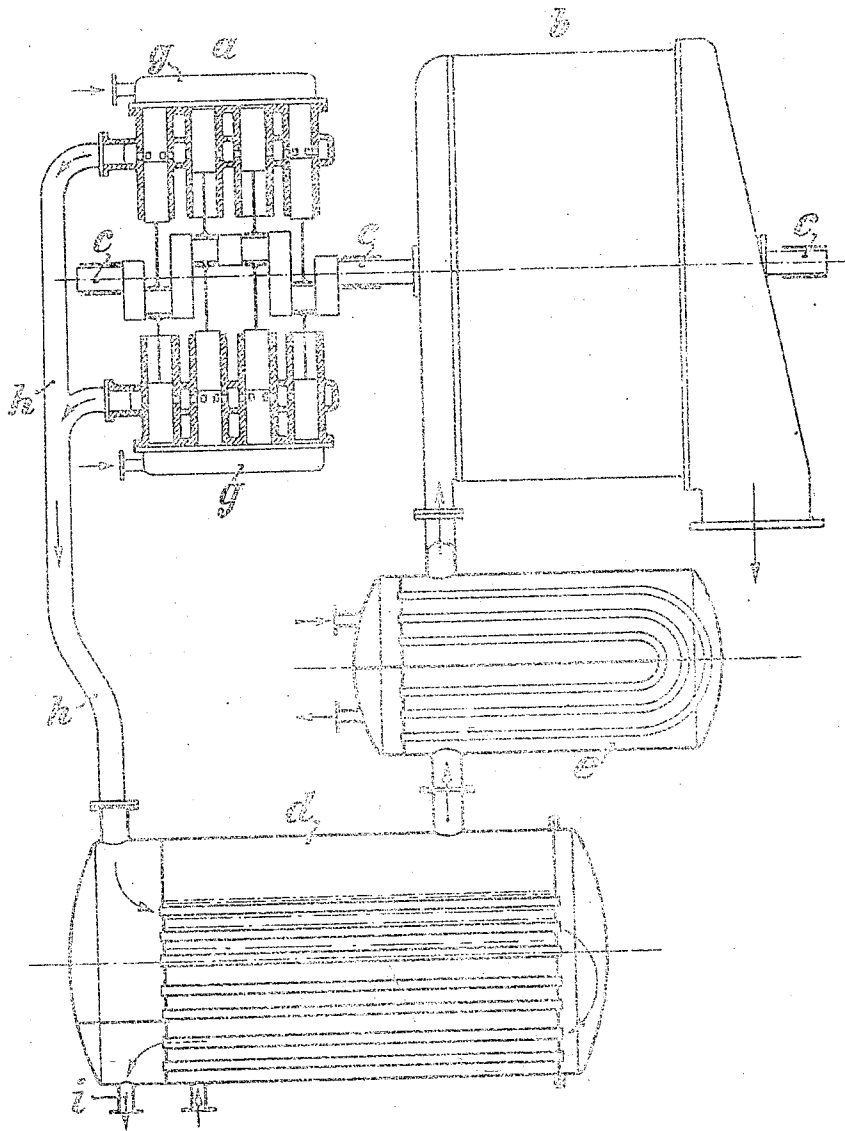


W. SCHMIDT.
 COMBINED RECIPROCATING ENGINE AND TURBINE PLANT.
 APPLICATION FILED JUNE 3, 1912.

1,044,693.

Patented Nov. 19, 1912.



WITNESSES:

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COMBINED RECIPROCATING ENGINE AND TURBINE PLANT.

1,044,693.

Specification of Letters Patent.

Patented Nov. 19, 1912.

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To all whom it may concern:

Be it known that I, WILHELM SCHMIDT, a subject of the King of Prussia, Emperor of Germany, residing at Wilhelmshöhe, near Cassel, Germany, have invented a new and useful Improvement in and Relating to Combined Reciprocating Engines and Turbine Plants, of which the following is a specification.

It is well-known that plants of the type above indicated, in which the high pressure elements consist of a reciprocating engine and the low pressure element of a turbine, are able with comparatively small dimensions of the working parts to utilize efficiently the high pressure steam with an expansion ratio reaching to the extreme limit of possible expansion at the low pressure end. Such an advantageous result cannot be obtained either with reciprocating engines alone or with turbines alone. One of the disadvantages in combined plants of the above type as hitherto constructed, lies in the fact that the steam in the high pressure element becomes more or less saturated with lubricating oil, and when such steam passes to the low pressure element, it becomes deposited on the turbine blades and reduces the efficiency of the turbine. The removal of the oil deposited from the turbine blades is a difficult and expensive operation. Further, in addition to being deposited on the turbine blades, oil is also deposited in the condenser, thereby diminishing the vacuum attainable, and effecting a further reduction in the efficiency of the plant. If, in order to remedy the above defect, an oil separator is interposed between the reciprocating engine and the turbine, a complete separation of the oil from the steam cannot be effected, as the separator merely delays the formation of the deposit in the turbine and condenser, but cannot eradicate it.

