(No Model.) 3 Sheets—Sheet 1.

F. E. SICKELS.

STEAM STEERING APPARATUS.

No. 273,617. Patented Mar. 6, 1883.

Fig. 1.

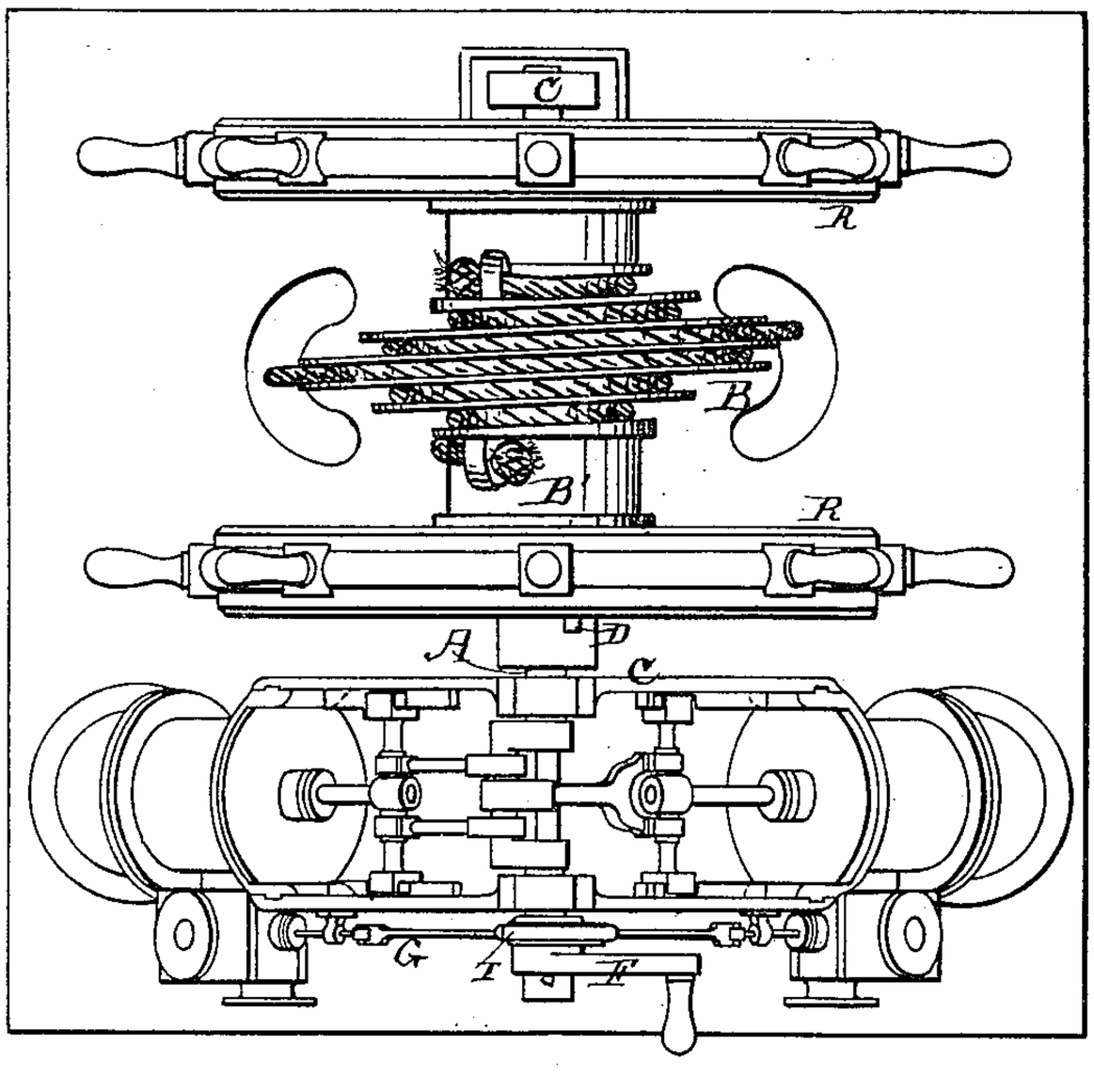

Fig. 2

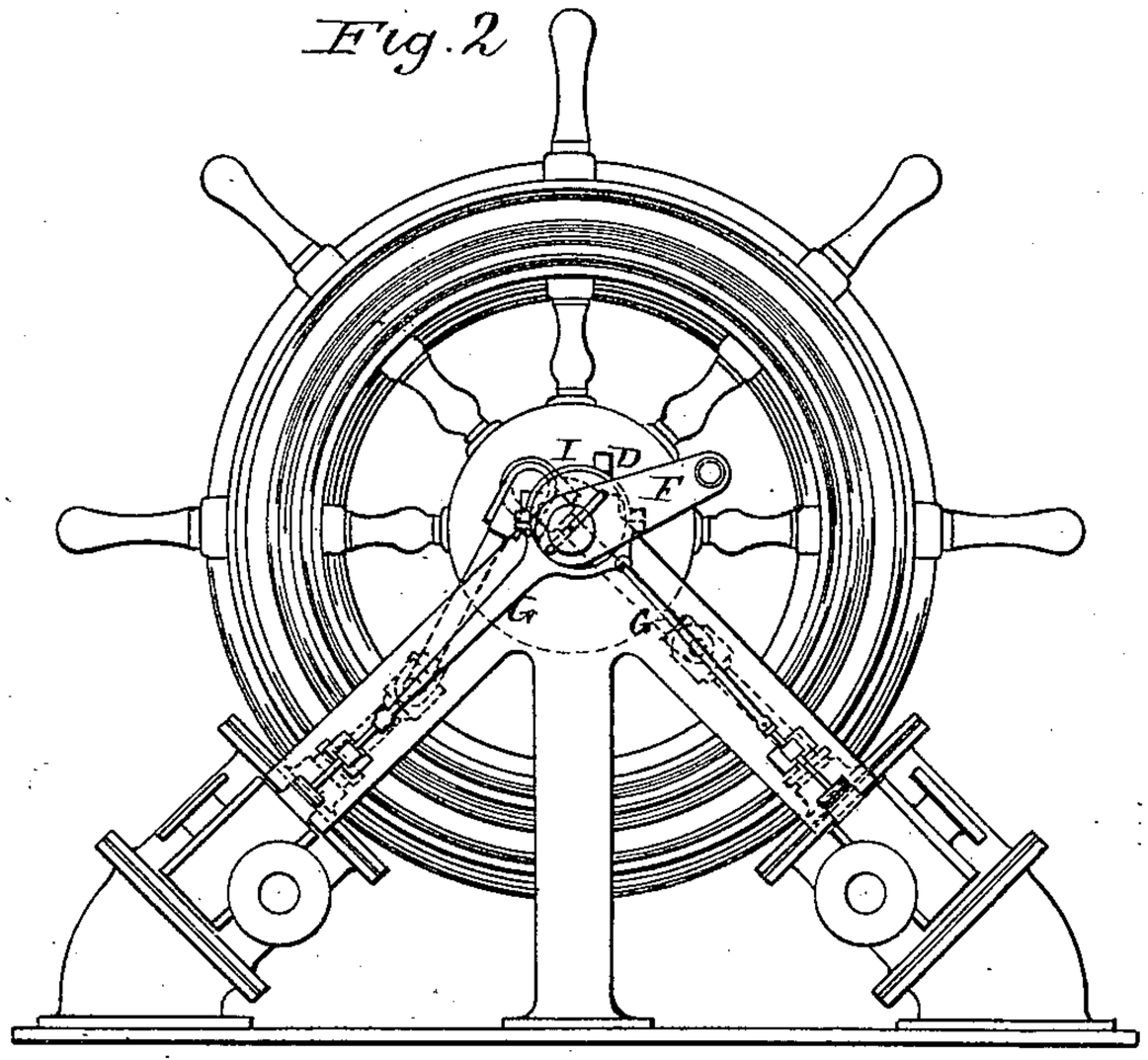

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Fig. 3.

