(No Model.)

J. J. HEILMANN.

SYSTEM OF ELECTRICAL PROPULSION FOR VESSELS.

No. 602,325. Patented Apr. 12, 1898.

Fig. 1.

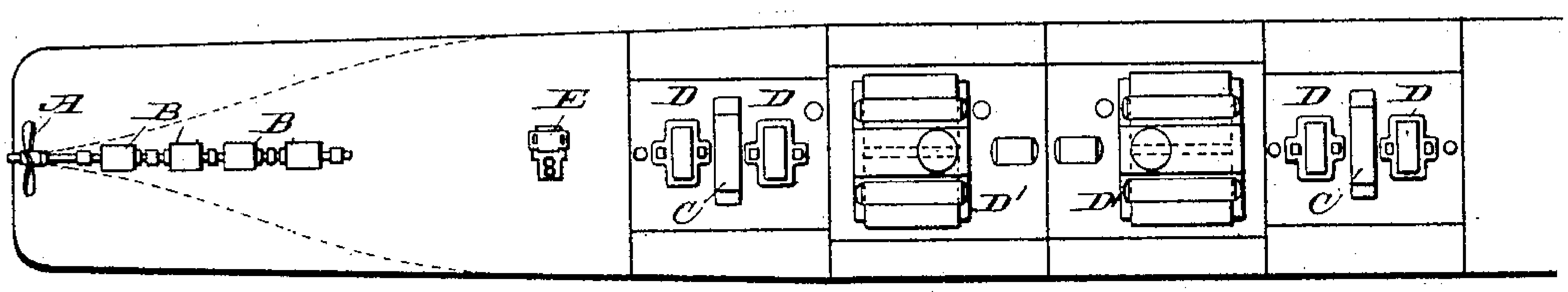


Fig. 2.

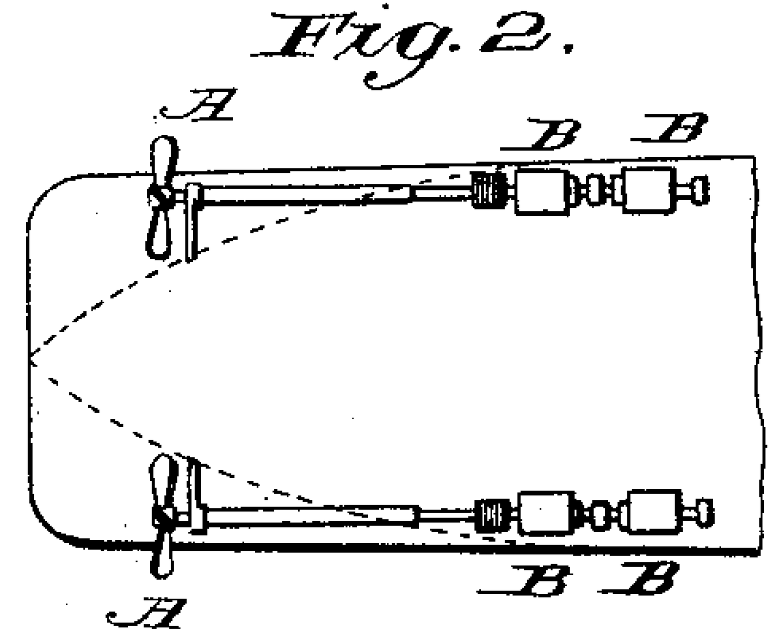


Fig. 3.

