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PORTABLE POWER PLANT UTILIZING STEAM AT DIFFERENT PRESSURES

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Fig. 2.

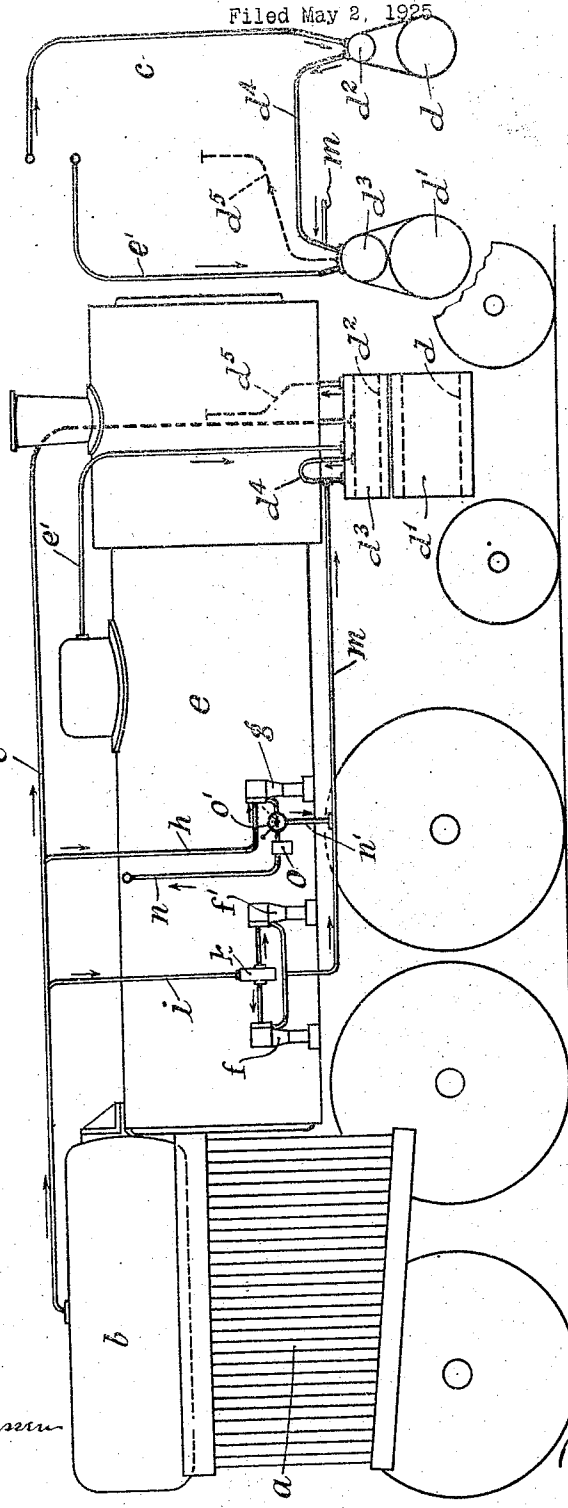

Fig. 1.

WITNESS

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PORTABLE POWER PLANT UTILIZING STEAM AT DIFFERENT PRESSURES.

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Portable steam power plants, and particularly locomotives, generally include auxiliaries such as feed water pumps and air pumps. In plants operating with different boiler pressures of steam (compound system and the like), the power requirements of such auxiliaries are greater than in plants using only one boiler pressure, chiefly for the reason that each portion of the plant which operates at a boiler pressure different from the other portions, requires a separate feed water pump. Thus, with the drive employed hitherto for the auxiliaries under such pressure conditions, the gains obtained by the use of two or more pressures, are reduced considerably by the increased power requirements of the auxiliaries.

According to our invention, the steam for operating the auxiliaries is taken from the high-pressure portion of the steam-generating plant, and the exhaust from these auxiliaries is conveyed to the low pressure portion of the power plant, either to the low-pressure portion of the engine, or to the low-pressure steam generator.

By this invention, we secure a system of high thermic efficiency for driving the auxiliaries of power plants employing steam at two or more pressures simultaneously. The heat contained in the steam is utilized to the extent of almost 100%, since the heat still contained in the exhaust of the auxiliaries is transferred, with but insignificant losses, to the low-pressure portion of the steam power plant. The heat losses are due exclusively to radiation and to mechanical friction.

The invention is of especial advantage when applied to locomotives of the type comprising a fire box constructed as a boiler for the generation of high-pressure steam (say about 60 atmospheres or more) and a longitudinal boiler for generating steam of a lower pressure, say the customary pressure of about 15 atmospheres.