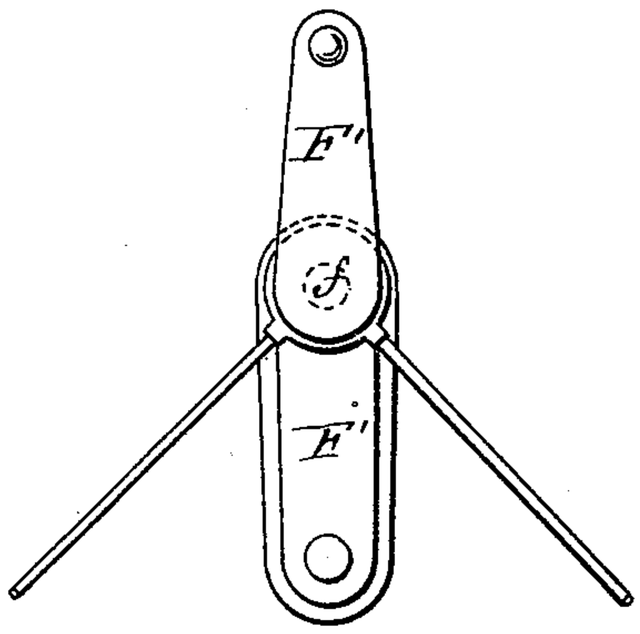

Fig. 4.

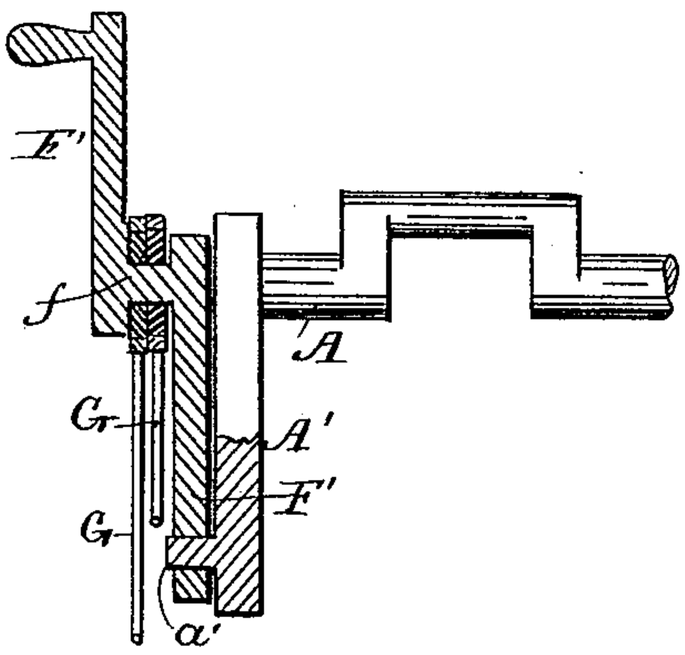

Fig. 5.

