J. K. RUTHS.

STEAM ACCUMULATOR.

APPLICATION FILED MAY 21, 1918.

1,328,593. Patented Jan. 20, 1920.

Fig. 1.

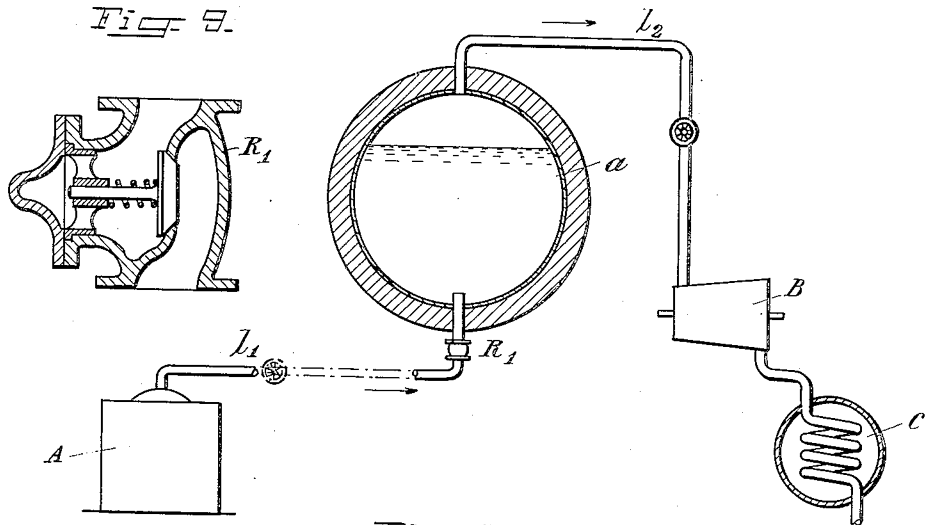


Fig. 9.

Fig. 2.

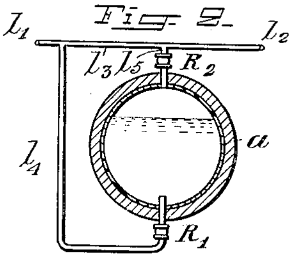


Fig. 3.

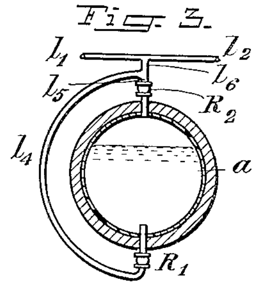


Fig. 4.

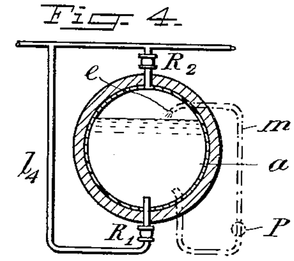


Fig. 8.

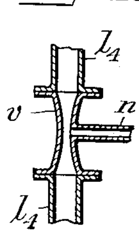


Fig. 5.

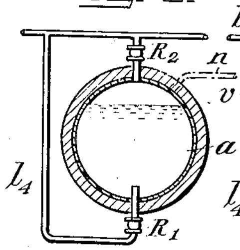


Fig. 6.

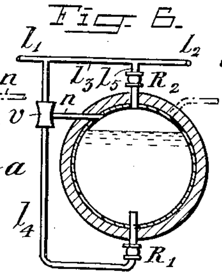
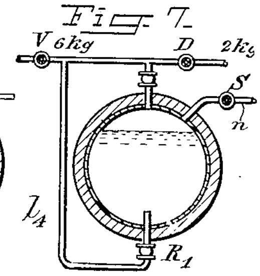


Fig. 7.



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UNITED STATES PATENT OFFICE.

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STEAM-ACCUMULATOR.

1,328,593. Specification of Letters Patent. **Patented Jan. 20, 1920.**

Application filed May 21, 1918. Serial No. 235,892.

To all whom it may concern:

Be it known that I, JOHANNES KARL RUTHS, subject of the King of Sweden, residing at Djursholm, Sweden, have invented certain new and useful Improvements in Steam-Accumulators, of which the following is a specification.

Steam accumulators may be employed in steam plants for compensation of, for instance, variations in the steam supply or steam consumption.

Figure 1 of the accompanying drawing shows diagrammatically the principle of such an accumulator. l_1 is a conduit supplying the steam to the accumulator a for instance from the steam-generator A, and l_2 the pipe for conducting steam from the accumulator to a steam consumer B, which in the present case is a turbine provided with a condenser C.

In l_1 and l_2 the necessary valves are arranged. The accumulator is shown as consisting of an insulated receptacle, containing water.

To prevent back-flow of the water from the accumulator to the supply conduit l_1, a non-return valve R_1 is arranged in the said conduit (in all cases, where the different elevations do not prevent such a back-flow).

An arrangement according to Fig. 1, however, has the considerable drawback, that in any case all steam must pass through the accumulator a. As a consequence thereof, when, as usual, water is used as the accumulating medium, water-particles will be carried along in the escaping steam; when super-heated steam is employed the heat of superheat will be absorbed by the water, so that in l_2 only saturated steam flows, though super-heated steam was perhaps wanted.

Another drawback, when accumulators, in which another medium than water is used for the accumulation of the heat, is, that if large quantities of steam are wanted, it often is difficult to lead the total desired steam quantity through the outlet and inlet conduits of the accumulator; if these conduits were built for the whole quantity, they would be too large.

According to my invention these drawbacks are avoided in that the steam accumulator and the steam-conduits are connected in parallel and in the outlet-conduit of the accumulator, and eventually also in the inlet conduit thereof, a non-return valve is inserted.

