No. 891,352. PATENTED JUNE 23, 1908.

# W. L. MERRILL.

## TOWING SYSTEM.

APPLICATION FILED FEB. 9, 1907.

Fig. 1.

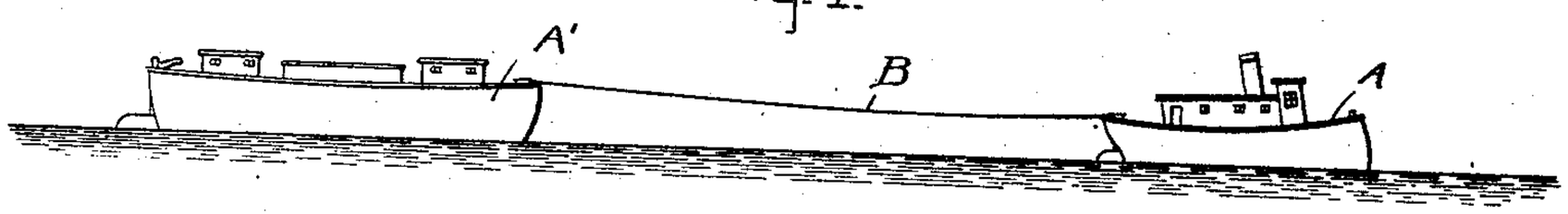
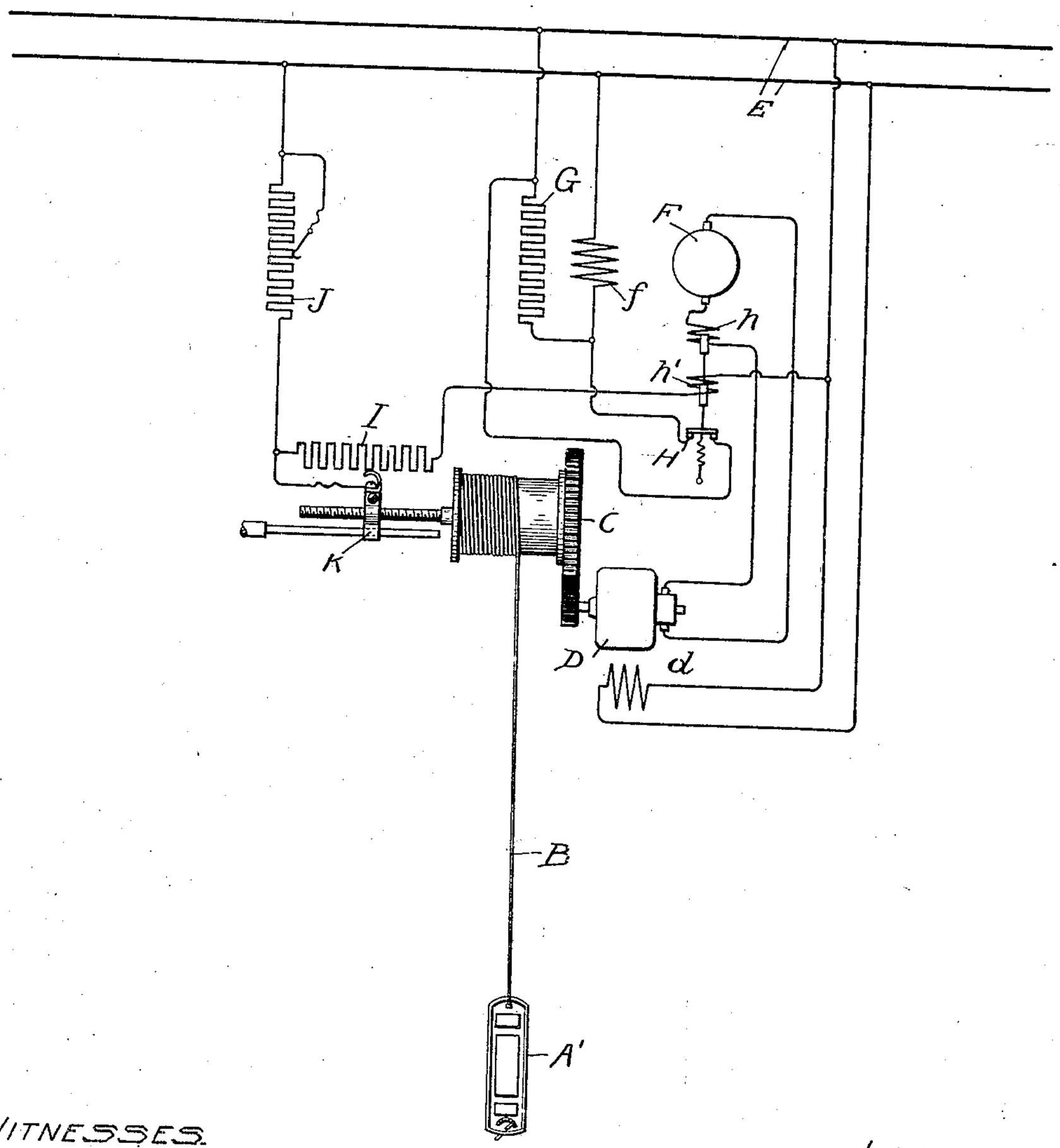