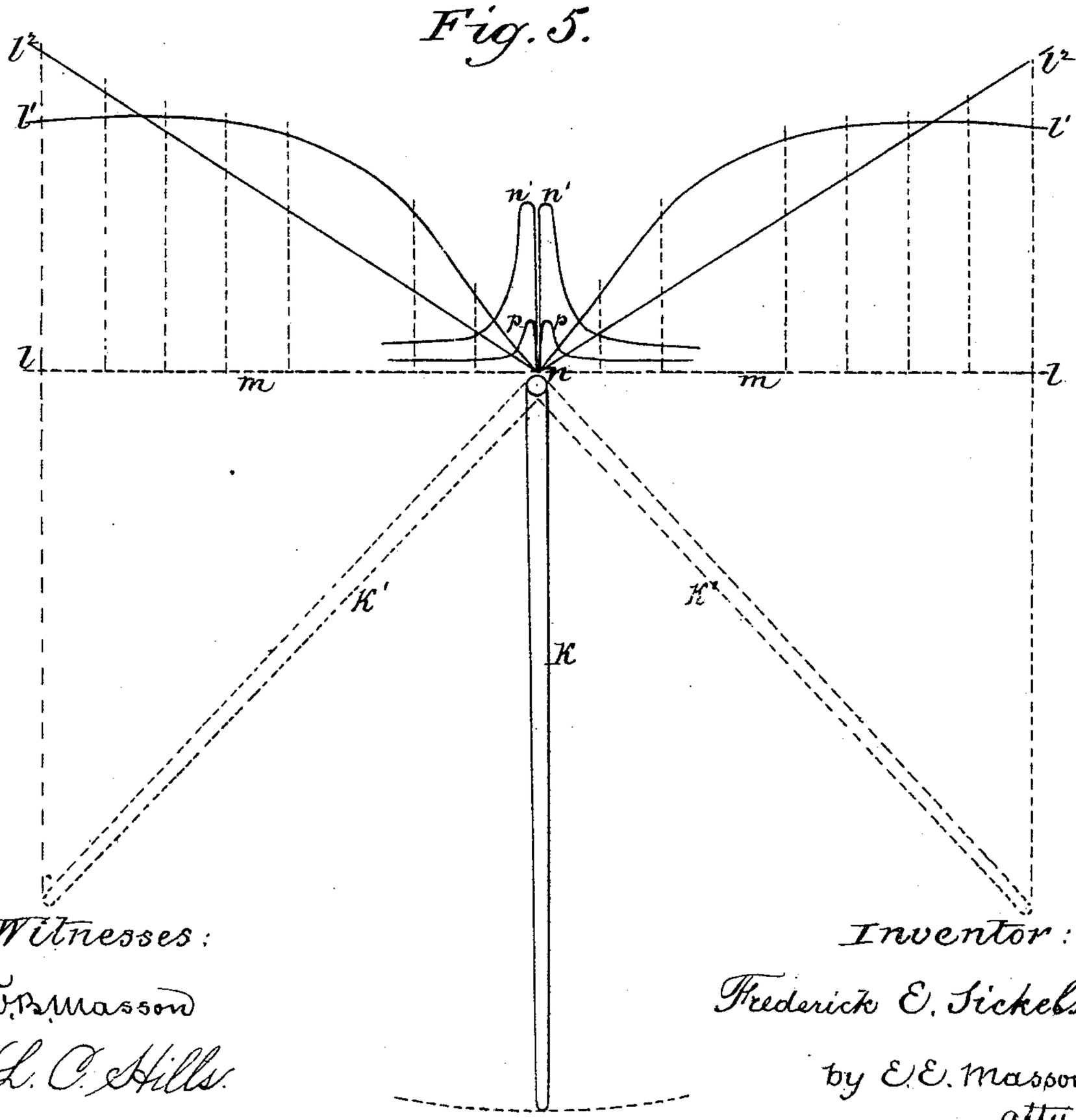

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Fig. 6.