In the accompanying drawing six different embodiments of my invention are shown in Figs. 2–7. Fig. 8 shows a detail of Fig. 6 and Fig. 9 a suitable construction of the non-return valve.

In the embodiment according to Fig. 2 the accumulator is connected in parallel to the piping l_1, l_3, l_2 by means of the steam supply pipe l_4, in which the non-return valve R_1 for preventing a back-flow of the water in the accumulator into the supply pipe l_4 is inserted, and the steam discharging pipe l_5. In order to force the charging steam through the water, a non-return valve R_2 is arranged also in the pipe l_5, preventing a back-flow from l_1 or l_2 into the accumulator, but allowing a flow of steam from the accumulator through l_5.

The non-return valves R_1 and R_2 can be of any known type. In Fig. 9 a preferred construction of such a valve is shown. The valve-body is in this embodiment pressed against its seat by means of a spring.

The arrangement works in the following manner: If through the piping l_1 more steam is supplied than will be consumed in the piping l_2, then the pressure in the piping l_4 will be increased to some degree and the valve R_1 will be opened, the surplus steam thus entering the accumulator. In the accumulator the steam is condensed. On the other hand, if the steam supplied through the piping l_1, is not enough to cover the steam consumption through l_2, the pressure in the piping l_1, l_3, l_2 will be reduced, causing the non-return valve R_2 to open so that additional steam will flow from the accumulator a into the piping l_2.

In Fig. 3 another embodiment is shown, which in principle and operation exactly corresponds to Fig. 2. The only difference in construction is, that the piping l_4 is connected to the piping l_5 above the non-return valve R_2; the part l_3 of the piping therefore is omitted and is replaced by the shorter piping l_6 between l_4 and l_5 on one side and l_1 and l_2 on the other side.

While the non-return valve R_1 does not offer any constructive difficulties, it is different with the non-return valve R_2. The first mentioned one only has to tighten against water, while the last one must tighten against steam; on account hereof it is impossible to prevent leakage of steam from l_1 into the accumulator *a*, as the valve R_2 can not be made quite tight.

This leakage will result in the following inconvenience:

The quantity of steam which leaks in from l_1 will be gathered in the steam-space of the accumulator, and, as in most cases the difference in temperature between the steam and the water is very small and only a small quantity of steam will be condensed, a higher steam-pressure will occur above the water of the accumulator than what corresponds to the temperature of the water. Therefore the steam-pressure, required for charging the accumulator,—which is the pressure of the piping l_4—in its turn must be increased, which increase again will cause still more steam to enter the steam-space and so on. One will thus find, that the accumulator never can be charged to a pressure, corresponding to the pressure of the piping, as a result of which its capacity under such circumstances can be considerably reduced.

These drawbacks, however, may be remedied in different manners and, in Figs. 4, 5 6 and 7 some different arrangements are shown, by means of which the said drawbacks will be eliminated.

In the embodiment according to Fig. 4 a piping *m* is arranged between the water-space and the steam-space of the accumulator, said piping *m* being provided with a small pump P, which pumps the water from the lower part of the accumulator to the steam-space through the sprayer *e*, for instance a Körting-nozzle. Thus the steam in the steam-space of the accumulator will be condensed. In certain cases even cold water may be used for the same purpose, this water at the same time serving as a compensation for at least a part of the water-quantity, which escapes in form of steam.

Fig. 5 shows another embodiment, in which a considerably simpler method is used. Into the steam-space of the accumulator opens a tube *n* of small diameter, through which a quantity of steam continually can escape from the steam space of the accumulator, this quantity of steam being somewhat greater than that one leaking through the valve. The steam escaping through the piping *n* may be blown off into a piping with lower pressure or led into the feed-water receptacle in order to be condensed or it can be employed in any other suitable manner.

In Fig. 6 a modification of the arrangement according to Fig. 5 is shown, in that the piping *n* is connected to a contraction *v*, arranged in the piping l_4 and constructed on the venturi-principle. In Fig. 8 the pipe-connection and the device *v* are shown on a larger scale.

If the contraction *v* is arranged in l_4 and the steam-quantity in l_2 suddenly is reduced, the pressure in the pipings will be increased to some extent and steam will flow partly through R_1 and partly also in form of leakage-steam through R_2 into the accumulator. Since the steam-quantity through l_4 in most cases is considerably greater than the leakage of steam through R_2 a suction effect will arise in *v*, causing steam from the steam-space of the accumulator to return over *n*, *v*, l_4 and R_1 to the water-space of the accumulator, where it is condensed.

In certain cases an arrangement according to Fig. 7 may be used. The accumulator is in this case working between a high charging-pressure (for instance 6 kg.) and a low pressure (for instance 2 kg.). The charging pressure is during the whole time constantly 6 kg. and the charging-quantity is regulated by means of the valve V; the discharging pressure can be held constant by means of a reducing-valve D of any known type. In this case, if the leaking-steam can not be constantly employed, a safety-valve S may be inserted into the piping *n*, which valve for instance may open for a pressure of 5 kg. so that the leakage-steam at this pressure or greater can escape.

In many cases the piping *n* in Fig. 7 can be connected to a low pressure piping.

I claim:

1. In combination with steam-piping a steam accumulator in parallel with said steam-piping and provided with independent charging and discharge conduits, a non-return valve in the discharging conduit and a non-return valve in the charging conduit.

2. An arrangement as specified in claim 1 in which an exhaust conduit leading from the steam-space of the accumulator is provided for the steam leaking into the steam-space through the non-return valve in the discharge conduit.

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

JOHANNES KARL RUTHS.

Witnesses:
FRITZ E. DALLIN,
JACOB BAGGE.