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SHIP'S SCREW DRIVING MECHANISM FOR SUBMARINE BOATS.

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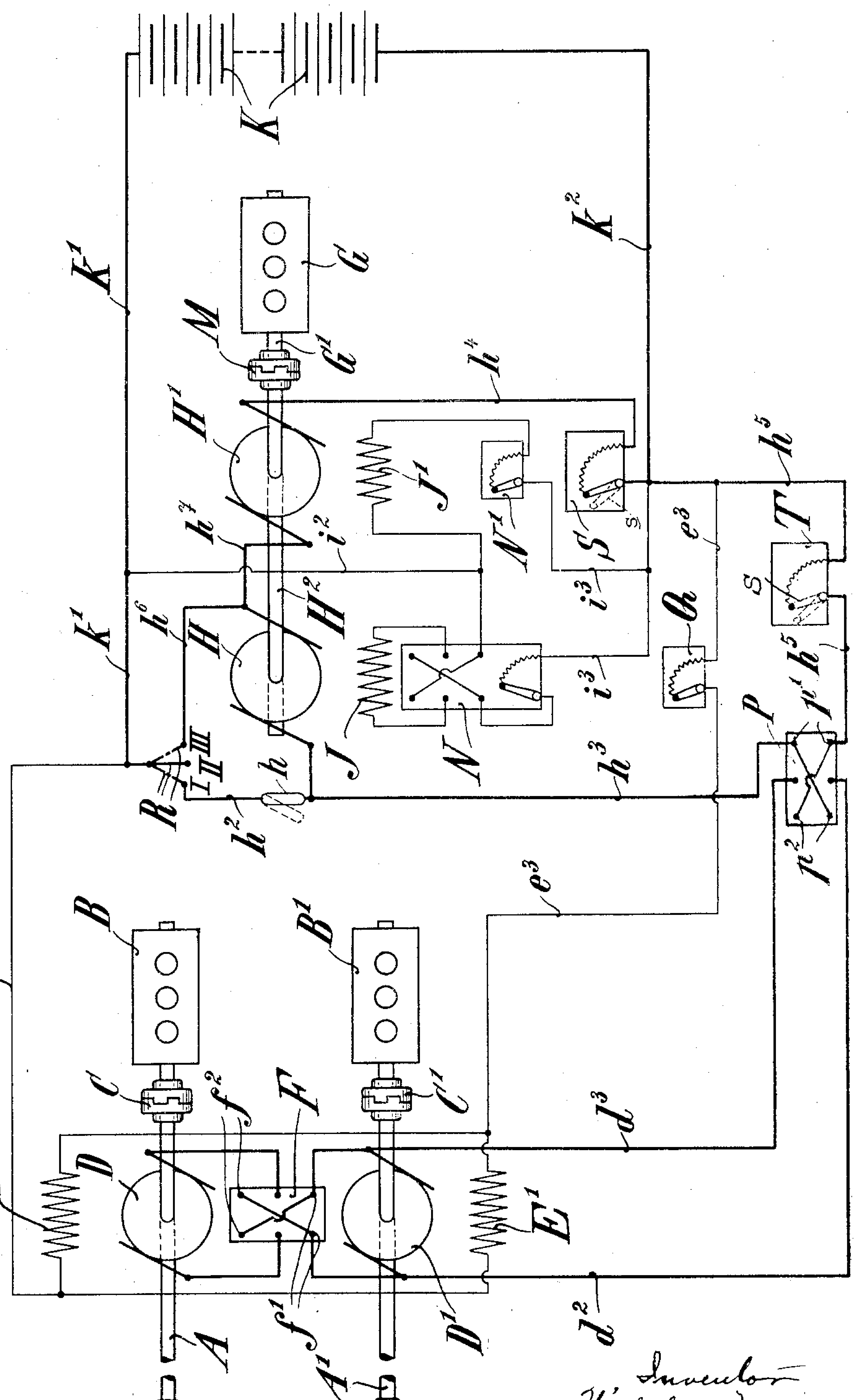

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SHIP'S-SCREW-DRIVING MECHANISM FOR SUBMARINE BOATS.

