Aug. 28, 1928. 1,682,006

A. FRANCO

STEAM LOCOMOTIVE

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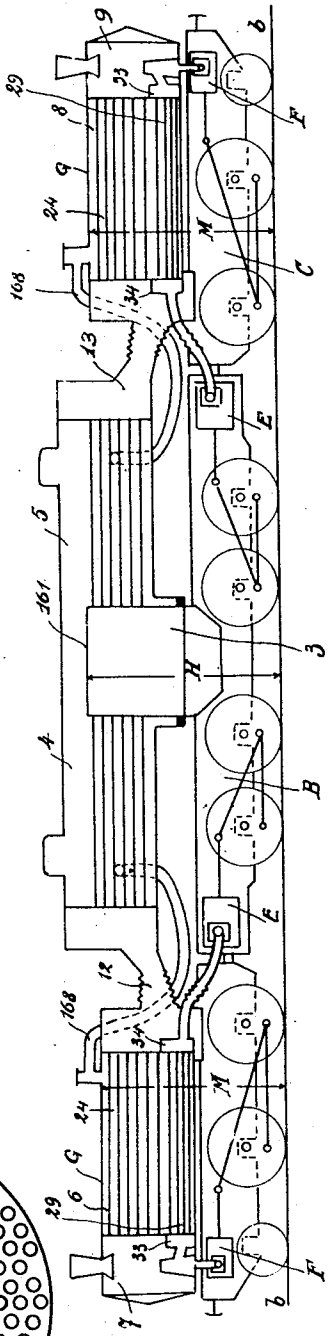

Fig. 1.

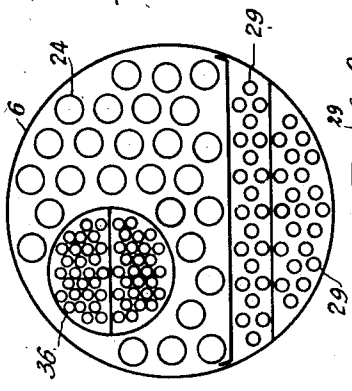

Fig. 2.

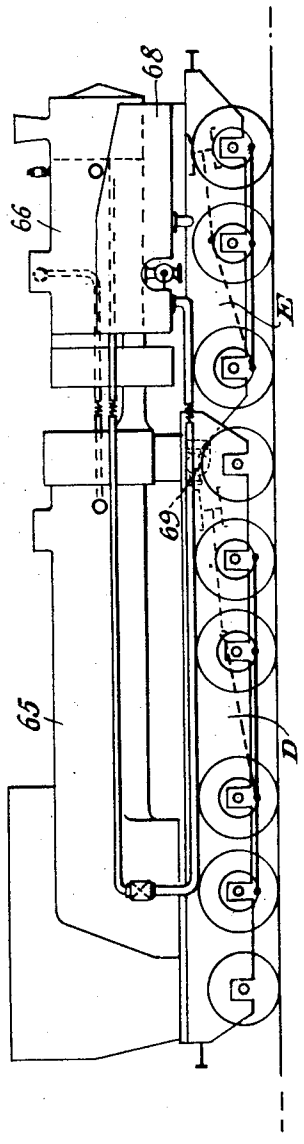

Fig. 5.

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STEAM LOCOMOTIVE

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Fig. 3.

