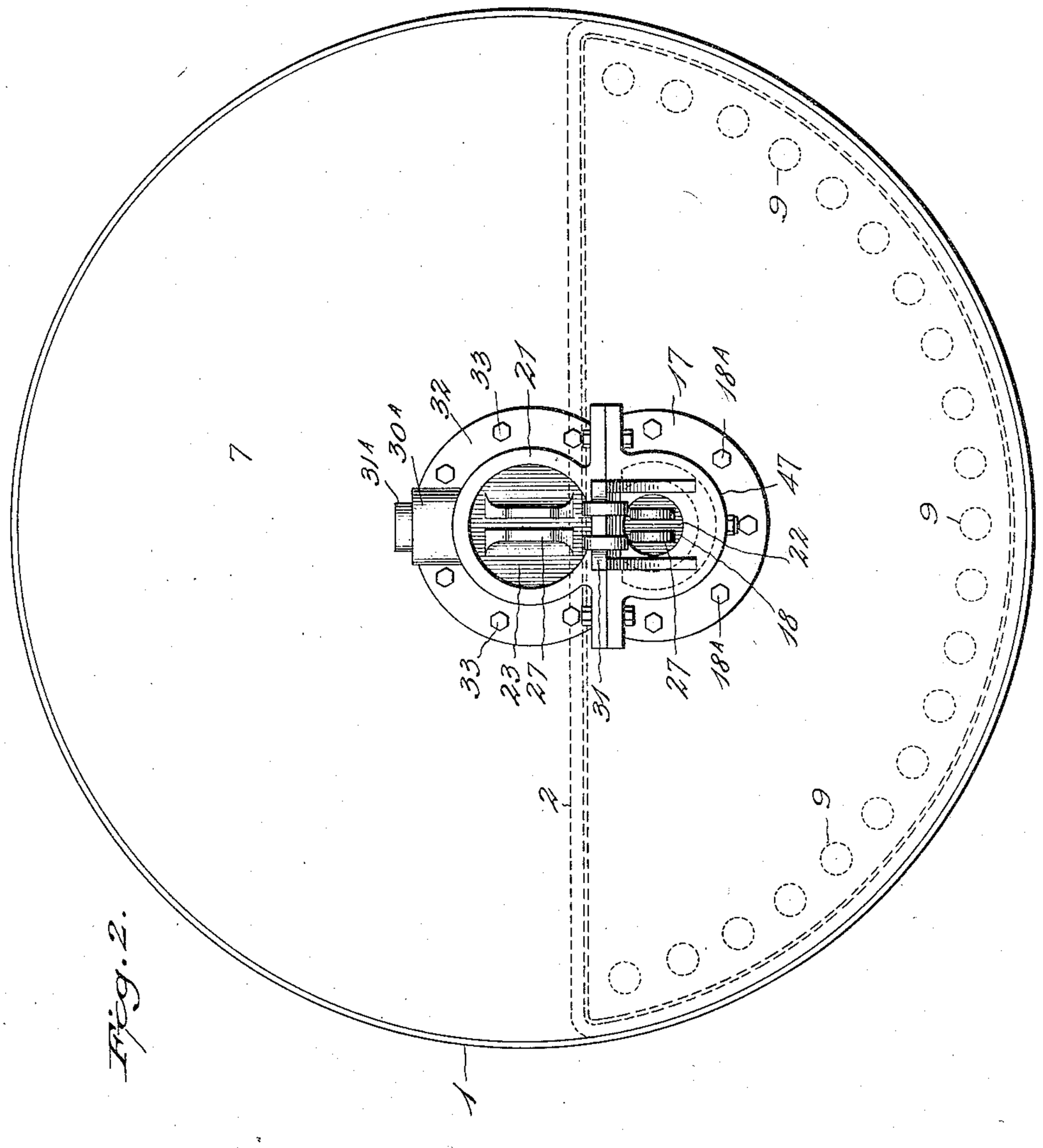

Fig. 2.

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UNITED STATES PATENT OFFICE.

