Aug. 3, 1948. G. T. UNDERWOOD 2,446,498

LIQUID AIR BOILER

Filed July 27, 1945

2 Sheets-Sheet 1

Fig. 2.

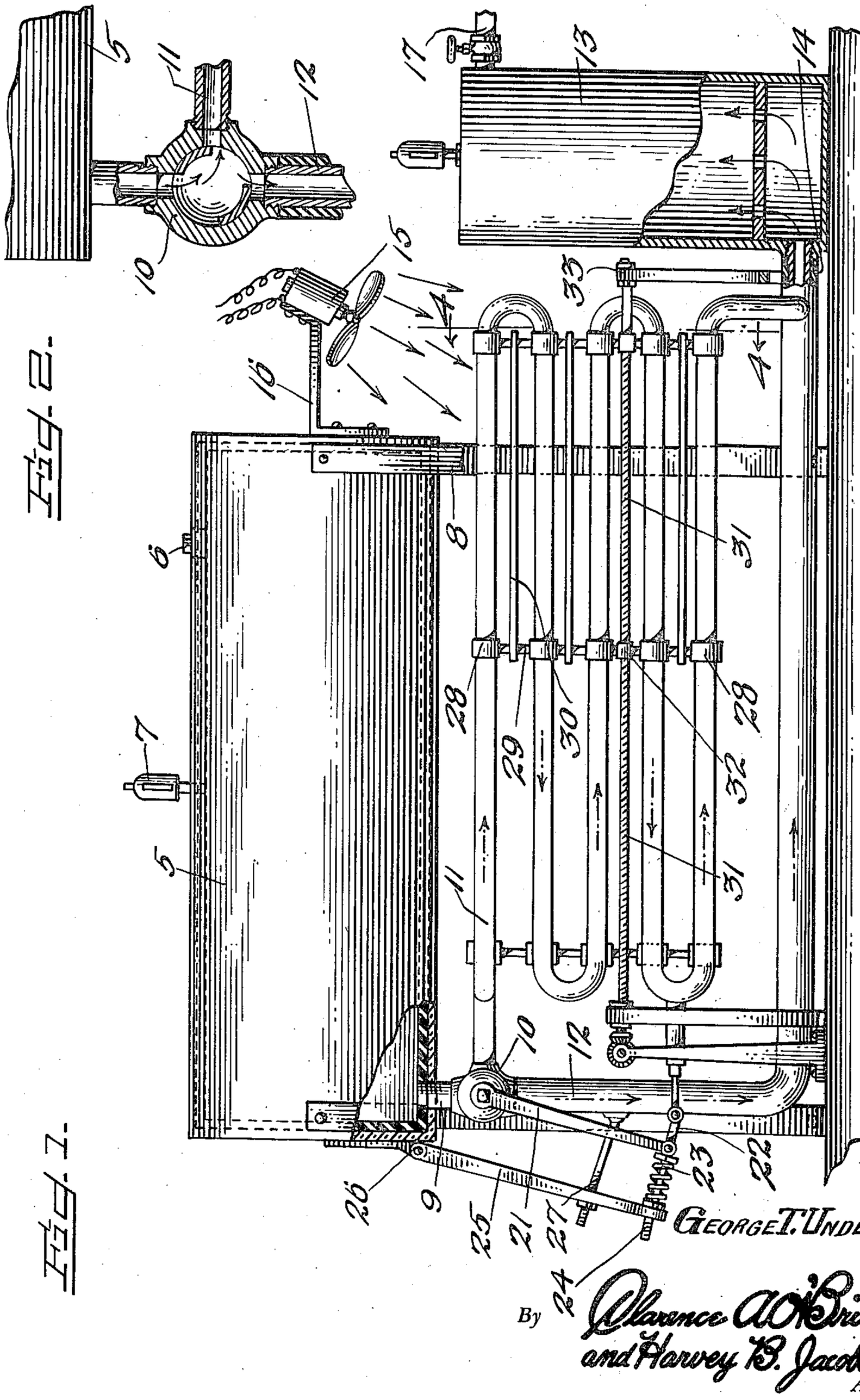

Fig. 1.

