March 19, 1929. G. HOLTHAUS 1,705,975

HEAT ACCUMULATOR

Filed Dec. 15, 1924

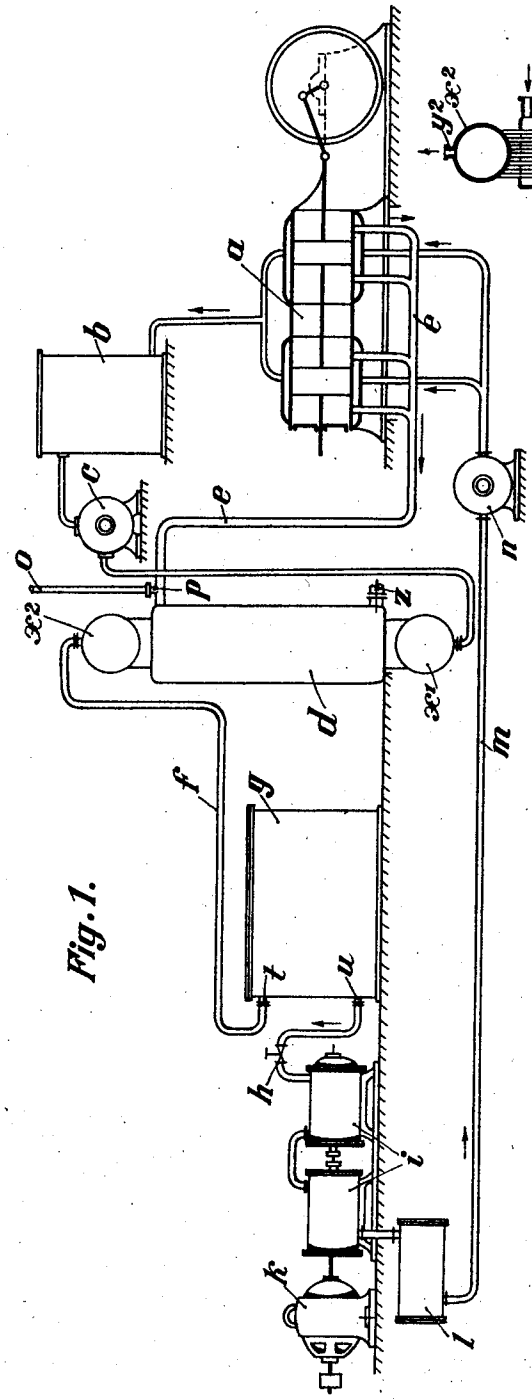


Fig. 1.

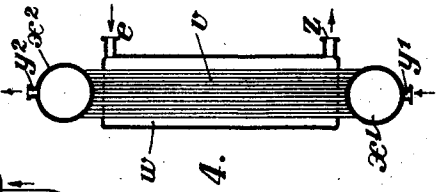


Fig. 4.



Fig. 3.

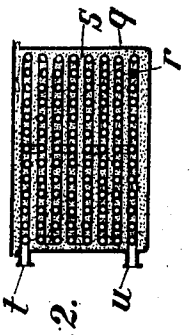


Fig. 2.

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UNITED STATES PATENT OFFICE.

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HEAT ACCUMULATOR.

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In establishments where a blast furnace is run conjointly with a coke producing plant and with steel works and rolling mills, and where the power for the latter is derived from the waste gases of the coke oven and of the blast furnace, Sundays and holidays bring with them the disadvantage that, owing to the stoppage of the steel work and the rolling mills, the gases cannot on these days be fully utilized. The acquisition of gasometers in which the gas may be stored for later use would lead to expenses which could not be covered by the saving of the gas.

The object of the present invention is to provide inexpensive means whereby the energy of this gas may be fully utilized, and the invention consists in the provision of a steam accumulator in the form of a pipe coil embedded in concrete in a thick-walled shell and adapted to hold steam at a pressure of over 225 atmospheres and of a temperature of over 374° C., any waste gases available for the purpose being utilized in generating and accumulating the steam.

It is well known that steam having a pressure of over 225 atmospheres can be stored without risk, since steam and water enclosed together in a receptacle under this pressure, are of equal volume. One cubic meter of blast furnace gas contains at most 1000 heat units. A cubic meter of steam of over 225 atmospheres pressure contains at least 150,000 heat units. It is evident that a steam accumulator which is 150 times smaller than a gasometer will be considerably cheaper although it has to be constructed to meet the higher pressure.

Fig. 1 of the accompanying drawings represents a diagrammatic view of a plan according to the invention,

Fig. 2 is a vertical section of the steam accumulator, and

Fig. 3, a horizontal section of the same.

Fig. 4 is a sectional view of the high-pressure steam boiler.

The water for cooling the gas engine *a* is forced by means of a pump *n* with a pressure of about 5–10 atmospheres through the radiator space of the engine into a receptacle *b*. Another pump *c* delivers the water, under a pressure of over 225 atmospheres, into a high-pressure boiler *d* which is heated by the exhaust gases from the engine *a*, it being connected to the latter by a pipe *e*. This boiler converts the water into steam of a pressure of over 225 atmospheres and of corresponding temperature. The steam passes through a pipe *f* into a vessel *g* which is built so as to withstand the pressure and which accumulates the waste energy of the engine in the form of saturated or superheated steam of a pressure of over 225 atmospheres. The steam, controlled by a cock *h*, is utilized for driving a steam turbine *i* which in its turn drives a dynamo *k*. The water collected in the condenser *l* of the turbine is led through the pipe *m* to the pump *n* and is again used for cooling the engine *a*. When, during Sundays and holidays, the gas engine is not in use, the blast furnace gas which ordinarily would be used for driving the engine, is led through a pipe *o* to a burner which may be situated at *p* for heating the boiler *d*.

The steam accumulator *g* is composed of an outer, thick-walled shell *q* in which a pipe coil *r*, made in one piece and strong enough to resist the pressure, is accommodated. The shell *q* is filled in with concrete *s* or the like so as to protect the coil from external heat exchange and so as to form a bed in which the coil is supported on all sides and relieved of stress other than that caused by the pressure. The steam enters the coil at *t* and leaves it at *u*.

Fig. 4 shows the construction of the high-pressure steam boiler which has the form of an ordinary feed water heater though very much stronger. The steam pipes *v*, which must be capable of withstanding a pressure of over 225 atmospheres at a temperature of at least 500° C., pass through the heating space *w* from one to another of two spherical chambers x^1 and x^2 which are preferably arranged outside the boiler shell. The gases from the engine *a* or from the burner *p* are delivered into the space *w* by the pipe *e* at

the top of the boiler shell and leave the space through a pipe z at the bottom of the shell. The water or steam passes in the opposite direction, it being fed at y^1 into the chamber x^1 and discharged at y^2 from the chamber x^2. The upper chamber x^2 and the pipe f must be well insulated against loss of heat.

I claim:

A steam storer or accumulator comprising a thick-walled shell filled with concrete, and a pipe coil embedded in the concrete so as to be supported thereby and protected from external heat interchange.

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