The object of the present invention is to provide a plant of the type above indicated in which all access of oil to the interior of the turbine and condenser is prevented.

According to the present invention, a steam generator is arranged between the reciprocating engine and the turbine, so that the steam generator is heated by the exhaust from the reciprocating engine and supplies the steam for driving the turbine.

By means of my invention, not only is

the interior of the turbine and the condenser kept perfectly free from oily deposits, but the interposed generator also acts as an accumulator which keeps the main steam generator protected against injury in the event of sudden variations of the load. This latter feature is of considerable importance in cases where steam of very high pressure is employed, as steam generators of this type have usually a very small water space and cannot respond easily to large variations of the load. In such circumstances, the larger water space of the interposed steam generator exerts an equalizing action, and allows the turbine, which as is well-known, is able to bear considerable overloading, to absorb the inequalities in the load. The drop in pressure of the steam during its conversion, is small, while the loss of heat in the steam generator is also small, as the latent heat of the exhaust steam of the high pressure element is almost wholly transmitted to the steam evaporated in the generator.

The deposition of oil on the heating surfaces of the intermediate steam generator does not cause any great injury, as the working pressure thereof is low and the generator may be suitably constructed so as to be readily cleaned.

If necessary, an oil separator may be inserted between the high pressure element and the steam generator in order to reduce the oily deposit on the heating surfaces thereof.

In some cases a superheater may be arranged between the interposed steam generator and the turbine, which superheater will act very efficiently in view of the fact that the steam upon which it operates is free from admixture with oil. Such intermediate superheaters in combined plants as heretofore constructed, are very quickly rendered useless owing to the deposition of oil on their heating surfaces. This disadvantage is obviated by means of the present invention.

The advantages of the present invention are particularly apparent in those circumstances in which steam of very high pressure is employed, as the losses caused on the conversion of the steam are then relatively smallest.

The accompanying drawing which forms

part of my specification illustrates diagrammatically one example of a plant constructed according to my improvements.

In carrying my invention into effect, I provide a high pressure element, *a*, and a low pressure element, *b*. The high pressure element consists of eight single acting high pressure reciprocating engines situated in one plane, and acting upon a common shaft, *c*. The low pressure element, *b* consists of a steam turbine acting also upon the shaft, *c*. A steam generator, *d*, is arranged between the engine, *a*, and the turbine *b*, while a superheater, *e* is interposed between the generator, *d*, and the turbine, *b*. The engine, *a*, is supplied preferably with superheated steam from a suitable generating plant, by way of the steam chests, *g*. After performing this work in the engines, the steam exhausts through the pipe, *h*, to the steam generator, *d*, giving up its heat to the heating surfaces thereof, and becoming condensed into water which is drawn off through the pipe, *i*. The steam generated in the generator, *d*, passes into the superheater, *e*, preferably heated by high pressure boiler steam, wherein it is dried or superheated, and thereafter led to the turbine to perform work therein. The exhaust from the turbine passes to a condenser, of any of the usual forms. The water of condensation of this condenser, is almost chemically pure, and may conveniently be used as feed-water for the generator *d* thus preventing the deposition of scale therein, or the condensed water may be used for any other suitable purpose.

Instead of the arrangement above described, I may in some cases arrange that the high pressure element and the low pressure element work upon independent shafts instead of a common shaft. Also a plurality of independent high pressure elements may have one or more common low pressure elements.

I wish it to be understood that I do not wish my invention to be limited to the exact arrangement which I have described, as it is evident that modifications may be made therein without departing beyond the scope of my invention.

Having now particularly described and

ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. In a plant consisting of a combination of a reciprocating engine and a turbine, the arrangement of a steam generator between the reciprocating engine and the turbine and means for heating the steam generator by the exhaust from the reciprocating engine, whereby the steam generator supplies the steam for driving the turbine, substantially as described.

2. In a plant consisting of a combination of a reciprocating engine and a turbine, the arrangement of a steam generator between the reciprocating engine and the turbine and means for heating the steam generator by the exhaust from the reciprocating engine whereby the steam generator supplies the steam for driving the turbine, and a superheater, interposed between the steam generator and the low pressure element, substantially as described.

3. In a plant consisting in a combination of several single-acting high pressure reciprocating engines and a turbine, the arrangement of a steam generator between the reciprocating engines and the turbine and means for heating the steam generator by the exhaust from the reciprocating engines, whereby the steam generator supplies the steam for driving the turbine, substantially as described.

4. In a plant consisting in a combination of eight single-acting high pressure reciprocating engines situated in one plane and a turbine, the arrangement of a steam generator between the reciprocating engines and the turbine and means for heating the steam generator by the exhaust from the reciprocating engines, whereby the steam generator supplies the steam for driving the turbine, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

WILHELM SCHMIDT.

Witnesses:

JULIUS FRANK,
EGMONT DOETTLÖFF.