In the practical carrying out of our invention, we may, during the operation of the main engine, convey the exhaust of the auxiliaries either to the low-pressure stage or stages of the main engine, or to the low-pressure boiler. In the latter case we place an oil separator in the connection leading from the respective auxiliary to the low-pressure boiler so as to keep the lubricating oil from reaching such boiler. At such times as the exhaust from the auxiliary is led directly to the low-pressure portion of the main engine, this oil separator is put out of action, by the closing of suitable cocks, or in any other well-known or approved manner.

Another advantage of the present invention is that it requires no departure from the customary way of tending the engine and the boilers.

A satisfactory example of our invention is illustrated by the accompanying drawings, in which a power plant for a steam locomotive is shown in diagrammatic side elevation in Fig. 1, while Fig. 2 is a diagrammatic end view.

The boiler is represented as having two separate portions in which steam of high and low pressures respectively is generated. In the fire-box a, constructed as an independent water-tube boiler, we produce steam of a pressure of say 60 atmospheres. This steam is taken to one or more collectors b located above the fire-box, and is then conveyed by pipes c to the slide valves d^2 of the high-pressure cylinders d of the main engine driving the locomotive. In the longitudinal boiler e, here shown as a smoke flue boiler, we produce steam of a lower pressure, say 15 atmospheres, and this steam is conveyed by pipes e' to the slide valves d^3 of the low-pressure cylinders or stages d' of the main engine. At d^4 we have indicated a pipe connecting the high-pressure cylinder with the corresponding low-pressure cylinder; this pipe also serves as a receiver. A pipe d^5 leads the exhaust of the low-pressure cylinder to the blast pipe in the smoke box in the usual manner. At f and f' we have indicated the feed water pumps for the high-pressure boiler and the low-pressure boiler respectively, and at g the air pump. The steam for operating these auxiliaries f, f' and g is taken from the high-pressure steam collector b. Thus, a branch pipe h may lead from one of the pipes c to the air pump g, while from the same pipe c a branch pipe i leads to both feed water pumps f and f'. The distribution of the steam to these two pumps is effected by a regulator k of any appropriate construction.

The exhaust steam from these auxiliaries may be conveyed to the low-pressure stage of the main engine, or to the receiver of said

stage, or the low-pressure boiler *e*. In the example illustrated, it has been assumed that the exhaust steam from the feed water pumps *f*, *f'* is conveyed, through a pipe *m* common to them, to the low-pressure portions of the main engines. This arrangement is desirable, as a rule, since the feed water pumps are operated only while the locomotive is under way. On the other hand, the air pump is generally operated only when the locomotive is standing still. Thus the exhaust steam of the air pump is conveyed to the low pressure boiler *e*. In order to prevent the oil contained in this steam from reaching the boiler *e*, an oil separator *o* has been placed in the exhaust steam pipe *n* leading from the air pump *g* to the said boiler. A selecting arrangement (such as a three-way cock *o'*) might also be provided for putting the oil separator out of operation when the exhaust from the auxiliaries, instead of passing to the boiler, is conveyed to the low-pressure portion of the main engine. This will improve the lubrication of such low-pressure portion. Various modifications may be made without departing from the nature of our invention as set forth in the appended claims.

We claim:

1. A locomotive comprising a high-pressure steam generator, a low-pressure steam generator, a main engine having two stages receiving steam from said generators respectively, an air pump and an engine therefor, a conduit leading from said high-pressure generator to the air pump engine, a conduit leading exhaust steam from said air pump engine to said low-pressure steam generator, a connection from the air pump engine to the low-pressure stage of the main engine, and a selecting arrangement for permitting exhaust steam from the air pump engine to pass either to the low pressure steam generator or to the low-pressure stage of the engine.

2. A locomotive comprising a high-pressure steam generator, a low-pressure steam generator, a main engine having two stages receiving steam from said generators respectively, an air pump and an engine therefor, a feed-water pump and an engine therefor, conduits leading from said high-pressure generator to said last mentioned engines, a conduit leading exhaust steam from said air pump engine to said low-pressure steam generator, a conduit leading exhaust steam from said feed-water pump engine to the low-pressure stage of the main engine, a connection from the air pump engine to the low-pressure stage of the main engine, and a selector for permitting exhaust steam from such air pump engine to pass either to the low-pressure steam generator or to the low-pressure stage of the main engine.

In testimony whereof we have hereunto set our hands.

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