F. REVEL AND A. BOLDORINI.

ELECTRIC STEAM GENERATOR.

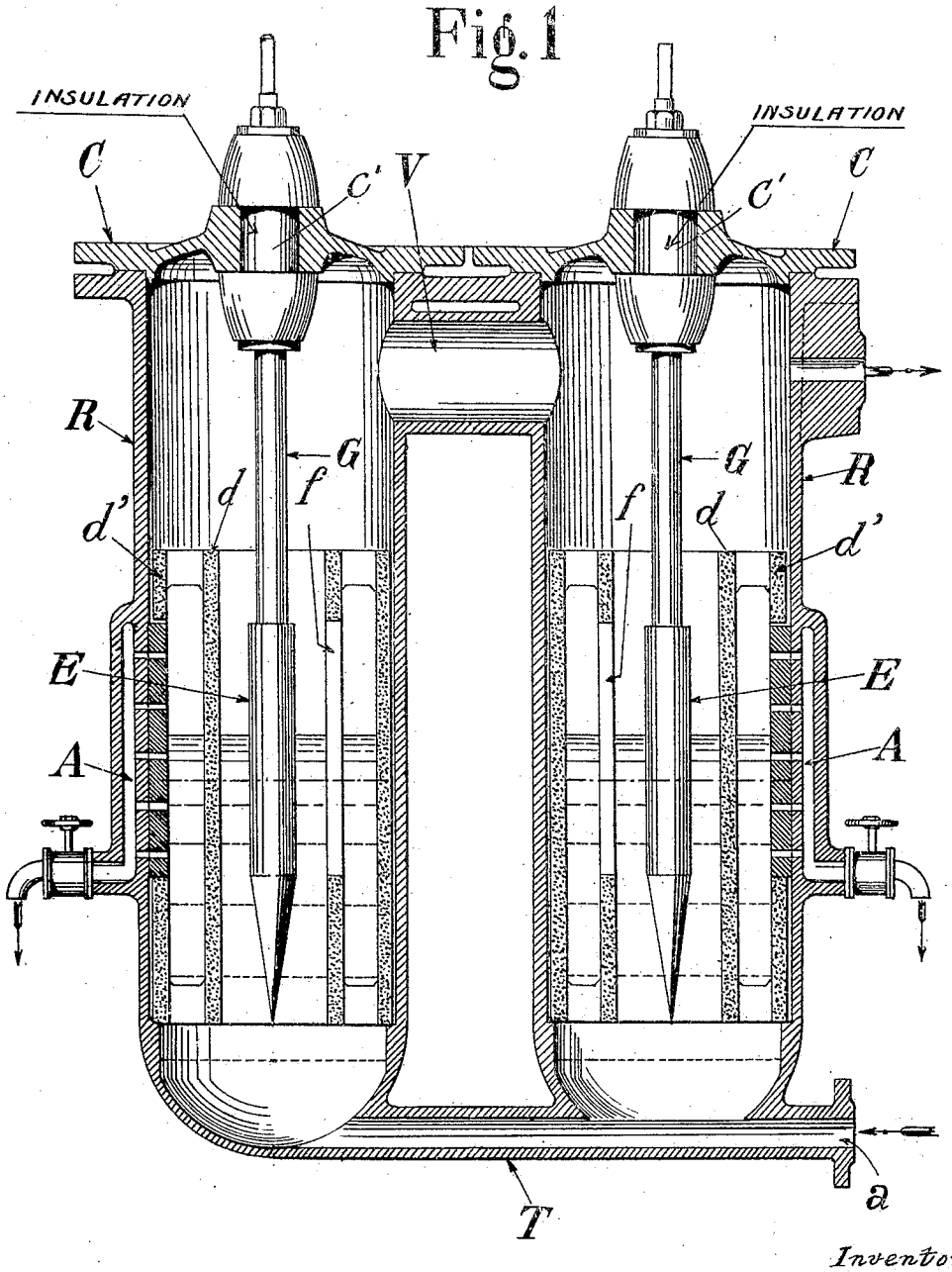
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1,368,212.

