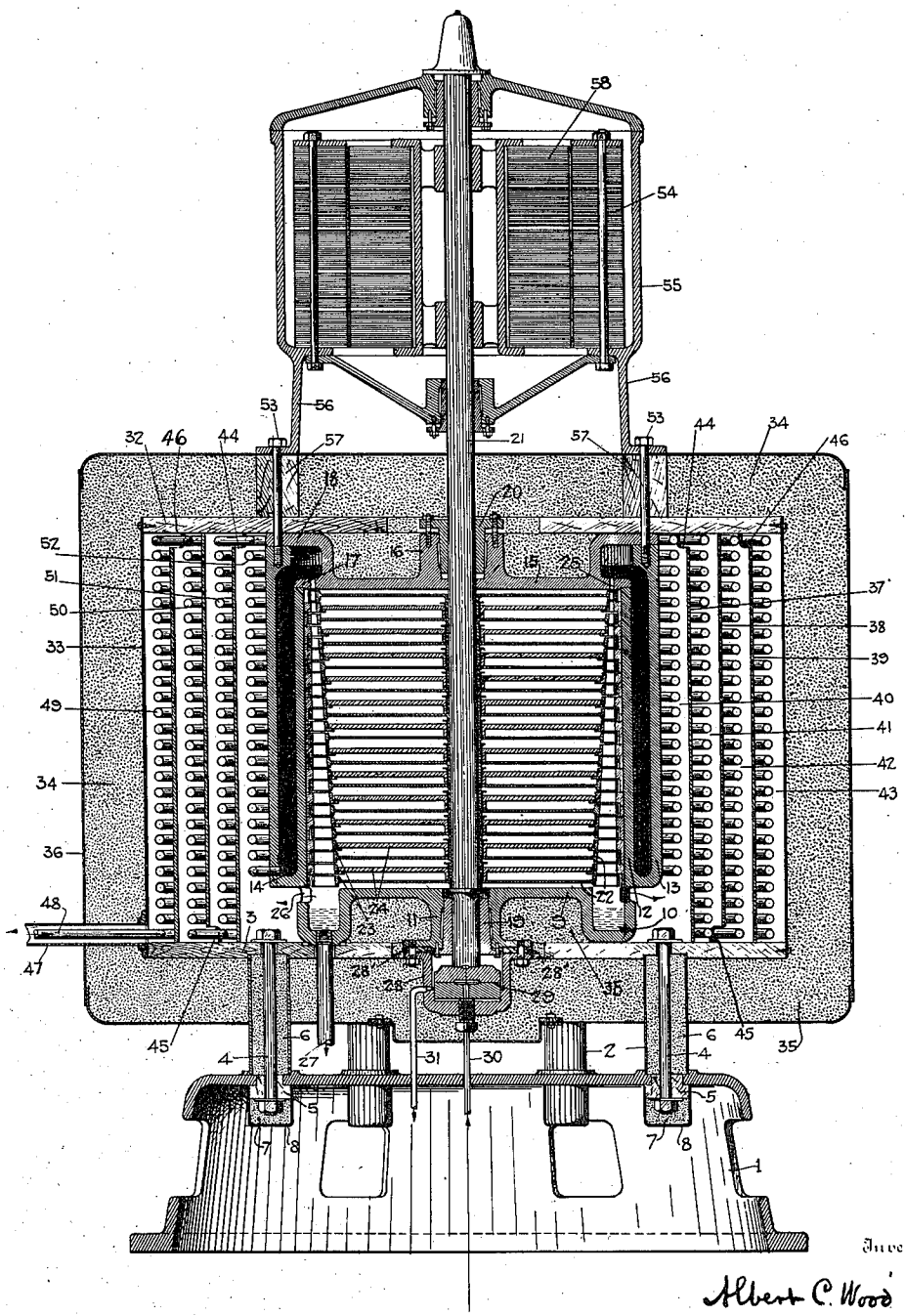
A. C. WOOD.

APPARATUS FOR LIQUEFYING GASES.

APPLICATION FILED OCT. 21, 1905.

984,875. Patented Feb. 21, 1911.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR LIQUEFYING GASES.

984,875. Specification of Letters Patent. Patented Feb. 21, 1911.

Application filed October 21, 1905. Serial No. 283,734.

To all whom it may concern:

Be it known that I, ALBERT C. WOOD, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain Improvements in Apparatus for Liquefying Gases, of which the following is a specification.

This invention, designed primarily to provide improved means for liquefying air, comprises in its preferred form a heat insulating envelop having therein a motor, a series of coils by which the gas is carried under pressure around and to said motor where it is expanded and caused to do external work at the expense of the heat energy of the gas thereby lowering its temperature so as to effect the liquefaction of a portion of the gas, and interchanging mechanism wherein is circulated cold gas and the vapor which is separated from the liquefied product that has been developed, this gas and vapor being carried over the coils to refrigerate the incoming gas and through concentric passages surrounding the motor to effectively insulate the expanding apparatus. The motor as a turbine may be used for any desired work, such as driving a dynamo for operating a compressor used in compressing gas for the apparatus.

The accompanying drawing represents a vertical sectional view of a form of mechanism embodying the invention.