Inventor

GEORGE T. UNDERWOOD,

By Clarance A. O'Brien and Harvey B. Jackson

Attorneys

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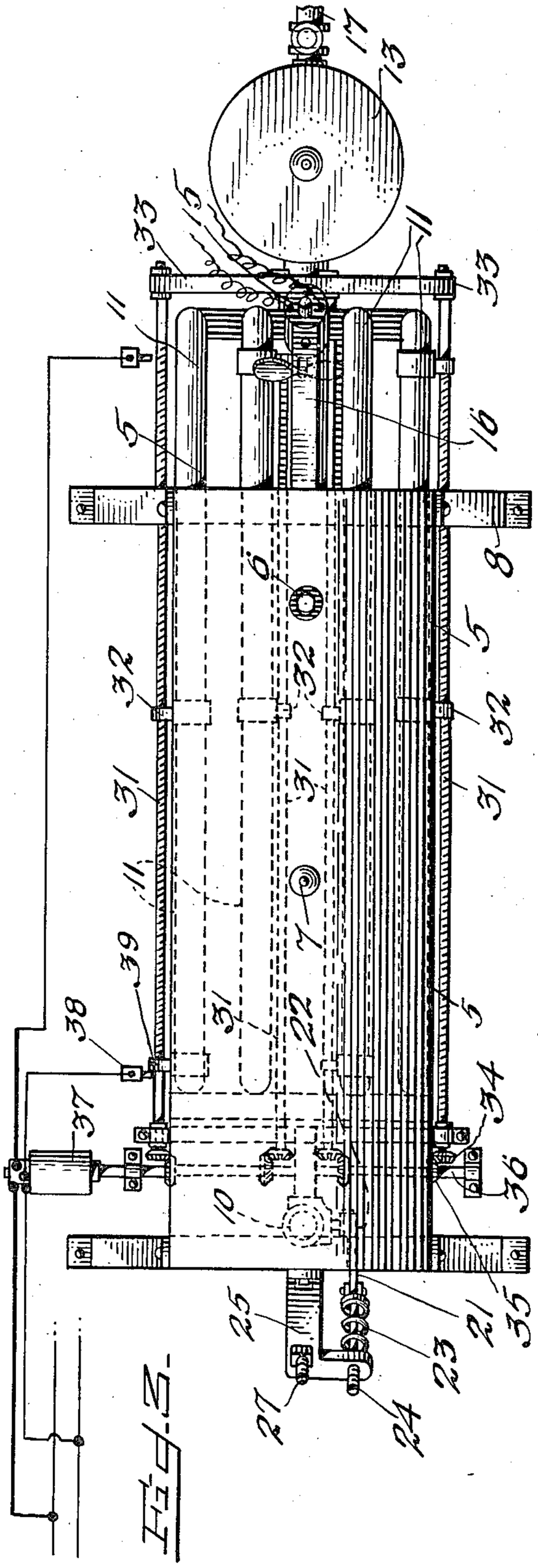

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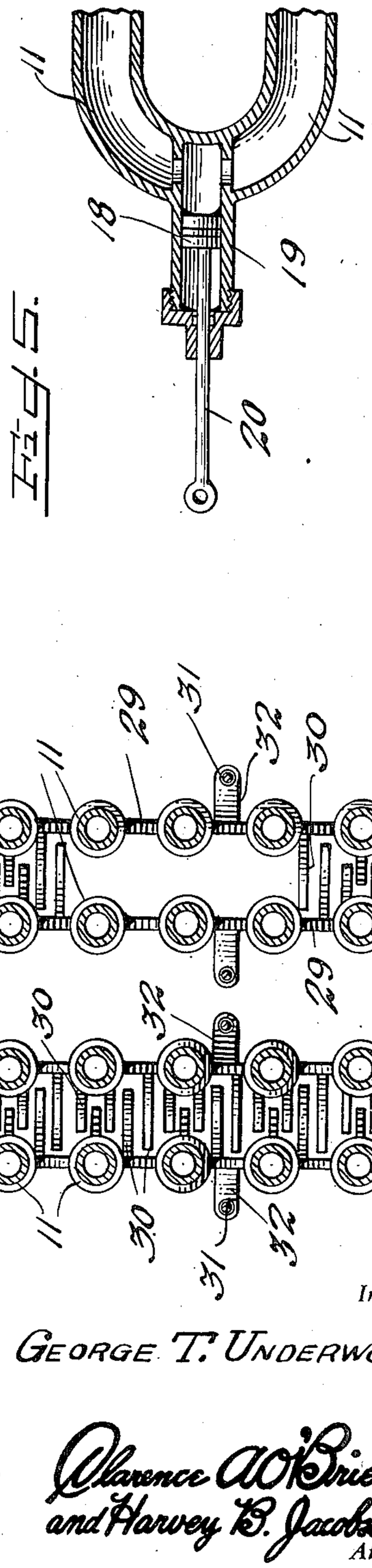

FIG. 5.