Fig. 2.

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# UNITED STATES PATENT OFFICE.

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## TOWING SYSTEM.

No. 891,352. Specification of Letters Patent. Patented June 23, 1908.

Application filed February 9, 1907. Serial No. 356,557.

*To all whom it may concern:*

Be it known that I, WILBUR L. MERRILL, a citizen of the United States, residing at Schenectady, in the county of Schenectady and State of New York, have invented certain new and useful Improvements in Towing Systems, of which the following is a specification.

My invention relates to towing systems, and is particularly applicable to the control of electric winches for towing barges.

A satisfactory system for towing should embody the following features: When the speed of the vessel is increased, the hawser should be lengthened to avoid sudden shock, and then should be gradually wound in to reduce the distance between the two boats to the original amount. If the forward boat should be slowed down, the hawser should be reeled in to take up the slack, and then gradually reeled out to maintain the proper distance between the two boats.

My invention consists in so arranging the control of the hawser that the pull is increased when the distance between the ships increases, and is decreased as the distance between the ships decreases. I accomplish this by providing yielding means for paying out the hawser, and means for automatically increasing the pull on the hawser with the amount paid out. More specifically stated, I provide an electric motor controlling the winch or winding-drum, and means controlled by the movement of the winch for controlling the torque of the motor.

My invention will best be understood by reference to the accompanying drawings, in which

Figure 1 shows a tug and its tow, and Fig. 2 shows diagrammatically the arrangement of the control system.

In Fig. 1, A represents the tug and A′ the tow connected by the hawser B. This hawser is made fast to the tow, and at the tug is controlled by means of the apparatus shown diagrammatically in Fig. 2. In this figure C represents a winch or drum for paying out the hawser. D represents an electric motor geared to the drum and controlling the pull on the hawser. The field *d* of the motor may be series, shunt, compound, or separately-excited. In the drawing I have shown it separately excited from the constant potential circuit E. F represents the armature of an electric generator supplying current to the motor armature. *f* represents the generator field, which is connected across the constant potential circuit E through a resistance G. Resistance G is provided with a short-circuiting device H, comprising two magnet windings, of which one, *h*, is placed in series with the motor armature, while the other, *h′*, is connected across the constant potential circuit E through the variable resistances I and J. The resistance J is employed merely for the initial adjustment of the system, while the amount of resistance I in circuit is controlled automatically by a contact carried by a nut K, which is moved by a screw formed by an extension of the shaft of the drum C.

The two windings *h* and *h′* assist each other in tending to open the short-circuit around the resistance G. If the current through the winding *h′* were constant, the winding *h* would tend to maintain a constant torque on the motor D, since if the motor current, and consequently the motor torque, should rise above a certain amount, the increased current in the winding *h* would remove the short-circuit from the resistance G, thereby decreasing the generator voltage, and consequently the motor torque; while, as soon as the motor current fell below a certain limit, magnet winding *h* would be weakened sufficiently to allow the contact member H to short-circuit resistance G again, and consequently again to increase the generator voltage. This tendency toward maintaining a constant torque on the motor is modified by the action of magnet winding *h′*. The strength of this winding is controlled by the amount of the hawser that is paid out,—or, in other words, by the position of the drum C, since the position of this drum determines the position of the nut K, and, consequently, the amount of resistance I which is in circuit. For instance, if the two vessels are moving under normal conditions, and the forward vessel suddenly speeds up, due to any cause, the increased strain on the hawser B will cause it to be paid out, thereby shifting the nut K away from the drum C, and increasing the amount of resistance I included in circuit with magnet winding *h′*. This magnet winding *h′* is consequently weakened, so that the current in magnet winding *h* must rise to a greater amount than before, in order to remove the short-circuit from resistance G. In other words, the torque of motor D is in-