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To all whom it may concern:

Be it known that I, WILHELM MAIER, a citizen of Germany, and a subject of the Emperor of Germany, residing at No. 46 Birkenwaldstrasse, Stuttgart, Germany, have invented a new and useful Ship's-Screw-Driving Mechanism for Submarine Boats, of which the following is a specification.

This invention relates to that class of ship's screw driving mechanism for submarine boats, in which each propeller shaft is connected with a driving engine and an electromotor under the control of an operator in the boat and in which each propeller shaft can be worked separately from the driving engine or together therewith, and in which each motor can be fed by a generator driven by a special auxiliary motor or by a battery of accumulators.

The object of the invention is to provide a ship's screw driving mechanism of this kind which enables the screw shafts to be economically started as well as quickly reversed, and moreover permits the number of revolutions of the screw shafts to be quickly adjusted within certain limits to any desired value.

In the drawing the invention is diagrammatically shown by way of example for two propeller shafts.

Upon the screw shafts A A^1, which can be connected to the driving motors B B^1 (explosion motors for example) by clutches C C^1 which can be disconnected, are mounted the armatures D D^1 of electromotors. The armatures are connected up in parallel with the conductors d^2 d^3 leading to a double pole reversing switch P, and are likewise connected with each other by a double pole reversing switch F. The field windings E E^1 of the electromotors, which are likewise connected up in parallel, are connected to a battery of accumulators K by conductors e^2 k^1 and e^3 k^2. In the conductor e^3 is inserted a variable resistance Q.

The primary station consists of a motor G (an explosion motor for example) and a double dynamo machine. The armatures H H^1 of the latter are coupled by a shaft H^2, which in its turn can be connected to the shaft G^1 of the motor G by a clutch M capable of being thrown out of operation. The armatures H H^1 are connected up in series. From the free terminal of the armature H a conductor h^2 leads to a switch R, which is connected to the accumulator conductor k^1, and a second conductor h^3 to the double pole reversing switch P.

From the free terminal of the armature H^1 a conductor h^4 leads to a starting resistance S, which is connected to the accumulator conductor k^2, and also by another conductor h^5 to the reversing switch P. In the conductor h^5 is also placed a starting resistance T. The conductor h^7 connecting the two armatures H H^1 is connected by a conductor h^6 to the reversing switch R. The field windings J J^1 of the double machine are connected to a reversing regulator N or to a variable resistance N^1 and in parallel by conductors i^2 i^3 to the accumulator conductors k^1 k^2.

When a submarine boat equipped with the above described driving apparatus is to travel on the surface of the water, the clutches C C^1 are thrown out of operation, the switches P and F opened, and the current generating plant G H^1 J^1 H J set working. If the motor G be an explosion motor, it can be started in a simple way by means of the machine H^1 J^1, which is driven as a motor from the battery K by means of the starting resistance. The clutch M is at the same time thrown into operation, and the switch R is at position III. The armature H runs conjointly as a centrifugal mass. As soon as the engine G has been set in motion, the switch R is brought into position II. The engine G now in its turn sets the armatures H H^1 in rotation. As the field windings J J^1 are fed from the battery K, the double machine now forms two generators connected in series. It should be remarked here that the excitation of the fields J J^1 may be also effected by a separate exciting machine.