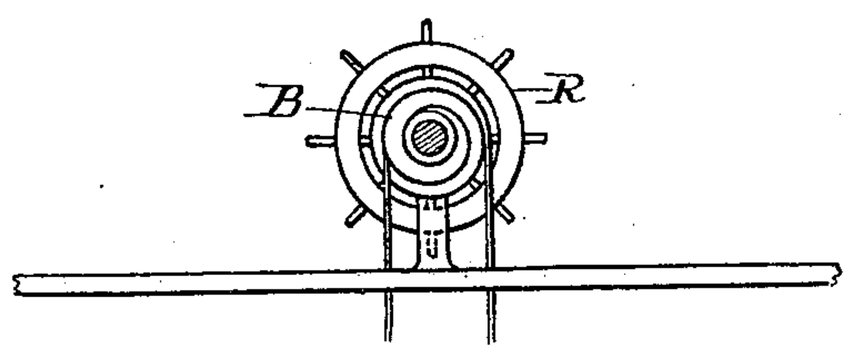
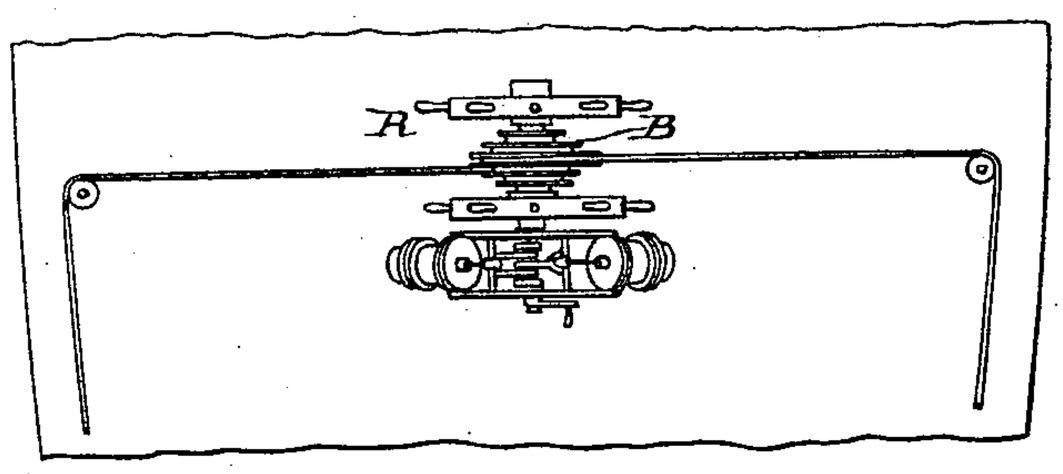
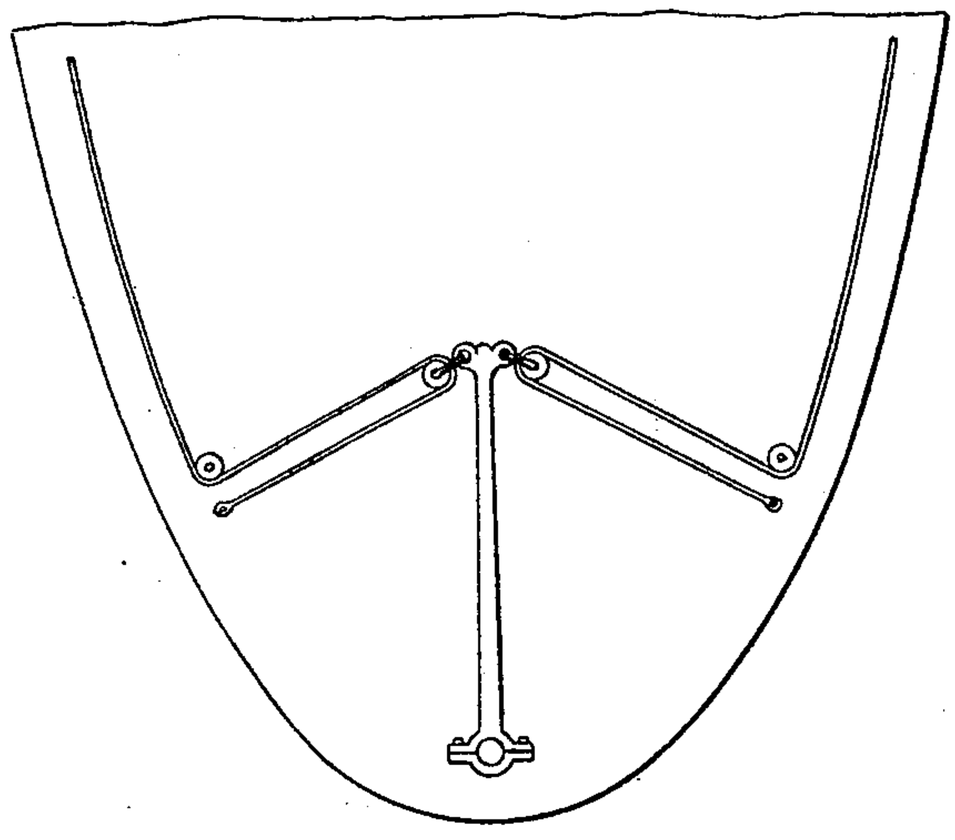


Fig. 7.





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UNITED STATES PATENT OFFICE.

FREDERICK E. SICKELS, OF NEW YORK, N. Y.

STEAM STEERING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 273,617, dated March 6, 1883.