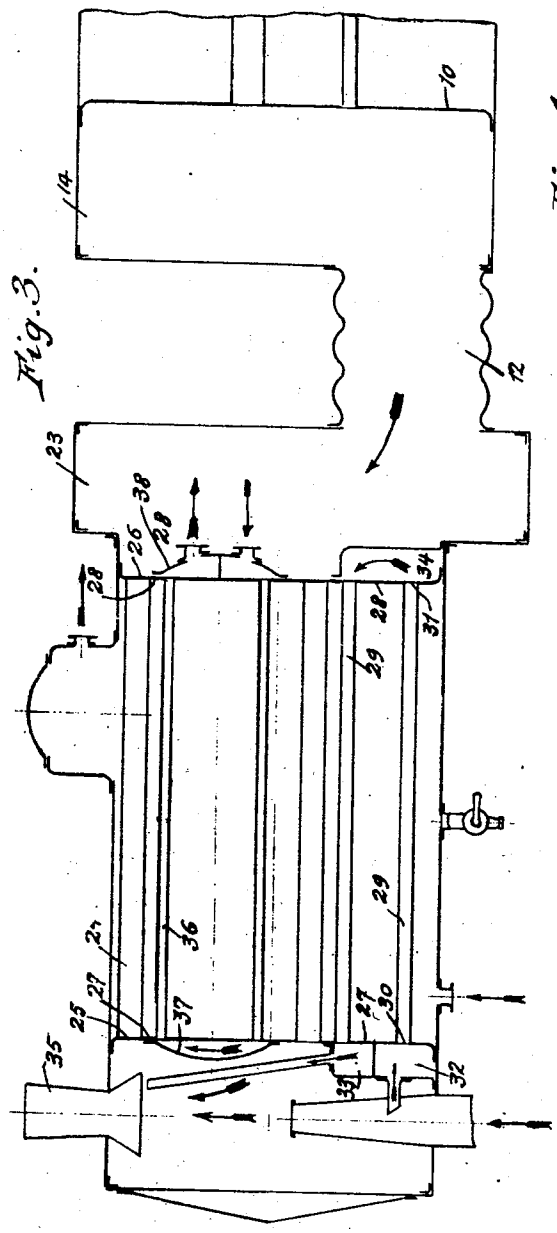
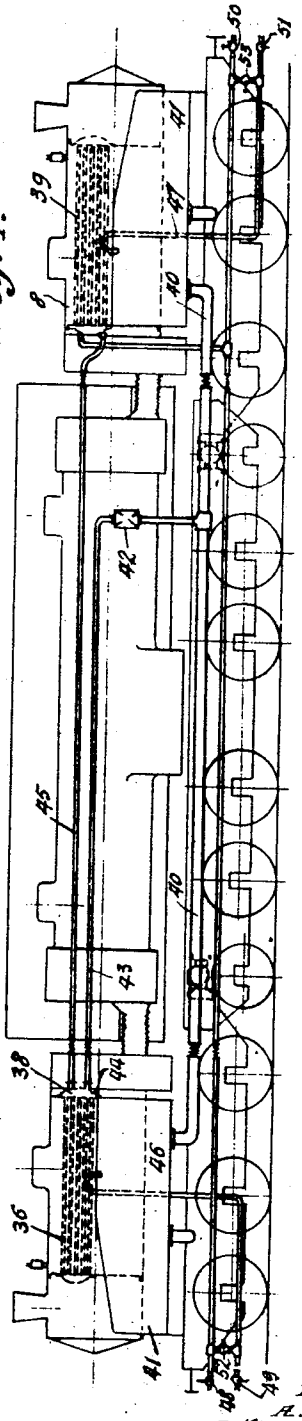


Fig. 4.



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STEAM LOCOMOTIVE

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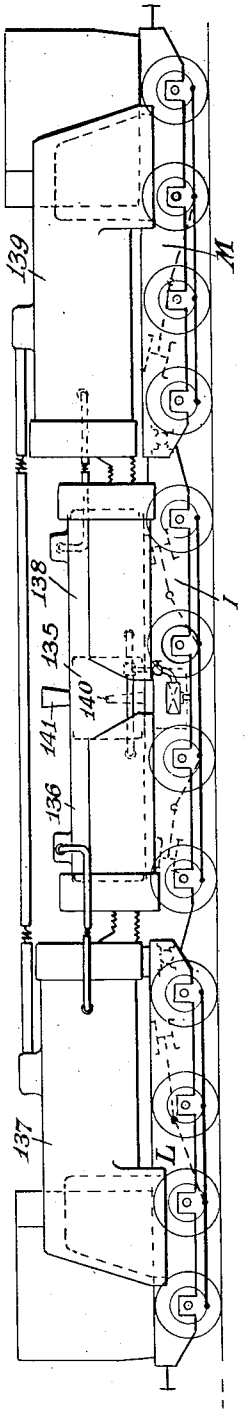

Fig. 6.