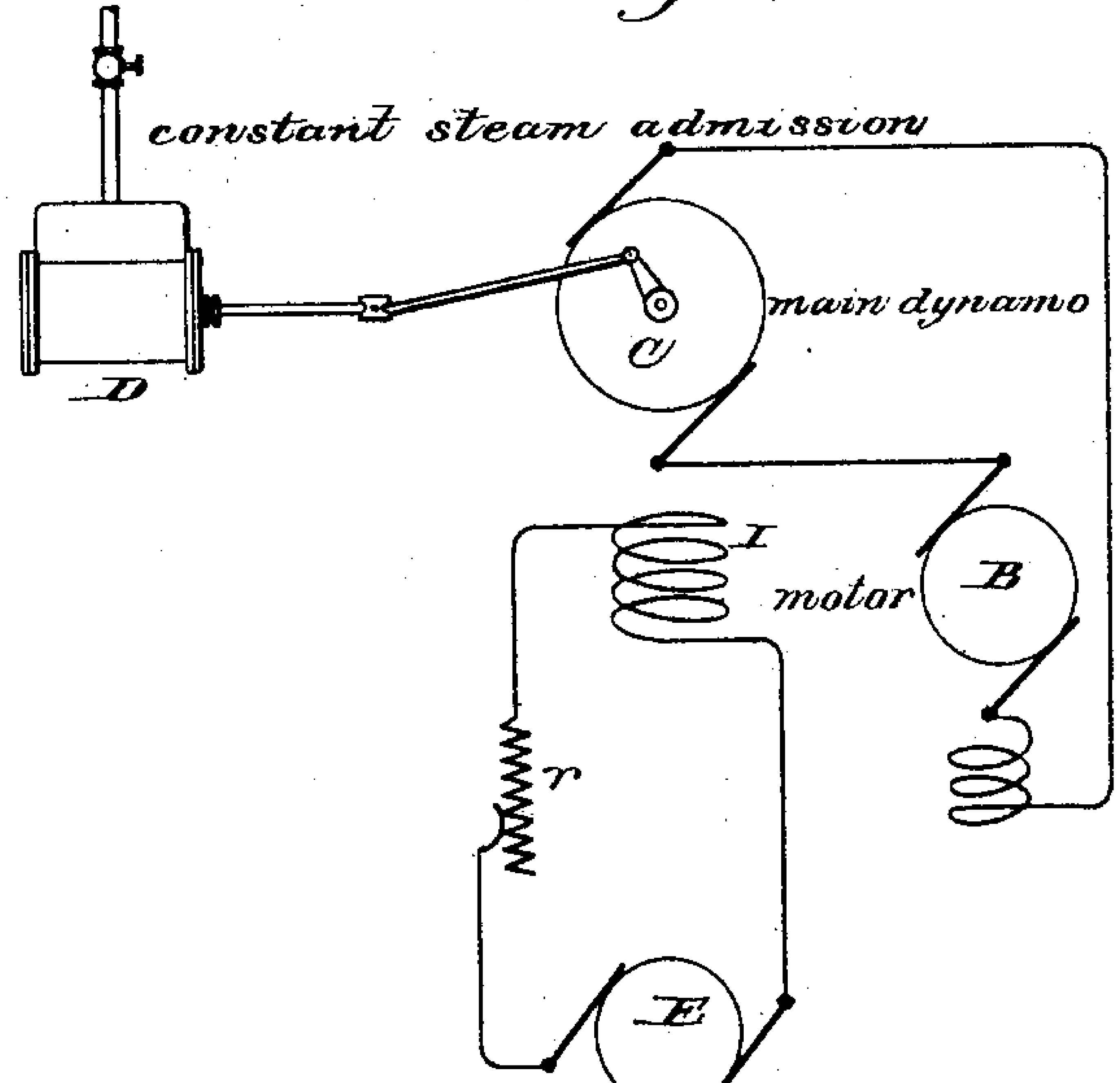
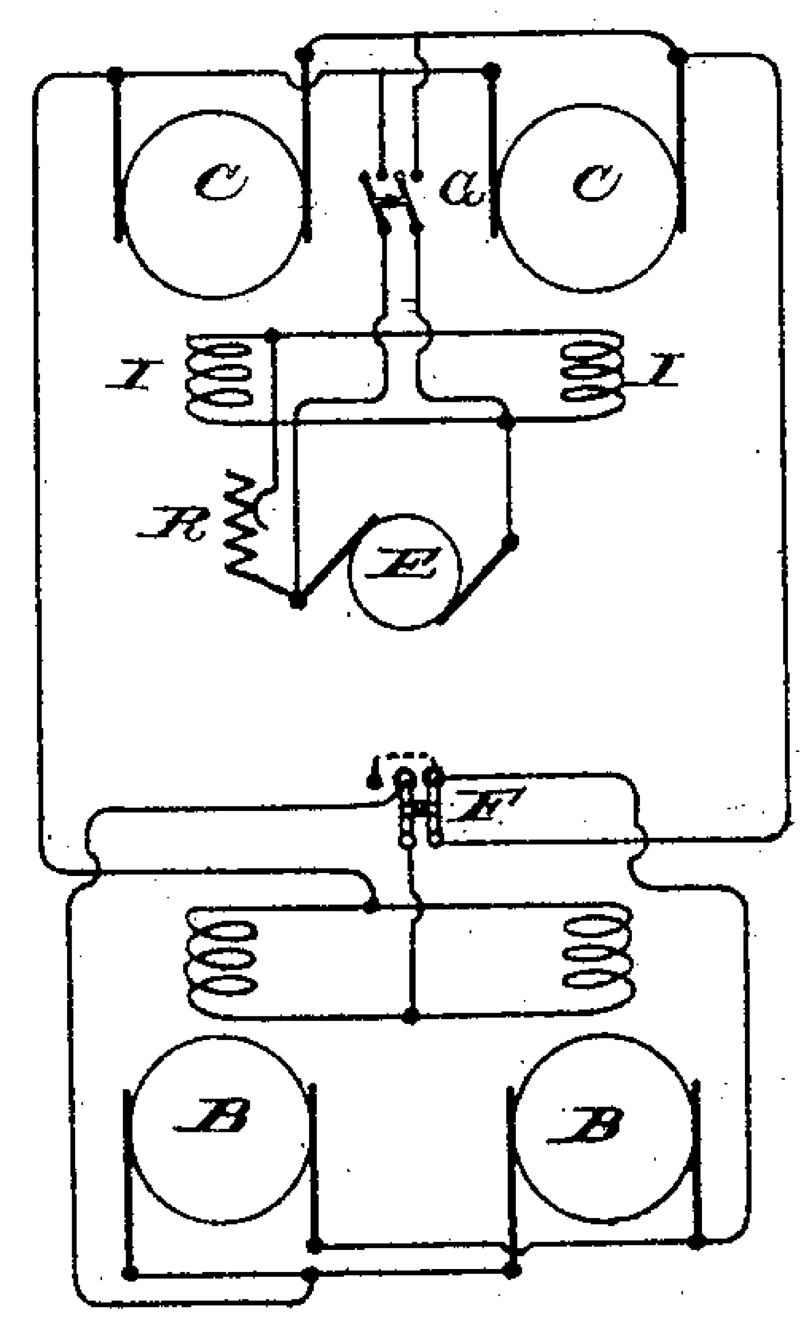