Patented Feb. 8, 1921.

3 SHEETS—SHEET 1.

Fig. 1



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3 SHEETS—SHEET 2.

Fig. 2

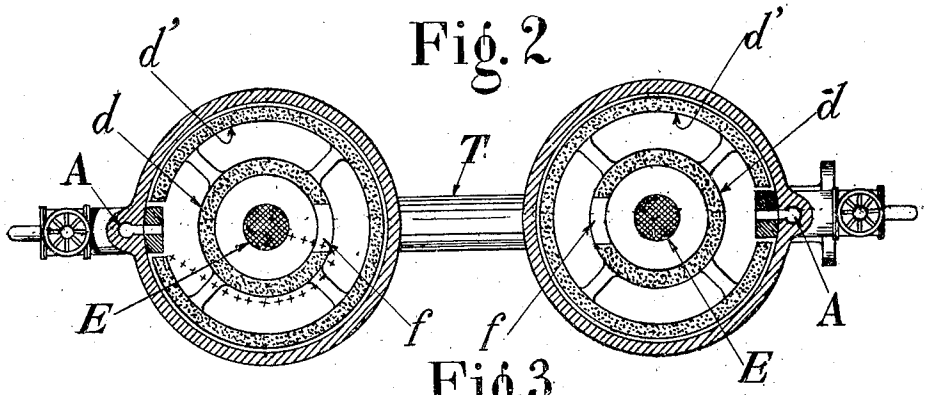


Fig. 3

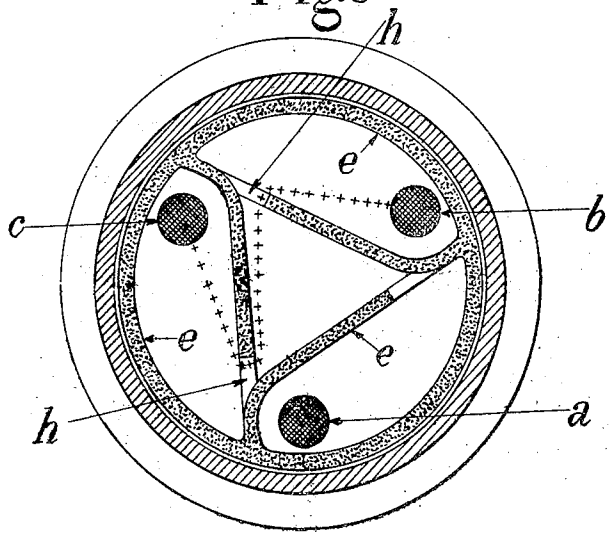
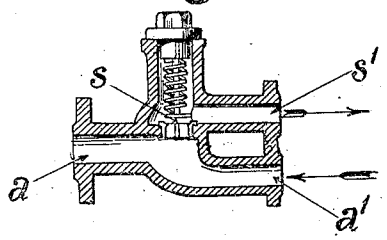


Fig. 4



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3 SHEETS—SHEET 3.