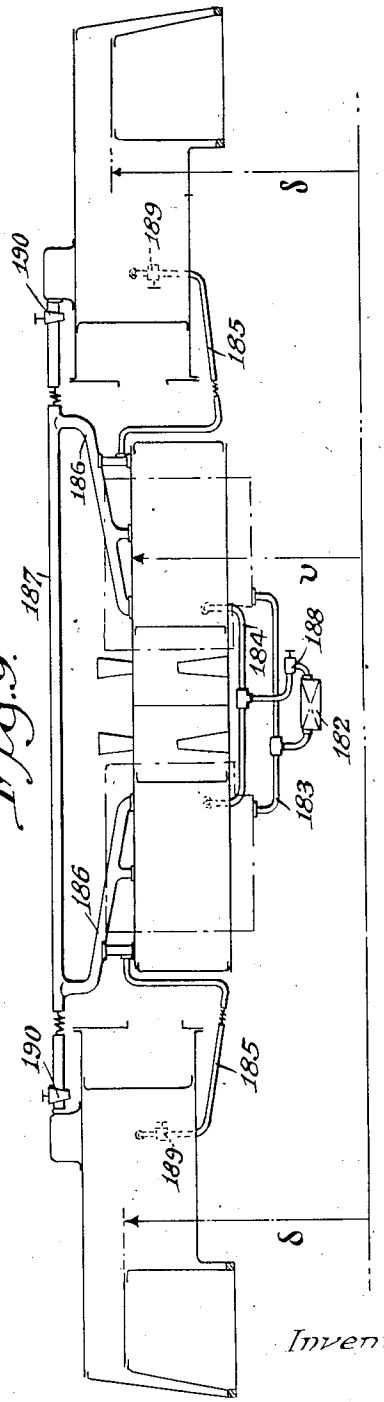

Fig. 9.

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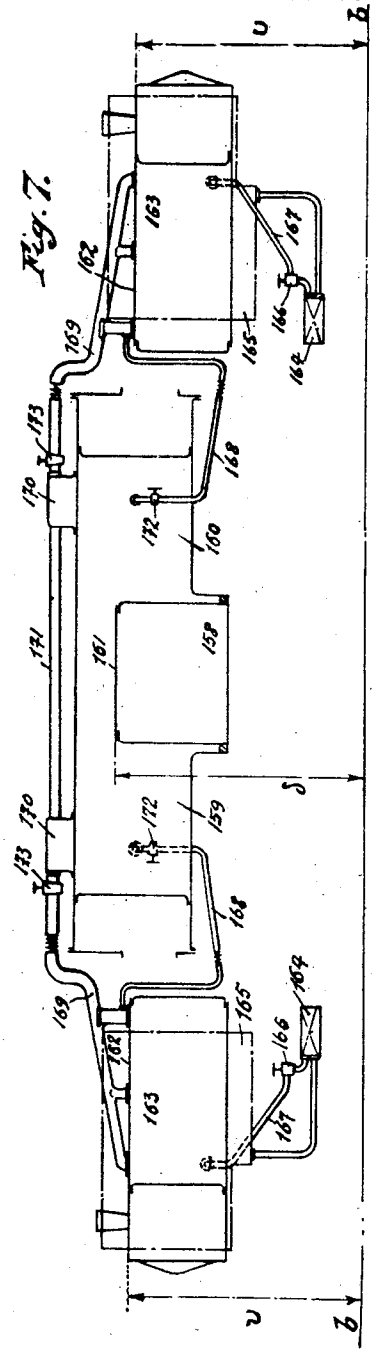