creased by the paying out of the hawser, so that it acts gradually to wind in the hawser again and restore the normal distance between vessels. If the forward vessel should slow down suddenly, the hawser would immediately be wound in by the motor D, but this would move the nut K so as to cut a portion of resistance I out of circuit and strengthen magnet winding $h'$. The current needed in magnet winding $h$ to remove the short-circuit from resistance G would consequently be decreased, thereby decreasing the torque of the motor D, so as to allow the hawser to be paid out again, and to restore the distance between the vessels to its normal amount.

It will be understood that I have illustrated my invention diagrammatically, and consequently I do not desire to limit myself to the particular construction and arrangement of parts here shown, but aim in the appended claims to cover all modifications which are within the scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is,

1. In a towing system, in combination with a hawser, yielding means for paying out said hawser comprising a drum and an electric motor geared to said drum, and means for automatically increasing the pull on said hawser exerted by said yielding means with increase of the amount of hawser paid out.

2. In a towing system, in combination with the hawser, a rotatable drum for paying out said hawser, an electric motor for producing a torque on said drum, and means controllable by the movement of said drum for controlling the torque of said motor.

3. In a towing system, in combination with the hawser, a rotatable drum for paying out said hawser, an electric motor for producing a torque on said drum, a screw and nut operated by said drum, and means controlled by said screw and nut for controlling the torque of said motor.

4. In a towing system, in combination with the hawser, means for paying out said hawser, an electric motor controlling the pull on said hawser, and means controlled by variation in the effective length of said hawser for controlling the torque of said motor.

5. In a towing system, in combination with the hawser, a rotatable drum for paying out said hawser, an electric motor geared to said drum, and means controlled by the movement of said drum for varying the torque of said motor.

6. In a towing system, in combination with the hawser, a rotatable drum for paying out said hawser, an electric motor geared to said drum, a screw and nut operated by said drum, and contacts controlled by said screw and nut controlling the torque of said motor.

7. In a towing system, in combination with the hawser, means for paying out said hawser, an electric motor controlling the pull on said hawser, a generator for supplying said motor, and means controlled by variation in the effective length of said hawser, for controlling the voltage of the generator.

8. In a towing system, in combination with the hawser, a rotatable drum for paying out the hawser, an electric motor geared to the drum, a generator for supplying said motor, and means controlled by the movement of said drum for controlling the voltage of the generator.

9. In a towing system, in combination with the hawser, means for paying out said hawser, an electric motor controlling the pull on the hawser, and a torque-controlling device for said motor comprising two magnet windings, one controlled by variation of current in the motor and the other by variation in the effective length of the hawser.

10. In a towing system, a combination with the hawser, a rotatable drum for paying out the hawser, an electric motor geared to the drum, and a torque-controlling device for said motor comprising two magnet windings, one controlled by the current in the motor and the other by the movement of the drum.

11. In a towing system, in combination with the hawser, means for paying out said hawser, an electric motor controlling the pull on the hawser, a generator for supplying the motor, and a voltage-controlling device for the generator comprising two magnet windings, one controlled by variation of current in the motor and the other by variation in the effective length of the hawser.

12. In a towing system, in combination with the hawser, a rotatable drum for paying out the hawser, an electric motor geared to the drum, a generator for supplying the motor, and a voltage-controlling device for the generator comprising two magnet windings, one controlled by the motor current and the other by the movement of the drum.

In witness whereof, I have hereunto set my hand this 7th day of February, 1907.

WILBUR L. MERRILL.

Witnesses:

BENJAMIN B. HULL,

HELEN ORFORD.