After the primary station has been set in motion in the manner described, the double pole reversing switches P and F are brought into the position p^1 or f^1. The motor armatures D D^1 are then connected to the dynamo machines H J H^1 J^1 by the conductors h^3 d^3 on the one hand, and by the conductors h^4 h^5 d^2 on the other hand, while the current for the field windings E E^1 is taken from the accumulator battery K by the conductors k^1 e^2 and k^2 e^3. The starting and the adjustment of the number of revolutions of the motor armatures D D^1 also is now accomplished by suitably varying the tension at the free terminals of the armatures H H^1 by means of the reversing regulator N. If the field proceeding from the winding J be oppositely directed to the field proceeding from the winding J^1, then, according to the strengths of current present in the windings J J^1, the fields and therefore the armature tensions of the armatures H H^1 cease entirely or partially, while if the fields be similarly directed, they are added together so that by shifting the reversing regulator N command may be had over a tension varying from zero to the sum of the tensions of the machines H J H^1 J^1 for the driving of the motor armatures D D^1. The number of revolutions of the motors D E, D^1 E^1 may be still further augmented by weakening the field strengths of the windings E E^1 by means of the variable resistance Q. Other maneuvers, such as running backward and turning, are accomplished by means of the double pole reversing switches P and F. If the reversing switch P be thrown over into position p^2, then both shafts A A^1 reverse their direction of rotation, so that the direction of movement of the vessel is changed. After throwing over the switch F into position f^2, only the shaft A reverses its direction of motion, that is to say the screws work in opposite directions. Each motor may also be driven separately after switching off the connecting conductors between the motor armatures D D^1. If it be desired to raise the speed of the vessel to the maximum of the total output of the driving mechanism, then the driving engines B B^1 are allowed to work upon the screw shafts A A^1 in addition to the electromotors D E, D^1 E^1. For this purpose the clutches C C^1 are thrown into action. In this case the starting of the engines B B^1, if they are explosion engines, is effected from the shafts A A^1.

During prolonged runs on the surface of the water, which require a mean output of the engines, the screw shafts A A^1 are driven by the engines B B^1 alone. The clutches C C^1 are thrown into operation, so that the motor armatures D D^1 are carried around conjointly as centrifugal masses. The switch P is opened and no current can therefore pass through the motor armatures D D^1.

The construction of the primary station in the manner set forth also provides efficient means of regulating the electromotors D E D^1 E^1 when running under water. In this case the switch R is brought into position III, so that the accumulator battery K is connected to the armature H^1 by the conductors k^1 h^6 on the one hand, and the conductors k^2 h^4. The reversing switch P is next opened and the field J unexcited by suitably adjusting the reversing regulator N. The clutch M is thrown out of action and the machine H^1 J^1 started idly as a motor by means of the starter S from the battery K and brought to its normal number of revolutions. The armature H runs at first at the same time conjointly as a centrifugal mass.

As soon as the exciting current coming from the battery K flows through the winding J by manipulating switch N, the machine H J runs as a generator. If the magnet field J of the machine H J be simultaneously excited, by suitably adjusting the reversing regulator N in such a direction that its terminal tension is oppositely directed to the battery tension, and the reversing switch then closed, the electromotive forces in the conductor branch h^3 P d^3 D^1 D d^2 P h^5 will be balanced since switch R is in position III; no current can then flow through the motor armatures D D^1. If the field J of the driven machine H J be now weakened by means of the reversing regulator N, the battery tension will preponderate, and there arises at the terminals of the motor armatures D D^1 a small tension, which increases more and more the more the magnet field J of the driven dynamo H J is weakened. The result of this is that the electromotors D E and D^1 E^1 revolve first slowly and then with increasing speed. When the magnet field J is entirely unexcited, the dynamo H J yields no tension, so that the electromotors D E, D^1 E^1 receive the full tension of the battery and run at half speed. If the field J of the dynamo H J be now excited by the throwing-over of the reversing regulator N in the opposite direction, so that it adds its armature tension to the tension of the battery, the number of revolutions of the electromotors D E, D^1 E^1 goes on increasing until, when the magnet field J is wholly excited, they run at full speed. The machine H^1 J^1 works at the same time as a motor and takes current from the battery K.

The above described way of supplying current for the electromotors D E, D^1 E^1 by accumulator batteries and transforming machines, has the advantage that both the starting, as well as the regulation of the motors, can be accomplished very economically. If the current for the motors were taken directly from the accumulator batteries K, the motors would have to be started with a starter. This would however mean a great loss of power when starting. In this case also the alteration in the terminal tension at the motor armatures D D^1 required for the reduction of the number of revolutions of the motors D E, D^1 E^1, would only be possible by regulating starters which work very uneconomically. By altering the field excitations E E^1 the normal number of revolutions of the motors could only be increased, but not reduced.