FIG. 4.

Inventor

GEORGE T. UNDERWOOD,

By Clarence A. O'Brien and Harvey B. Jacobson

Attorneys

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LIQUID AIR BOILER

George T. Underwood, Chehalis, Wash.

Application July 27, 1945, Serial No. 607,349

6 Claims. (Cl. 62—1)

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The present invention relates to a new and useful improvement in liquid air boilers, and more particularly to a device of this character adapted for generating compressed air for use as a source of power for various purposes, such as refrigeration plant or for operating factory, mining machinery, or for other useful purposes.

A further object of the invention is to provide an apparatus of this character by means of which atmospheric temperatures is utilized for evaporating the liquid air and collecting the resultant air under pressure to be used for operating various types of power plants.

A further object of the invention is to provide an apparatus of this character of simple and practical construction, which is efficient and reliable in operation, inexpensive to manufacture and install in assembled relation and which is otherwise well adapted for the purposes for which the same is intended.

Other objects and advantages reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming part hereof, wherein like numerals refer to like parts throughout, and in which:

Figure 1 is a side elevational view of the present liquid air boiler apparatus, with parts thereof broken away and shown in section.

Figure 2 is an enlarged sectional view of the two-way control valve.

Figure 3 is a top plan view.

Figure 4 is a vertical sectional view taken substantially on a line 4—4 of Figure 1, and

Figure 5 is an enlarged sectional view of the pressure operated system for the control valve.

Referring now to the drawings in detail wherein for the purpose of illustration, I have disclosed a preferred embodiment of the invention. The numeral 5 designates a liquid air supply tank having a filler plug 6 by means of which liquid air may be supplied to the tank, and the tank is also provided with a safety valve 7 of conventional construction.

The tank 5 is supported in an elevated position by means of suitable supports 8 and to the bottom of the tank is connected a pipe 9 in which a two-way valve 10 is positioned for controlling the flow of liquid air by gravity to a series of boiler tubes 11 in the form of a group of upright coils and through which the liquid air flows by gravity as indicated by the arrows in Figure 1, the valve 10 also regulates the flow of liquid through a feed pipe 12, leading directly to the bottom portion of a compressed air tank 13. The pipe 12 and tank

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5 are covered with a suitable heat insulation material 14.

The boiler tubes or coils 11 are exposed to atmospheric temperature and air is blown over the coils by means of an electric fan 15 mounted in an elevated position above the coils at one end thereof by means of a bracket 16 secured to one end of the tank 5.

As the liquid air passes through the boiler tubes or coils 11, and is subjected to atmospheric temperature, the liquid air will evaporate to thus increase the air pressure. The lower end of the coils 11 are connected to the pipe 12 adjacent the tank 13 so that the compressed air is fed and collected in the tank. A supply pipe 17 leads from the tank 13 for utilizing the compressed air for any useful purpose such as operating a compressed air engine or for other work.

The flow of liquid air entering the boiler tubes or coils 11 and the pipe 12 is controlled by air pressure in the coils through the medium of a piston 18 mounted in a cylinder 19 connected to one of the lower tubes 11, the piston having a piston rod 20 projecting outwardly of the cylinder and connected to a lever 21 for operating the valve 10 by a link 22.

The valve is shown in detail in Figure 2 of the drawings and is operable by the lever 21 to regulate the volume of liquid air entering the boiler tubes 11 and pipe 12 in the manner as indicated in accordance with air pressure in the boiler tubes 11.

The piston 18 works against the tension of a coil spring 23 mounted on a rod 24 connected at one end to the outer end of the lever 21 and having its other end loosely positioned in the free end of an arm 25 which is pivoted as at 26 to one end of the tank 5. The arm 25 is secured in pivotally adjusted position by means of a screw 27 and by means of which the tension of the spring 23 is regulated.

More or less moisture in the atmosphere causes frost to accumulate on the boiler tubes or coils 11 and in order to prevent the accumulation of frost on these tubes, I provide each of the tubes with a plurality of scraper rings 28 slidably mounted on the tubes, the rings on the vertically spaced tubes of each coil being connected for uniform sliding movement by rod 29.