GEORGE A. FOWLER, OF DENVER, COLORADO.

WATER OR OTHER FLUID HEATING APPARATUS.

955,393. Specification of Letters Patent. Patented Apr. 19, 1910.

Application filed June 25, 1909. Serial No. 504,349.

To all whom it may concern:

Be it known that I, GEORGE A. FOWLER, a citizen of the United States of America, residing in the city and county of Denver and State of Colorado, have invented a new and useful Water or other Fluid Heating Apparatus, of which the following is a specification.

My invention relates to improvements in water or other fluid heating apparatus, and the objects of my invention are: First, to provide an explosive mixture fluid heating apparatus in which the resulting heated gas of the exploded explosive mixture is forced into the fluid, such as air, water, or other fluids, in such a manner that they are heated thereby. Second, to provide a combined explosive mixture feeding exploding and pumping apparatus for forcing the resulting heated gas of exploded explosive mixtures into such intermingling contact with air and water or other fluid as to heat them; and third, to provide a simple practical and inexpensive explosive mixture air heating apparatus for use underground in operating pneumatically operating mining tunneling, and other machinery, with air operated motors, drills, cars, pumps, and othe machinery. I attain these objects by the mechanism illustrated in the accompanying drawings, in which:

Figure 1, is a longitudinal sectional view through the improved fluid or liquid heating apparatus, showing the same in connection with a tank or boiler. And Fig. 2, is a front elevation of the same, the piston rods and operating lever being omitted.

Similar characters of reference refer to similar parts throughout the several views.

Referring to the drawings, the numeral 1, designates a fluid holding tank or boiler, such as an air receiving tank or a steam generating water or other fluid holding receptacle of which it is desired to heat the contents. Inside of this heat tank or boiler, two drum heads 2 and 3 are placed, each of which consists of two substantially semicircular sheet metal plates 4 and 5, which are connected by channel ends or bands 6, the plates being riveted to the said bands to form fluid tight drum heads. These heads rest on the inside bottom plate of the boiler at a short distance from the heads 7 and 8 of the same, and extend up adjacent to the center of the boiler, but preferably not to its top portion. A plurality of perforated tubes 9 are supported by the inner heads of these drums, and these tubes and also the bottom portion of the channel ends 6 of the drums are provided with one or more rows of perforations 10, of sufficient size and number to allow the heating gases to escape from them into the fluid in the boiler that is to be heated. The outer head 4 of the drum head 2 is provided with an aperture which is surrounded by a flanged hub 11, in which is screwed a nipple 12, which is connected by a union 13 with a similar nipple 14, which is screwed in the end of a cap 15, which is threaded to the hub 16 of a flange 17, that forms a part of a cylinder 18, the flange portion 17 of which is bolted to the tank head 7 by bolts 18^A, which extend through the tank head and through a flanged band or ring 19, which surrounds the hub portion 16 of the cylinder's flange 17. A packing ring 20 is inserted between the end of the flanged ring 19 and the end of the cap 15, which is screwed against it and forms a tight joint between the cap and the ring.

The cylinder 18 forms an auxiliary cylinder to a main cylinder 21, which is also secured to the head of the boiler above and adjoining the cylinder 18. These two cylinders are provided with piston heads 22 and 23, and with piston rods 24 and 25 respectively. These connecting rods are pivotally connected at their inner ends by pins 26 to lugs 27 formed on the piston heads, and their opposite ends are pivotally connected by pins 28 to a rock arm 29, which is pivotally connected by a pin 30 to a bracket extension 31 formed on the adjacent end of the cylinder 18. The main cylinder 21 is provided with a flange portion 32, which is bolted to the boiler head 7 by bolts 33. This cylinder 21 is an explosive mixture compression cylinder, and the cylinder 18 is an explosive mixture explosion cylinder and a pressure pumping cylinder for the heated gas that results from the explosion of the explosive mixture cylinder, and after the explosion acts to pump this gas into the distributing tubes of the boiler from which it distributes through the air or water or other liquid or gas in the boiler and heats it. Thus if the boiler is provided with air, the hot gases from the explosion cylinder heat it, and if it contains a supply of water, steam