Fig. 4.



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JEAN JACQUES HEILMANN, OF PARIS, FRANCE.

SYSTEM OF ELECTRICAL PROPULSION FOR VESSELS.

SPECIFICATION forming part of Letters Patent No. 602,325, dated April 12, 1898.

Application filed December 3, 1895. Serial No. 570,878. (No model.) Patented in Italy January 28, 1895, No. 38,132; in India April 6, 1895, No. 111; in Russia April 29, 1895, No. 8,818; in Spain July 1, 1895, No. 17,662; in Portugal July 19, 1895, No. 2,039, and in Belgium October 22, 1895, No. 118,016.

To all whom it may concern:

Be it known that I, JEAN JACQUES HEILMANN, engineer, residing at 19 Rue Cambon, Paris, in the Republic of France, have invented certain new and useful Improvements in a System of Electrical Propulsion for Navigable Vessels of all Kinds; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

This invention has been patented in the following countries: Italy, No. 38,132, dated January 28, 1895; India, No. 111, dated April 6, 1895; Russia, No. 8,818, dated April 29, 1895; Spain, No. 17,662, dated July 1, 1895; Portugal, No. 2,039, dated July 19, 1895, and Belgium, No. 118,016, dated October 22, 1895.

This invention relates to a system of electrical propulsion for navigable vessels of all kinds characterized by the use of one or more propellers in each vessel rotated by means of electric motors supplied with current from an electrical generator, which is also carried upon the same vessel. Either paddle-wheels or screws may be employed; but the latter being more generally useful these improvements will be described with reference to them, and from this description the application to paddle-wheels will be obvious.

The accompanying drawings and diagrams illustrate my invention and will be hereinafter referred to.

Figure 1 is a sectional plan of a vessel arranged to be propelled according to my system. Fig. 2 shows a modification. Fig. 3 is a diagram showing the electric circuits of a single generator and motor. Fig. 4 shows the circuits of two generators and motors.

Each screw-propeller A is driven by a series of electric motors B, which are supplied with current from the main dynamos C, operated by steam-engine D. The boilers are represented at D'.

The engines are by this system not compelled to occupy a certain position in the vessel nor to have their crank-shafts at a certain height, and they may be chosen of a perfectly-balanced type completely exempt from vibrations. The propelling-screws A may be arranged in any suitable and effective manner. Thus, as shown by Fig. 1, there may be a single screw in line with the keel, or there may be twin screws arranged with the motors within the vessel, as in Fig. 2. In any case the ordinary precautions are taken to secure the free action of the screws effectively.

My improvements particularly relate to devices for permitting the vessel to be propelled at different speeds with a sensibly constant efficiency, the electrical apparatus being grouped in such a manner as to permit the steam-engine to rotate at a speed proportional to the work to be done and, above all, with a constant steam admission. Fig. 3 represents, diagrammatically, a grouping of the electric devices which allows this result to be attained. For the sake of greater simplicity only one motor B and one generating-dynamo C are shown, the armature of the dynamo being in circuit with the motor without the intercalation of a rheostat. The field-coils I of the generator are in circuit with a separately-driven exciter-dynamo E, which furnishes a current of constant potential. The magnetism of the generator-field therefore depends upon the current of the exciter. By means of a rheostat *r*, in series with the field-coils I, the strength of the exciter-current can be varied, and hence the strength of the generator-field can be varied.