Each tube 11 is provided with a pair of scraping rings 28 secured in longitudinally spaced relation from each other by means of longitudinally extending connecting rods 30 so that the rings will slide as a unit on the tube. The connecting rod 30 of adjacent coils project lat-

erally toward each other in overlapping substantially closed spaced relation as indicated in Figure 4 of the drawings whereby frost collected on the rods 30 will be scraped by the overlapping connecting rods during the sliding movement of the rings on the tubes. The groups of rings 28 for each of the coils are slidably actuated by means of longitudinally extending screws 31 threaded through arms 32 projecting from the vertical rods 29, the screws being journaled in brackets 33 at the ends of the coils and have bevelled gears 34 secured at one end thereof operatively engaged with similar gears 35 secured on a transversely extending shaft 36 operated by an electric motor 37.

The gears 35 for the screws of adjacent coils are arranged for operating the screws in opposite directions so that the rings 28 of adjacent coils will move in opposite directions during their scraping action to thus produce a scraping action between the overlapping connectors 30.

The motor 37 is reversed to cause a forward and backward sliding movement of the rings 28 by means of stationary contacts 38 connected to the motor and engaged by a movable contact 39 carried by one of the screws.

In view of the foregoing description taken in conjunction with the accompanying drawings it is believed that a clear understanding of the construction, operation and advantages of the device will be quite apparent to those skilled in the art. A more detailed description is accordingly deemed unnecessary.

It is to be understood, however, that even though there is herein shown and described a preferred embodiment of the invention the same is susceptible to certain changes fully comprehended by the spirit of the invention as herein described and the scope of the appended claims.

I claim:

1. A liquid air boiler comprising a reservoir adapted to contain liquid air, a compressed air tank, a pipe connecting the reservoir to the tank, a coil connected at each end to the pipe, and exposed to atmospheric temperature to evaporate liquid air contained therein, a two-way valve regulating flow of liquid air through the pipe and coil, and a pressure operated piston in the coil for operating the valve.

2. A liquid air boiler comprising a reservoir adapted to contain liquid air, a compressed air tank, a pipe connecting the reservoir to the tank, a coil connected at each end to the pipe, and exposed to atmospheric temperature to evaporate liquid air contained therein, a two-way valve regulating flow of liquid air through the pipe and coil, a pressure regulated piston in the coil, and an operating connection between the piston and the valve for operating the valve in accordance with the movement of the piston.

3. A liquid air boiler comprising a reservoir adapted to contain liquid air, a compressed air tank, a pipe connecting the reservoir to the tank,

a coil connected at each end to the pipe, said coil being positioned in the path of air circulated at a temperature higher than that of the liquid air to evaporate the liquid air, a valve regulating flow of liquid air through the pipe and coil, and a scraper mounted for movement along the coil.

4. A liquid air boiler comprising a reservoir adapted to contain liquid air, a compressed air tank, an insulated pipe connecting the reservoir to the tank, an evaporator connected adjacent the ends of the pipe, valve means in the pipe controlling the flow of liquid air through the pipe and into the evaporator, said evaporator including a plurality of coils having spaced parallel tubes, and scrapers slidably mounted on said tubes.

5. A liquid air boiler comprising a reservoir adapted to contain liquid air, a compressed air tank, an insulated pipe connecting the reservoir to the tank, an evaporator connected adjacent the ends of the pipe, valve means in the pipe controlling the flow of liquid air through the pipe and into the evaporator, said evaporator including a plurality of coils having spaced parallel tubes, scraper rings slidably mounted on said tubes, connecting rods between the rings of each coil for uniform sliding movement, and gear drive means for moving the rings longitudinally of the tubes in opposite directions.

6. A liquid air boiler comprising a reservoir adapted to contain liquid air, a compressed air tank, an insulated pipe connecting the reservoir to the tank, an evaporator connected adjacent the ends of the pipe, valve means in the pipe controlling the flow of liquid air through the pipe and into the evaporator, said evaporator including a plurality of coils having spaced parallel tubes, scraper rings slidably mounted on said tubes, connecting rods between the rings in longitudinally spaced groups for uniform movement and including longitudinally extending bars, the bars of adjacent coils being arranged in overlapping scraping relation, operating screws for the rings of each coil oppositely arranged gear means communicating with each of the screws, means for operating the rings of adjacent coils in opposite directions, and electrical contact means for reversing the operation of said screws upon completion of the travel of the rings in one direction.

GEORGE T. UNDERWOOD.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,351,131	Kerr	June 13, 1944

FOREIGN PATENTS

Number	Country	Date
385,833	Great Britain	Jan. 5, 1933