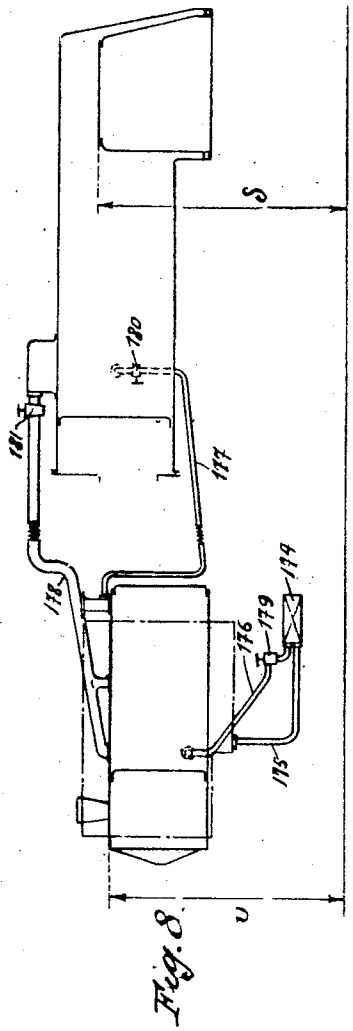

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UNITED STATES PATENT OFFICE.

ATTILIO FRANCO, OF MILAN, ITALY.

STEAM LOCOMOTIVE.

Application filed February 25, 1925, Serial No. 11,585, and in Italy February 25, 1924.

This invention has for its object a new articulated steam driven locomotive composed of two or three driving units having an improved boiler arrangement as hereinafter described.

The Fig. 1 is a longitudinal section of the new articulated locomotive composed of three driving units. The middle unit bears the evaporating boiler, whilst both end units each carry an auxiliary boiler communicating with the main boiler, each auxiliary boiler supplying water to the main boiler at the temperature of evaporation.

Fig. 2 is a cross section and Fig. 3 an enlarged longitudinal section of the auxiliary boiler. Figure 4 is a longitudinal view of the new articulated locomotive fitted with the pump and the required pipings for circulation of water within the water pipings forming a part of the auxiliary boiler.

Fig. 5 is a longitudinal sectional view of the new articulated locomotive composed of two units, unit D carrying the boiler of evaporation which is fed with water at the heat of evaporation by the auxiliary boiler carried by the unit E; Fig. 6 is a diagrammatic view of the new articulated locomotive composed of three units, each unit D, E carrying an evaporating boiler which is fed by the two auxiliary boilers which are carried by the central unit C.

Figures 7, 8, 9 show in elevation the auxiliary boilers communicating with the cooperating boiler and acting always under complete water filling, their highest point being lower than the level of the furnace roof of the steam producer or main boiler.

In Figure 1 is shown at B the central driving unit embodying the evaporating boiler with metal furnace 3 the latter being in common with two opposed bodies 4, 5 containing each a number of fire tubes. At 12 are shown the communication channels for the combustion gases with the auxiliary boilers 6, 8 serving for heating the feed water of the steam producing or main boiler.

The auxiliary boiler 6 is carried by the end unit A, whilst the auxiliary boiler 8 is carried by the end unit C.

Each auxiliary boiler 6, 8 contains (Figures 1, 2, 3) in its lower portion steam tubes 29 and in the middle and upper portions smoke tubes 24 and water tubes 36.

The water tubes 36 through which the circulating water flows supplied by a pump 42 (Fig. 4) serve to heat water adapted for instance for heating the railway cars. The caps 37, 38 (Fig. 3) serve to insulate the water tubes 36 from the combustion gases.

The boxes 33, 34 (Figs. 1, 3) serve to insulate the steam tubes 29 from the combustion gases coming from the main boiler.