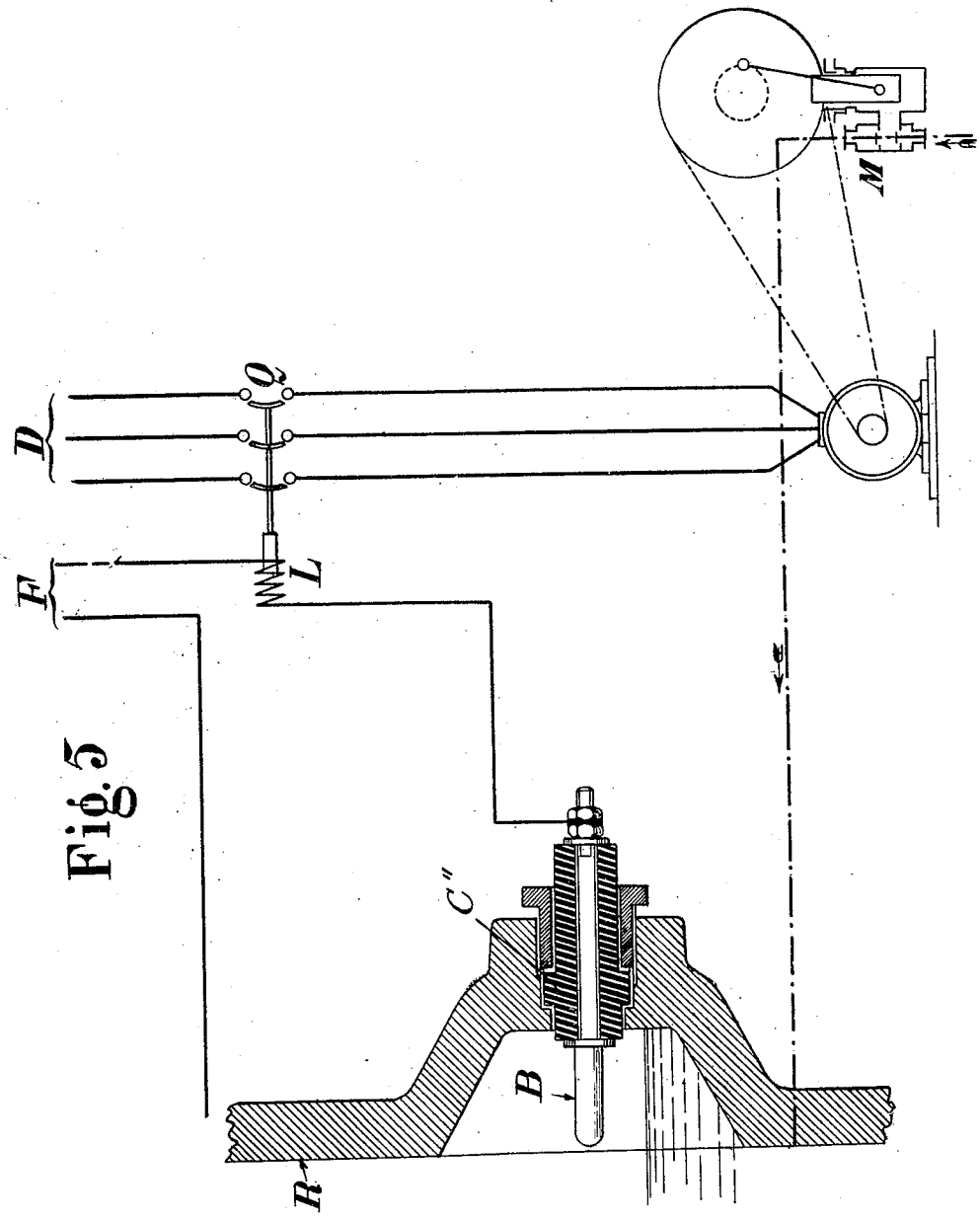


Fig. 5

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UNITED STATES PATENT OFFICE.

FRANCESCO REVEL, OF TURIN, AND ANGELO BOLDORINI, OF MILAN, ITALY.

ELECTRIC STEAM-GENERATOR.

1,368,212. Specification of Letters Patent. Patented Feb. 8, 1921.

Application filed July 8, 1918. Serial No. 243,857.

To all whom it may concern:

Be it known that we, FRANCESCO REVEL, engineer, residing at 75 Via Lamarmora, Turin, in the Kingdom of Italy, and ANGELO BOLDORINI, electrotechnic, residing at 11 Corso Porta Nuova, Milan, in the Kingdom of Italy, have invented new and useful Improvements in Electric Steam-Generators, of which the following is a specification.

The present invention relates to electric steam generators of the water resistance type utilizing high tension threephase or monophase currents, having one phase earthed, and more precisely to arrangements which permit of the installation and working of electric steam generators where the space available is reduced and not readily accessible.

