

A REGENERATIVE ACCUMULATOR,
AND ITS APPLICATION FOR USING EXHAUST STEAM.

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(Translated from the French.)

The new apparatus referred to in this Paper is intended to allow, in a turbine or any other motor, the use of the exhaust steam from machines having intermittent action, such as winding engines or the reversible engines of rolling mills. Engines with intermittent action are well known to be defective in respect of the satisfactory use of the steam, caused by condensation within the cylinders. This inconvenience has no doubt been to a small extent remedied by compounding and also by condensing; but the advantage gained is much less than can be obtained by using the steam at about atmospheric pressure in a turbine provided with a condenser.

The Hon. C. A. Parsons has already urged the use of turbines with low steam-pressure, attached to continuously-running steam engines. For instance, if we take a winding engine using 45 kilogrammes (99 lbs.) of steam per B.H.P. (*utile*), which is about the minimum for non-compound engines without condensation, these 45 kilogrammes of steam are sufficient to give, in a steam turbine coupled to a dynamo, an electric power of at least two horse-power; by the application in this case of the regenerative accumulator system, two horse-power is added for each one horse-power of the winding engine.

The difficulty which this apparatus solves is the following:—

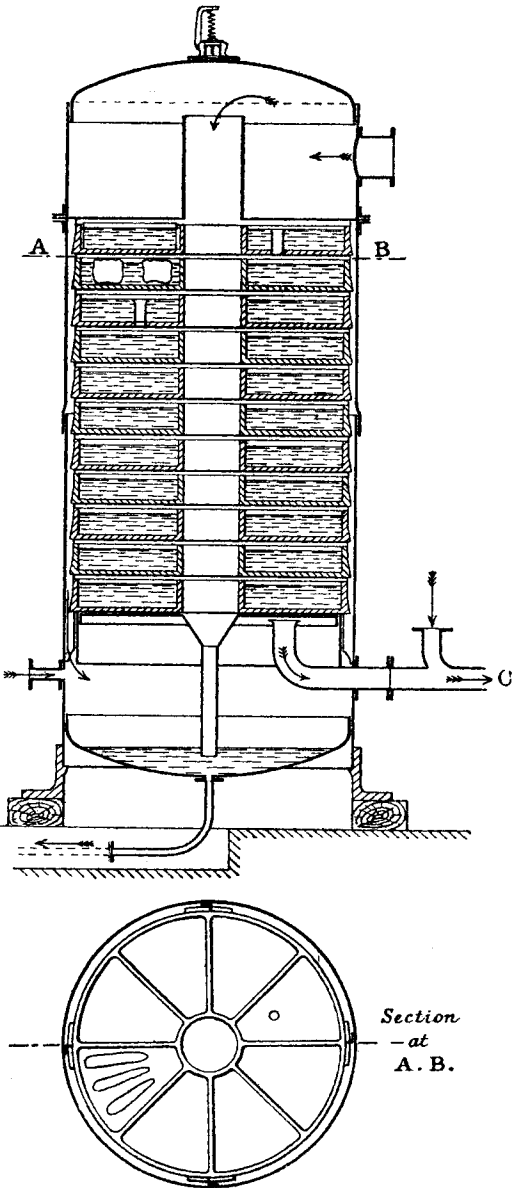
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The turbine requires to be supplied with a continuous flow of steam, whereas the engine working intermittently delivers it at more or less regular intervals of one or two minutes. A reservoir is therefore required between the two engines. An ordinary reservoir would have excessive dimensions, whilst with the apparatus about to be described this excessive size is avoided, and the cost of erection is relatively small.

This apparatus, which may be called a "regenerative steam-accumulator," serves the purpose of a reservoir. The solid and liquid materials, which it contains, form a storage in which the steam gathers and condenses when arriving in excess, and subsequently re-evaporises during the period when the main engine slackens or stops. The variations in temperature necessitated by the condensation and re-evaporation of steam correspond to the small fluctuations of pressure in the accumulator. The pressure rises while the apparatus is filling, and falls while it is being emptied. The amplitude of these temperature and pressure oscillations is not great, 3° to 5° C., and 0.10 to 0.15 kg. per cm^2 (1.4 to 2.1 lbs. per square inch). This variation can be limited to any desired range by designing the apparatus sufficiently large in accordance with the periods of running and standing of the main engine.

Calling the variation of temperature t (which is in practice 3° to 5° C.), the weight of materials forming the storage of heat P , and the mean specific heat of these materials G , the quantity of heat absorbed by the accumulator and restored by it at each period is $P G t$ calories; and the quantity of condensed vapour, then vaporised, corresponding to this number of calories, is equal to about $\frac{P G t}{L}$, L being the latent heat of the steam.

The apparatus consists, as may be seen from the illustration (page 947), of cast-iron annular basins placed one above the other, inside a cylindrical vessel of sheet iron. The steam, which enters the vessel by the pipe near the top, reaches the basins by the central channel. The portion which is not condensed, as well as that which is re-evaporated, descends along the lateral partitions of the vessel, and reaches the pipe C leading to the low-pressure machine.



The water carried away by the steam separates out in the upper chamber and falls, first through holes in the top plate, thence from basin to basin by the passages in the overflow to the bottom of the vessel, whence it is discharged by the small pipe, having an automatic steam-trap. The basins are thus always covered with water.

The apparatus is completed with a safety valve and an automatic steam-valve for assisting the turbine by steam direct from the boilers.

By means of this accumulator it is possible to obtain, in an ordinary-sized winding-engine plant, an additional motive power of about 500 H.P., with no expense but the cost of installing the turbine and accumulator, which is not great.

An application of 250 H.P. is now in course of erection at the Bruay Mines in the North of France, and will be working in a few months.

The Paper is illustrated by 1 Fig. in the letterpress.

[NOTE.—*The discussion on this Paper was postponed until after the following Paper by the same author had been submitted to the Meeting.*]