Application filed September 27, 1882. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK E. SICKELS, a citizen of the United States, residing at New York city, in the county and State of New York, have invented certain new and useful Improvements in Steam Steering Apparatus, of which the following is a specification.

My invention relates to improvement in machines for steering vessels by steam; and the objects of my improvements are, first, to cause the steam-engine operating said machine to work with less of a jerking motion than heretofore while holding the vessel on her course; and, second, to give for this purpose a greater resistance to be overcome by said engine while the rudder is near the midship position, and at the same time increase the relative power of the steam-engine upon the rudder by making the central portion of the drum (corresponding with the midship position of the rudder) much larger than heretofore found in steam steering-machines, and causing the steering-ropes to pass over the spiral, rapidly diminishing in size toward both ends of the drum. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a top view or plan of a steam steering-machine provided with my improvement. Fig. 2 is a side view of the same. Fig. 3 is a side view of the lever and attachments used to control the valve-motion of the engine in one of the forms of what is termed the "sensitive" or "differential" motion. Fig. 4 is a vertical section of the same. Fig. 5 is a diagram showing lines made to represent the pressure upon the piston to overcome the resistance of the rudder, and also the inertia and friction to be overcome in using a spiral and plain drum. Fig. 6 is a transverse vertical section of my improvement upon the deck of a vessel with the steering-ropes leading vertically from the spiral drum. Fig. 7 is a top view of my improvement upon a vessel's deck, with the steering-ropes leading to the sides of the vessel and tiller.

Heretofore cylindrical drums have been used, in connection with steam steering-engines, to wind or unwind the steering ropes or chains of vessels. Spiral cones similar to mine have been used in connection with a hand steering-wheel; but the disadvantage of their application to the rudder in this case is that instead of diminishing the labor of the steersman in keeping the vessel upon her course it increases the said labor, as the blow of the sea-waves, acting upon the increased leverage of the spiral, is transmitted to the steersman when the rudder is near the midship position, and it is in that position most of the time when the vessel is running on her course. Therefore the application of the spiral and steering-wheel practically increases the fatigue of the steersman in holding the rudder; but when a steam-engine is applied to a spiral, and ropes arranged thereon as hereinafter stated, the engine receives the increased shock of the blow of the sea upon the rudder transmitted by the spiral; and, furthermore, the labor of the steersman is practically diminished, (as compared with a plain drum,) as it is not required to move the valve-motion of the engine so far as he would have to do with a plain drum. Steam steering-machines have also been proposed with drums having spiral grooves of such width as to allow the leading and paying-out steering-ropes to lie and pass beyond each other in the same groove, so that the point at which one portion of the rope enters the drum is the same at which another portion leaves the drum. By that construction the leading-rope is taken up exactly as fast as the other is paid out, as on a cylindrical drum, and a telescopic tiller or its equivalent, is required to avoid the large amount of slack rope thus obtained. By my arrangement the spiral grooves do not require to be wide enough for one part of the steering-ropes to pass the other, as said ropes leave the cone-drum at different points on its circumference, always leaving an uncovered portion thereon, and as the surface of the spiral drum in contact with the ropes is constantly changing it size while steering, the leading or steering end is taken up faster than the other pays out, (on either side of the midship position of the rudder.)

In the drawings, A represents the crank-shaft, upon which the spiral drum B is mounted. It is supported in bearings C, and this shaft is connected with the hub B′ of the spiral drum by means of a key D, the steering-wheel R being only for use in case of accident to the engine, in which case this key D is removed. The crank F is mounted loosely upon the crank-shaft to turn round in the same direction, and with the same number of revolutions, and is a well-known mode of working the valves in steam steering.

In Figs. 3 and 4 the crank-shaft A has an arm, A′, carrying a pin, *a′*, adjoining its extremity, and upon said pin *a′* is pivoted one of the operating-levers F′, in the form of a crank, having a pin, *f*, at or about the middle of its length, upon which is mounted one end of each connecting-rod G, operating the slide-valves of the engines, and thus producing one form of what has been termed a "sensitive" or "differential" valve-motion. Any other form of valve-motion can be used with my improvement, whether it is operated directly by a single handle and crank, as here shown, or by a more complicated arrangement in which an ordinary steering-wheel is used to operate the valve or valves; and, also, whether the valves thus operated are the main admission-valves to the engine or are supplementary valve or valves reversing the steam upon the main admission-valve, as there are various forms of valves or valve-gear used in connection with steam steering-engines.