This is the case, for instance, with electric generators to be installed on electric locomotives so as to utilize the currents that serve as the driving agent for the production of the train heating steam where the carriages are equipped for steam heating.

The space available for the steam generators on ordinary electric locomotives is necessarily very small and of uneasy access when the train is running. The generator should therefore be of very small dimensions because in view of the high voltages generally employed for these locomotives, they could not be attained in ordinary steam generators, without resorting to the insulating diaphragms that form the object of the present improvements. Furthermore the steam generator should be capable of working without need of special attendance, and should consequently adjust its own steam production automatically to suit the steam calls which may vary from one moment to the next, the distribution pressure being maintained approximately constant.

One of the methods of realizing the said objects according to the invention and also of directly utilizing in the steam generators the same currents—in a general way—that are used for the electric traction is illustrated, only by way of example of the various dispositions that may be given to the said improvements, in the annexed drawing in which:

Figures 1 and 2 show in vertical and horizontal section respectively one of the constructions that may be adopted when the current available is threephase, with one of the phases earthed, and when unbalanced load conditions are of no inconvenience.

Fig. 3 shows in section a likewise threephase construction, with one phase earthed, when balanced load conditions are desired in the three phases.

Fig. 4 shows a controlling device therefor to maintain a constant pressure of the produced steam.

Fig. 5 shows an automatic device for limiting the water level so that it cannot exceed a desired height.

The steam generator proper consists of a single chamber R, or of two or three chambers forming a single block or independent from one another, the chambers being made of cast iron or steel plates and suitably connected with one another. The chambers communicate with one another both at the bottom T, where the water inlet is provided, and at the top V that forms the steam space, so that the same water level obtains in all of them.

The chambers or containers R are fitted with a common steam-tight lid C or with separate steam tight lids, through which are led the iron rods G, suitably insulated from the lids C by means of insulators C′ and supporting the electrodes E that carry the current to the water in the water space.

When one of the phases is earthed, one of the electrodes is supplied by the container walls or portions thereof, as in Figs. 1 and 2, which represent an unbalanced threephase system. In the balanced threephase system illustrated in Fig. 3 two electrodes, for instance —*a*— and —*b*—, are insulated and the third one —*c*— is electrically connected to the containers.

Between the electrodes suspended from the rods G and the container walls, diaphragms are arranged consisting of two coaxial cylindrical surfaces —*d*—*d*— of sandstone, por-

celain, quartz or other insulating material, the inner cylinder being provided with one or more openings —*f*— staggered relatively to the openings of the outer cylinder (Fig. 1). The diaphragms may also consist of a cylinder connected to a set of three walls arranged to form a triangle inside the cylinder and fitted with an opening —*f*— each. The object of the diaphragms is:

1. To insulate the electrodes and the water, by which the electrodes are surrounded, from the metallic mass of the containers where necessary;

2. To suitably lengthen, as indicated by dotted lines in Figs. 2 and 3, the path which the electric current has to traverse across the water in order to travel from the electrodes to the wall portions that are left uncovered by the insulator in the case of Fig. 1, or from one electrode to the other in the case of Fig. 3.

3. To form partitions in the containers, in order to lessen the washing motions which the locomotive tends to impart to the water mass when traveling.

The water is fed into the steam generator by a motor driven pump of a suitable output somewhat in excess of the generator's maximum output.

The pressure of the steam produced is maintained constant (Fig. 4) by discharging the amount of water that is fed into the container in excess of the steam call obtaining at any given moment. Any water surplus fed through —*a*—*a'*— into the boiler, causes the water level to rise in the container, and consequently the steam production and steam pressure to rise too. Owing to the increased steam pressure, the lift of the overflow valve —*s*—, which had been set for a certain constant pressure, is increased too and the surplus water will thus escape through the valve.