The apparatus shown in the drawing comprises the base 1 having thereon the hollow fiber or non-conducting columns 2 which support the wood floor 3. These parts are held together by bolts 4 which engage the floor and the base, the engagement with the base being made through non-conducting bearing washers 5, and the bolts are further insulated from the atmosphere by the non-conducting coverings 6 and 7 contained in the columns 2 and the caps 8, the latter covering the lower ends of the bolts and the washers.

The turbine, supported by the floor, has a shell comprising the base 9 with the circular channel 10 therein and the bearing box 11 thereon, the concentric cylinders 12 and 13 with the pressure chamber 14 between them and extending around the shell providing for a cooling jacket, and the head 15 having thereon the bearing box 16 and the flanges 17 and 18, the flange 17 fitting the top of the cylinder 12 and the flange 18 the top of the cylinder 13. Bearings 19 and 20, set in the respective boxes 11 and 16, have journaled therein the shaft 21 to which are fixed the vanes 22 with expanding ports therethrough. These revolving vanes alternate with the stationary ports 23 connected with the respective stationary disks 24 forming chambers having passages within which the vanes revolve and through which they communicate, the highest vane communicating by the inlet ports or nozzles 25 with the chamber 14 and the lowest communicating with the exit ports 26 and the concentric channel 10 having the pipe 27 leading therefrom.

To provide a thrust bearing for the shaft 21 a shoe 28 is supported by the box 11 and contains the step 29 which takes the downward thrust of the shaft, the shoe being insulated from the box by the fiber 28′. The step bearing thus formed is suitably lubricated through a tube 30 and drained through a tube 31 communicating therewith through the shoe.

The wood-cover 32 is supported on the top of the turbine shell and is connected with the floor 3 by the fiber board cylinder 33. Surrounding the cylinder 33, as also the bottom 3 and the cover 32 thereof, is a sheathing of fibrous heat insulating material 34 having the fiber board casing 36, the fibrous material 35 being also packed between the ends of the turbine and the top and bottom boards, to inclose the turbine and insulate practically all metal parts.

In the interchanger, between the cylinders 13 and 33, are disposed the fiber board cylinders or partitions 37, 38 and 39 concentrically arranged about the turbine, forming the concentric cylindrical chambers 40, 41, 42 and 43 surrounding the turbine. The ports 26 communicate with the chamber 40 and the latter communicates with the chamber 41 through the apertures 44 in the top of the cylinder 37. The chamber 41 communicates through the apertures 45 in the bottom of the cylinder 38 with the chamber 42, and the latter communicates through the apertures 46 in the top of the cylinder 39 with the chamber 43. A fiber tube 47 leads from the chamber 43 through the insulating envelop surrounding it.

In the tube 47 is a metal tube 48 which forms a cylindrical coil 49 in the chamber

43, thence it extends through an aperture 46 and forms a cylindrical coil 50 in the chamber 42, thence it extends through an aperture 45 and forms a cylindrical coil 51 in the chamber 41, thence it extends through the aperture 44 in the top of the cylinder 37 into the chamber 40, and thence into the annular chamber 14.

A dynamo, with its rotary elements 58 fixed to the shaft 21, has its stationary elements 54 fixed to the casing 55 which is provided with the legs 56, the latter being supported by wood-blocks 57 embedded in the fibrous envelop and resting on the part 32. Bolts 53 pass through the feet, their supports and the flanges 18 into the cylinder 13, by which these parts are secured together.

In operation the gas under pressure passes through the concentric coils of the tube 48 into the pressure chamber 14 around the turbine, whence it flows through the expansion ports or passages of the turbine, the heat energy in the gas being expended in doing external work, whereby a portion of the gas is liquefied, collected in the channel 10 and drawn off through the conduit 27, while the unliquefied gas and vapor escaping through the ports 26 are carried over the coils to refrigerate the incoming gas, and, through the chambers containing them, in concentric sheets, insulating both the turbine and the coils, to the outlet passage 47.

Having described my invention, I claim:—

1. An apparatus comprising a conduit, a motor, a casing containing an annular chamber surrounding said motor, said chamber communicating with said conduit and motor, a second conduit communicating with said motor and containing said first named conduit, and an insulating envelop containing said parts.

2. An apparatus comprising a turbine, a casing containing an annular pressure chamber surrounding and communicating with said turbine, a fluid conducting coil surrounding said turbine and communicating with said chamber, means for receiving liquid discharge from said turbine, means for conducting gas and vapor discharged from said turbine in contact with said coil, and an insulating envelop surrounding said mechanism.

3. An apparatus comprising a turbine, a dynamo connected with and operated by said turbine, a casing having an annular chamber therein surrounding said turbine, said chamber having an outlet communicating with said turbine, a coiled tube leading to said chamber, a conduit for conveying fluid from said turbine in contact with said tube, and a heat insulating envelop containing said turbine, tube and conduit, said turbine being surrounded by said coiled tube and conduit.

4. An apparatus comprising a turbine having a vertical shaft and a channel communicating with the outlets from the ports therein, an envelop having a floor supporting said turbine through its connection with said channel and a cover supported by said turbine, means providing a sequential passage having courses one within another between said floor and cover, said passage communicating with an outlet from said turbine, a plurality of sequentially disposed conducting coils in said passage and communicating with an inlet to said turbine, and an insulating envelop for said mechanism.

In testimony whereof I have hereunto set my hand this 10th day of October 1905, in the presence of the subscribing witnesses.

ALBERT C. WOOD.

In presence of—
ROBERT JAMES EARLEY,
UTLEY S. CRANE, Jr.