will be generated by the passing through it of the heated gas resulting from the explosions of the explosive mixture. These cylinders and pistons and their coöperating parts are preferably constructed and arranged in the following manner: The main cylinder 21 is provided with an apertured lug 30A, in which is screwed a nipple 31A, which is connected to a suitable carbureter or other suitable source of a supply of an explosive gas, which I do not illustrate, and a valve seat is formed in the lower end of the nipple against which a spring actuated valve 33A is seated. The valve is provided with a stem 34, which extends loosely through an aperture formed in a cross spider 35, that is inserted or forms a part of the inner end of the nipple 31A. A port 36 is formed from the bottom of the apertured lug 30A into the bore of the cylinder 21. A nut 37 is threaded on the end of the stem 34, and an expansive coiled spring 38 is mounted on the stem between the nut, which holds the valve against its seat at the end of the nipple, with pressure enough to permit it to yield and admit the explosive mixture that is drawn through it by the suction pull of the outward stroke of the piston head 23 of the main explosive mixture compressing cylinder 21. This piston head is reciprocally mounted in the bore of the main cylinder, and is provided with an expansive spring packing ring 39, to prevent leakage by the piston head. The main cylinder is provided with an explosive mixture discharging port 41, which extends through its shell into a recess formed in its shell in which a check valve 42 is placed, which is actuated to hold the port 41 closed to suction movements of the piston of the pressure cylinder by a spring 43, which is preferably made in the form of a blade of spring steel, and is secured at one end to the valve, and to the shell of the cylinder 21 at its opposite end, by a screw as shown. This main cylinder 21 is secured to press against the side of the explosive cylinder, so that this check valve retaining recess forms an inclosed port between the two cylinders, and from this port an entrance port 44 is formed, through the adjacent wall of the explosive cylinder 18, into its cylindrical bore, in which the piston head 22 is reciprocally mounted, and this head is provided with expansive spring packing rings 45. The explosive cylinder is preferably provided with a partially surrounding water jacket space 46, which is formed by a concentrically surrounding casing 47, which is cast around or otherwise formed around the shell of the cylinder far enough from it to form the water holding space 46. This outer space is provided with a water supply pipe 48, and also with a water discharging pipe 49, in order that a running supply of cold water may be kept circulating through the water space around the explosive cylinder. Through the casing of the water jacket and the shell of the cylinder, I thread a nipple 50, in which a spark plug 51 of any suitable type is secured, and to which circuit wires 52 and 53 are connected to emit a spark and cause an explosion on each operative outward stroke of the piston, as is well understood.

At the inner end of the bore of the cylinder 22, a fixed or integral cylinder head 54 is formed, having a central aperture, which forms a discharge port 54A for the heated gases of the exploded explosive mixture. This discharge port is provided with a valve seat against which a valve 55 is seated, and is held closed by a spring 56, which is preferably a coiled spring, that is mounted on a stem 57, that is formed on the valve. This stem extends loosely into a disk 58, which is threaded in the end of the hub portion of the flange 17 of the explosive cylinder 18, and the spring is mounted on the stem to bear expansively between the disk and the back of the valve. This disk is provided with a port 59, through which the compressed heated gas of the exploded explosive mixture passes into and through the nipples 12 and 14, into the adjacent drum 2, and into the perforated tubes 9, from which it is forced into the air or water in the boiler.

The rock arm 29 is connected to a power motor (not shown) in such a manner that a reciprocating movement of sufficient stroke to operate the pistons of the cylinders, will be imparted to it.

The operation of my improved explosive gas, air or other fluid heating or steam generating apparatus, is as follows: The rock arm being reciprocated by any suitable power, the explosive mixture, which preferably is carbureted gasolene, is drawn from a source of supply through the inlet nipple, and its check valve 33A, into the pressure cylinder, from which it is driven through the port 41 into the explosive cylinder 18, where it is exploded by the spark of the spark plug, and the resulting heated gas is driven on the inward strokes of the piston through the port 54A past the valve 55, and through the disk port 59 and nipples into the drum 2, and into and through the tubes 9 into the drum 3, and is discharged from them into the body of air or water or other fluid in the boiler through which it passes.