I have shown the engine-shaft connected directly to the spiral drum without any intermediate connection; but the spiral drum may be put upon a separate shaft and operated through intermediate connections with the engine-shaft—such as a worm-wheel gearing or belting; and the connection between the spiral cone and the rudder may be made by means of the well-known devices used with tiller ropes or chains. The effect of the spiral drum, in combination with the steam steering-engine, will be to steady the action of this engine, notwithstanding the various forms of valve-gear and automatic connections that may be used. The mode of disconnecting the steam steering-engine from the steering apparatus is by means of the key D; but any other mode of disconnecting the parts—as a clutch, for example—may be used so that the steering-wheel can be worked by hand and the engine can remain stationary.

The diagram, Fig. 5, is made to graphically illustrate the difference of pressure in the steam-cylinder when using the spiral drum, with the tiller-ropes arranged as shown and described, as compared with the straight drum, and in connection with the rudder of the vessel, said rudder K being in full lines in the midship position and in dotted lines K′ when hard over to port and starboard. The base-line of the pressure-diagram is shown at *m*. The distance *l l′* will represent the pressure in the steam-cylinder when the rudder is hard over in using this spiral drum. The distance *l l²* will represent the pressure in the cylinder when the rudder is hard over in using the straight drum.

In keeping a vessel upon her course in ordinary weather the rudder is shifted from the midship position only a short distance, and the line *n n′* shows the pressure of the steam upon the cylinder to overcome the resistance due to inertia and the friction of the parts when using the spiral drum; and the line *n p* shows the pressure of steam upon the cylinder to overcome the resistance due to the inertia and the friction of the parts when using the plain drum. I have found in practice that the increased resistance due to the use of this spiral drum in keeping a vessel upon her course acts to steady the motion of the engine and avoid the objectionable jerking action produced in using a straight cylinder, and this is specially important when it is considered that during nearly the whole time that the steering-engines are in operation they are simply used to keep the vessel upon her course. The diagram-line *n l′* is obtained by multiplying the length of the sine of the angle made by the rudder with the fore-and-aft center-line by the distance from the center of the spiral drum to its acting periphery for each position of the rudder. The line *n l²* is obtained in the same manner; but the distance from the center of the plain drum to its periphery remaining the same for each position of the rudder, the line *n l²* may be represented by a substantially straight line. The lines *n n* and *n p* show that the resistance, due to the inertia and friction, to be overcome by the steam steering apparatus and spiral drum is about three times as much as it is in using a plain drum, and hence the jerking of the engine is greatly reduced.

By my arrangement of the ropes upon a drum provided with narrow spiral grooves the length and weight of said drum is greatly reduced, (when compared with a cone-drum having grooves to receive two ropes together,) as well as the abrasion of said ropes against each other in entering and leaving the grooves at the same point, while by my construction the leading-rope enters the grooves at one point and the paying-out rope leaves it at another point. Chafing of the ropes is entirely avoided, as well as the liability of the engine to cause jerks on account of slack rope.

Having now fully described my invention and its operation, I claim—

1. The combination of one or more steam cylinders and pistons with a crank-shaft connected therewith, and one or more spiral drums having grooves constructed to receive a single tiller-rope therein, whereby the engine receives the shocks from the rudder and returns said rudder to its normal position, substantially as and for the purpose described.

2. The combination of a drum having spiral grooves constructed to receive a single tiller-rope therein with a steam-cylinder, its piston, and connecting mechanism, substantially as described, whereby the said spirally-grooved drum shall receive one portion of the tiller-rope within one of its grooves and pay off from another portion of the groove, and thereby alter the relative taking up and paying off of the two tiller-ropes leading to the rudder, substantially as and for the purpose described.

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