The steam-engine which drives the generator has a constant steam admission—that is, at each stroke of the piston a predetermined quantity of steam at a constant pressure is admitted to the cylinder. Inasmuch as the torque of the engine-shaft is directly proportional to the steam-pressure it will remain constant. The speed of the engine will therefore depend upon the torsional resistance which the constant torque meets with. The work done by the engine is the product of the speed and the steam-pressure. Hence if the constant-admission engine is called upon to do more work it must increase in speed.

The work done by the generator is the

product of the electromotive force and its current. Now the electromotive force is proportional to the speed of the engine. Hence the current is proportional to the torque of the engine. The engine having a constant torque, the generator will deliver a constant current so long as the magnetism of its field remains the same. In a system of this kind the amperes of current supplied to the motor will depend, therefore, upon the electromotive force of the current. At low speeds the resistance of the motor-circuit is low, and hence the electromotive force of the constant-current generator can be reduced. When the speed of the motor is to be increased, the electromotive force of the generator must be increased in order to overcome the increased resistance of the motor due to its counter electromotive force.

Now inasmuch as the electromotive force of the generator varies with the speed of the engine and the speed of the engine depends upon the steam-pressure and the torque of the generator, if the steam-pressure is constant it is only necessary to vary the torque of the generator in order to get either a greater or a less electromotive force. The torque of the generator depending on the current and the magnetism of its field and the current being constant, it follows that by simply increasing or diminishing the magnetism of the generator-field its torque will increase or diminish. It is therefore possible to make the engine run slower or faster by increasing or diminishing the magnetism of the generator-field. It follows that this simple manipulation of the rheostat *r* varies the electromotive force of the generator-current, and consequently the speed of the motors. Hence when the vessel is to travel at a slow speed the strength of the generator-field is increased by means of the rheostat *r*. If, on the other hand, the speed of the vessel is to be increased, it is only necessary to diminish the strength of the generator-field and the motors will thus vary automatically with the work to be done. Fig. 4 shows, diagrammatically, in what way two generating-dynamos and two motors may be arranged.

F is a reversing-switch by means of which the direction of rotation of the motors may be changed by reversing the direction of the current in the armatures of these motors.

When there are several propelling-screws, each of them may be rotated separately and there may be intercalated in each or any motor-current variable resistances. There may be employed all the ordinary rheostats, switches, resistances, and similar appliances commonly known and used for regulating the action of the electric motors, and more particularly in the case of twin screws employed without a rudder, as indicated in Fig. 2, for the purpose of controlling the speeds and the state of rest or motion of the respective motors. If the engines employed for driving the generating-dynamos have dead-centers, we may utilize the exciter for the purpose of starting the engines in the following manner: The exciter being driven by a separate small engine is easily moved, and the current from the exciter is sent into the generating-dynamo, which is thereby momentarily converted into an electric motor and by its rotation will start the generator-engine.

In Fig. 4, G is the double-pole switch, which can be employed for this purpose.

The current from the generating-dynamo may be used for energizing motors for driving various machinery in different parts of the ship—such, for instance, as the steering-gear.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is performed, I declare that what I claim is—

1. In a system of electrical propulsion for navigable vessels, the combination with a propeller-wheel, of a steam-engine having a constant steam admission, two or more generating-dynamos having their armatures connected in multiple with the main conductors, and driven by said steam-engine, a separately-driven constant-potential exciting-dynamo with which the field-coils of the main dynamos are connected in multiple, a rheostat in series with the exciter-armature for varying the field strength of said dynamos, two or more electric motors connected to the propeller-shaft, and having their field-coils in series multiple with their armatures, and a reversing-switch between the field-coils and the armatures of said motors, substantially as described.

2. In a system of electrical propulsion for navigable vessels, the combination with a propeller-wheel, of a steam-engine having a constant steam admission, a main generating-dynamo driven by said steam-engine, a separately-driven constant-potential exciting-dynamo in circuit with the field-coils of said main generator, a rheostat in series with the exciter-armature for varying the field-magnetism of the main generator, and an electric motor in series with the generator-armature and arranged to drive the propeller-shaft, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

JEAN JACQUES HEILMANN.

Witnesses:
CLYDE SHROPSHIRE,
HENRY DANHERF.