My invention is especially adapted to heating compressed air confined in and being constantly supplied to and fed from a receiving tank from a source of supply, where it is desired to use heated compressed air for driving drills in cold tunnels and shafts in mining, railroad, and engineering and other underground work, and especially for use in connection with driving the drills of tunnel driving machines, but can also be applied to

the heating of water for the generation of steam or for heating water or other solutions for various purposes.

While I have described the preferred construction and arrangement of my invention, I do not wish to be limited to it, as many changes might be made without departing from the spirit of my invention.

Having described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. An explosive mixture operating fluid heating apparatus, comprising a tank, a group of perforated pipes in said tank, provided with drum heads, hollow drum heads in the opposite end portions of said tank connected together by a group of pipes, provided with perforations, a cylinder secured to said tank provided with a hollow hub portion extending through the shell of said tank into its interior, a pipe connected to said hub at one end and to one of said drum heads at its opposite end, a cylindrical bore in said cylinder, a piston head reciprocally mounted in said cylindrical bore, a spark plug operatively connected to said cylinder, a valve controlled discharge port in said cylinder between its piston's bore and the said drum head, and means for feeding an explosive mixture to said cylinder.

2. In an explosive mixture operating fluid heating apparatus, the combination of the tank, the drum heads therein provided with perforations in their lower portions, the perforated tube connected to said drum heads, with the compression and explosive cylinders secured together, the reciprocating pistons therein, the valve controlled inlet port in said compression cylinder, the valve controlled port connecting said cylinders, the valve controlled tubular connection between said explosive cylinder and one of said drum heads, the spark plug in said explosive cylinder, and means including the power operated rock arm for operatively reciprocating said pistons in said cylinders.

3. In an explosive mixture operating fluid heating apparatus, the combination of the tank, the group of perforated pipes and the drum heads thereon, with a pair of cylindrical casings secured to said tank, said cylindrical casings being secured together and provided with two adjacent cylindrical bores, a valve controlled port extending from one cylinder to the other, piston heads in said cylinders provided with pivotal connecting rods, a bracket arm extending from one of said cylinders, a rock arm pivoted to said bracket intermediate of its ends and pivotally connected to said connecting rods, said rock arm being adapted to be connected to a reciprocating power transmitting motor or mechanism, valve controlled means for connecting one of said cylinders to a supply of explosive mixture, means including a spark plug in the casing of the other cylinder for exploding said explosive mixture, and means including valve controlled piping for connecting said explosive cylinder to one of said drum heads.

4. In an explosive mixture operating fluid heating apparatus for heating air, the combination of an air receiving tank, a group of combined perforated drum heads and tubes, resting on the bottom of said tank and provided with a valve controlled fluid inlet pipe connection extending through the shell of said tank, with a pair of explosive mixture pumping and compressing cylinders connected to said tank's shell and secured side by side together, one of which cylinders is an explosive mixture cylinder and the other an explosive mixture pumping and compressing cylinder, each of which is provided with a reciprocating piston, means including a rock arm connected to said pistons for reciprocating said pistons in unison by opposite stroke directions relative to each other, means including a check valve controlled inlet pipe for providing said compressing cylinder with a supply of explosive mixture during the operative suction stroke of said compression cylinder's piston, means including a checked valve port extending from said compression cylinder to said explosive cylinder for pumping explosive mixture into said explosive cylinder, means including a spark plug in said explosive cylinder for igniting explosive mixture in said explosive cylinder, a port in said explosive cylinder connecting with the valve controlled inlet port of said perforated drum head, and a water jacket space forming casing surrounding a part of said cylinders and provided with water circulating inlet and discharge pipes.

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

GEORGE A. FOWLER.

Witnesses:
G. SARGENT ELLIOTT,
ADELLA M. FOWLE.