Into the boxes 34 is discharged the exhaust steam from the driving cylinders E placed on the central unit B. The exhaust steam passing through the steam pipes 29 heats to a certain temperature (148° F.) the water in the lower portion of the auxiliary boilers 6, 8 which latter, as shown in Figure 7 are fed through tubes 167 by pumps 164, drawing the water from containers 165.

The combustion gases issuing from the main boiler pass through smoke tubes 24 (Figs. 1, 2, 3) of the auxiliary boilers 6, 7 and are discharged into the smoke rooms 7, 8.

The surface of the smoke tubes 24, utilizing the available calories of the combustion gases of the main boiler raises the temperature of the water which is already pre-heated by the smoke tubes 29 up to the evaporation heat corresponding to the working pressure of the main boiler which latter, as shown in Fig. 7 communicates with the auxiliary boiler 6, 8 by means of link tubes 168, 169. The water supply to the evaporation boiler is effected through the tubes 168.

In the Figure 1, G indicates the uppermost generatrix of the auxiliary boilers 6, 8. The straight line —*b*—*b*— indicates the plane of rails. At H is shown the level of the crown 161 of furnace 3 over the plane of the rails; M is the height of the generatrix G over the plane of the rails.

The level M is lower than the level H and therefore the auxiliary boilers act always under entire filling as the level of water within the main boiler is always higher than the highest point of the auxiliary boilers 6, 8.

From the foregoing description it will be seen:

(*a*) That the evaporation boiler is fed from the auxiliary boiler with water having an evaporation temperature corresponding to working pressure of the said main boiler; therefore the entire heated surface of the main boiler contacts with the water which has already the evaporation heat.

In other words the entire heated surface of the main boiler serves to transform the water into steam while it is known that the locomotive boilers of the type used heretofore accomplish two functions, i. e. the lower por-

tion of surface of the said boilers serves to heat the water up to the evaporation heat and only the remainder serves to transform water into steam.

(*b*) That the auxiliary boilers 6, 8 act always under complete water filling at the same pressure as the main boiler and raise the water to the evaporation heat corresponding to the working pressure of the main boiler simultaneously utilizing the available calories of the exhaust steam and of the combustion gases which in the usual locomotives are discharged into the surrounding atmosphere.

(*c*) That by heating of the water within the auxiliary boilers to a higher temperature than 256° F. the salts contained within the water are deposed on the bottom of the auxiliary boilers 6, 8 so that the main boiler will be freed from scale.

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 locomotive, interconnected end and center driving units, a main boiler carried by the center unit, an auxiliary boiler carried by each end unit for heating the feed water for the main boiler up to the evaporation temperature existing in the main boiler whereby the entire heating surface of the main boiler is utilized solely for converting the water heated to evaporation temperature in the auxiliary boilers into steam.

2. In a locomotive, interconnected end and center driving units, a main boiler carried by the center unit, an auxiliary boiler carried by each end unit, engine cylinders carried by the center unit, a fire box associated with the main boiler, means for conducting the combustion gases from the fire box through the auxiliary boilers, means for conducting the exhaust steam from the engine cylinders through the auxiliary boilers, the feed water for the main boilers being supplied by the auxiliary boilers and the combustion gases and exhaust steam for the center unit being utilized to heat the feed water for the main boiler up to the evaporation temperature existing in the main boiler whereby the entire heating surface of the main boiler is utilized solely for converting the water heated to evaporation temperature in the auxiliary boilers into steam.

3. A locomotive as claimed in claim 1 characterized by the provision of a fire box including a top wall located above the auxiliary boilers whereby the latter may be always filled with water at the same pressure existing in the main boiler.

4. A locomotive as claimed in claim 1 characterized by the provision of water tubes arranged in the auxiliary boilers adapted to supply heated water for heating purposes.

5. In a locomotive, interconnected end and center driving units, a plurality of main boilers on the center unit, and auxiliary boilers on the end units for heating the feed water for the main boiler up to the evaporation temperature existing in the main boiler.

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