The recharging of the battery K is effected while running above water, when the propeller screws are driven by the driving engines B B^1 alone and the auxiliary motor

G is available. The clutch M is then again thrown into operation, and the switch R brought into the position I. The motor G then drives the two machines H J, H^1 J^1 as series coupled generators. The fields J J^1 are in this case excited in shunt from the armatures H H^1. The tension can be easily regulated by means of the reversing regulator N. Should a break-down occur at the primary station G, H, J, H^1, J^1, the electromotors D E, D^1 E^1 may be started and fed directly from the battery K by means of the starter T. The machines H J, H^1 J^1 are at the same time switched off from the conductor h^2 or k^2 by moving switches h and s into the positions shown in dotted lines and the switch R is brought into the position I.

If the clutches C C^1 M be constructed as electro-magnetic clutches, then all the necessary manipulations for the driving and moving of the vessel, including the starting of the driving engines B B^1 G, may be performed from a common operating point.

Claims.

1. In a screw-driving power plant for submarine boats, the combination with the propeller shafts; a driving engine for each shaft; an electro-motor for driving each shaft, said engines and motors being adapted to act together or separately to drive their respective shafts; an auxiliary engine; a generator driven by said auxiliary engine and connected up to drive said electro-motors; an electric accumulator adapted to provide current for said generator said generator comprising two direct-connected generator elements connected in series and being provided with connections adapting one of said generator elements to be operated as a motor for driving the other generator element.

2. In a screw-driving power plant for submarine boats, the combination with the propeller shafts; of a driving engine and an electric motor for each shaft; means adapting said engine and motor to act separately or together upon the propeller shaft; an auxiliary power plant comprising two generators connected in series and an engine for driving the same; an electric accumulator for exciting the fields of all the aforesaid electric machines; a circuit through which said accumulator can be made to drive the first mentioned motors; another circuit through which said accumulator can be made to drive one of the generators as a motor; and a switch for closing and opening said circuits.

3. In a screw-driving power plant for submarine boats, the combination of two propeller shafts; a motor mounted on each shaft; a combustion engine adapted to be brought into driving relation with each shaft; a releasable clutch for connecting said combustion engine to its own propeller shaft; generators for supplying current to said motors; a combustion engine detachably connected in driving relation with said generators; an accumulator for exciting the fields of said motors and generators; a circuit for connecting said accumulator in driving relation with said motors; a circuit for connecting said accumulator with one of said generators to adapt it to run as a motor; and a switch by means of which either of said circuits may be opened and closed.

4. In a screw-driving power plant for submarine boats the combination with the motor-driven propeller shafts; of combustion engines adapted to be connected with said driving shafts; an auxiliary power plant for supplying current to the motors on said propeller shafts, said auxiliary plant comprising two generators connected in series and a combustion engine for driving said generators; an accumulator for energizing the fields of said motors and said generators; a circuit for connecting one of said generators to said accumulator to act as a motor and a switch for closing and opening said circuit to adapt said generator-motor to start the combustion engine of the auxiliary plant, said switch being also adapted to close the field energizing circuits.

5. In a power plant for operating the screw-driving propeller shafts of submarine boats, the combination with the propeller shafts, motors carried thereon, and combustion engines detachably connected therewith; of a generator plant for supplying current to said motors; a combustion engine for driving said generators, said engine being detachably connected with the generators; an accumulator for energizing the fields of said motors and generators; means for connecting the generators with said accumulator in such manner as to adapt one of said generators to act as a motor for starting the explosion engine connected therewith; and means for charging said accumulator from the generators when driven by the combustion engine.

The foregoing specification signed at Stuttgart, this twenty-ninth day of July, 1908.

WILHELM MAIER.

In presence of—
ROBERT ROMANN,
FRIEDRICH GROSSMANN.