When the available feed water is of such a quality as to cause too large a proportion of soluble salts to be present in the hot boiler water—as is more frequently the case—instead of discharging the cold water as it is delivered by the pump, the hot water lying between the electrodes should be blown off. This is attained by means of the arrangement shown by way of example in Figs. 1 and 2, and lettered A, which represent a blow-off device arranged in the electrode region. This discharging device may be connected to the pressure regulating valve in such a way that by the operation of a three-way cock the said valve can be made to discharge the excess water either from the bottom of the boiler (cold water) or from the electrode region (hot water) or from both. The hot blown-off water is made to traverse the pipe coil of a feed water heater in order to recover the heat contained in the blow-off.

Owing to constructional considerations the diaphragms cannot be made to extend into the space which is normally intended as steam space, as it is necessary to prevent the water level from reaching the said unprotected region, where it would give rise to short-circuits.

The following advantages are thus obtained:

1. The maximum input of electric energy in the electric steam generator is automatically limited.

2. The maximum amount of electric energy absorbed by the steam generator can be adjusted even from a distance, to suit the current available.

3. The complete filling of the electric boiler through wrong operation of the regulating devices or through the latter getting out of order is made impossible.

The attendant is consequently warned not to switch on the current when, after a standstill, he should find the boiler full of water and the filling when the boiler is at work is prevented.

This object is reached through a device of which Fig. 5 is a diagrammatic illustration. The device comprises a metallic contact button B projecting inside the container R and electrically insulated from the container's body by means of insulators C''. This button is connected in an auxiliary low-voltage circuit in which is inserted a relay actuating the control switch Q of the motor-pump set M or, failing this switch, the electro-magnetically operated cock controlling the water feed. One end of the relay winding is connected to the boiler body, so that the water, when reaching a predetermined level, closes the relay circuit either by direct contact with the insulated button, or indirectly through the intermediation of a float. The relay L, its winding being now traversed by the current, opens the control switch Q of the motor-pump set M or closes the feed valve.

Having now fully described our said invention what we claim is:

1. In an electric steam generator, a casing, electrodes therein, insulating diaphragms in the casing and provided with openings interposed between the electrodes with the object of increasing the length of the resistance represented by the water separating the electrodes, and of reducing the wash-motions of the generator water when the locomotive or carriage on which the generator is installed is traveling.

2. In an electric steam generator a casing, a cylindrical diaphragm arranged against the inner surface of the casing, a plurality of electrodes in the diaphragm but spaced therefrom, a plurality of diaphragms arranged to form a triangle within the cylindrical diaphragm and coacting with the ad-

jacent portion of the cylindrical diaphragm in forming a chamber for the adjacent electrode and in addition being provided with an opening to increase the length of the resistance represented by the water separating the electrodes and of reducing the wash actions of the generator water when the locomotive or carriage on which the generator is stalled is traveling.

3. In an electric steam generator as claimed in claim 2, an automatic adjustable spring-loaded regulating valve for discharging from the water space, a large or small amount of feed or hot water and in consequence regulating the steam production.

4. In an electric steam generator as claimed in claim 2, a jacket surrounding and arranged in communication with the casing, and a manually operable discharge valve fitted to the jacket.

5. In an electric steam generator as claimed in claim 2 a feed water pipe for the casing, a jacket surrounding and communicating with the casing, a pressure regulating valve mounted in the feed water pipe, a pipe leading from the jacket and connected to the valve, a three way valve arranged for discharging hot water from the electrode region or from the bottom of the casing and a pipe coil in the feed water heater through which the hot blown-off water passes.

6. In an electric steam generator as claimed in claim 2, a feed water pipe leading to the casing, a pump interposed in the pipe, a motor operatively connected with the pump, a float in the casing, a metallic body connected with the float, an electric contact arranged inside of the casing and coming into action when the water reaches a predetermined level, either through the water coming directly in touch with the contact, or through contact with the metallic body on the float, and a controlling switch in circuit with the contact and motor.

In testimony whereof we affix our signatures.

FRANCESCO REVEL, INGEGNERE.
ANGELO BOLDORINI.