

No. 622,600.

Patented Apr. 4, 1899.

A. B. BROWN.  
STEERING MACHINERY.

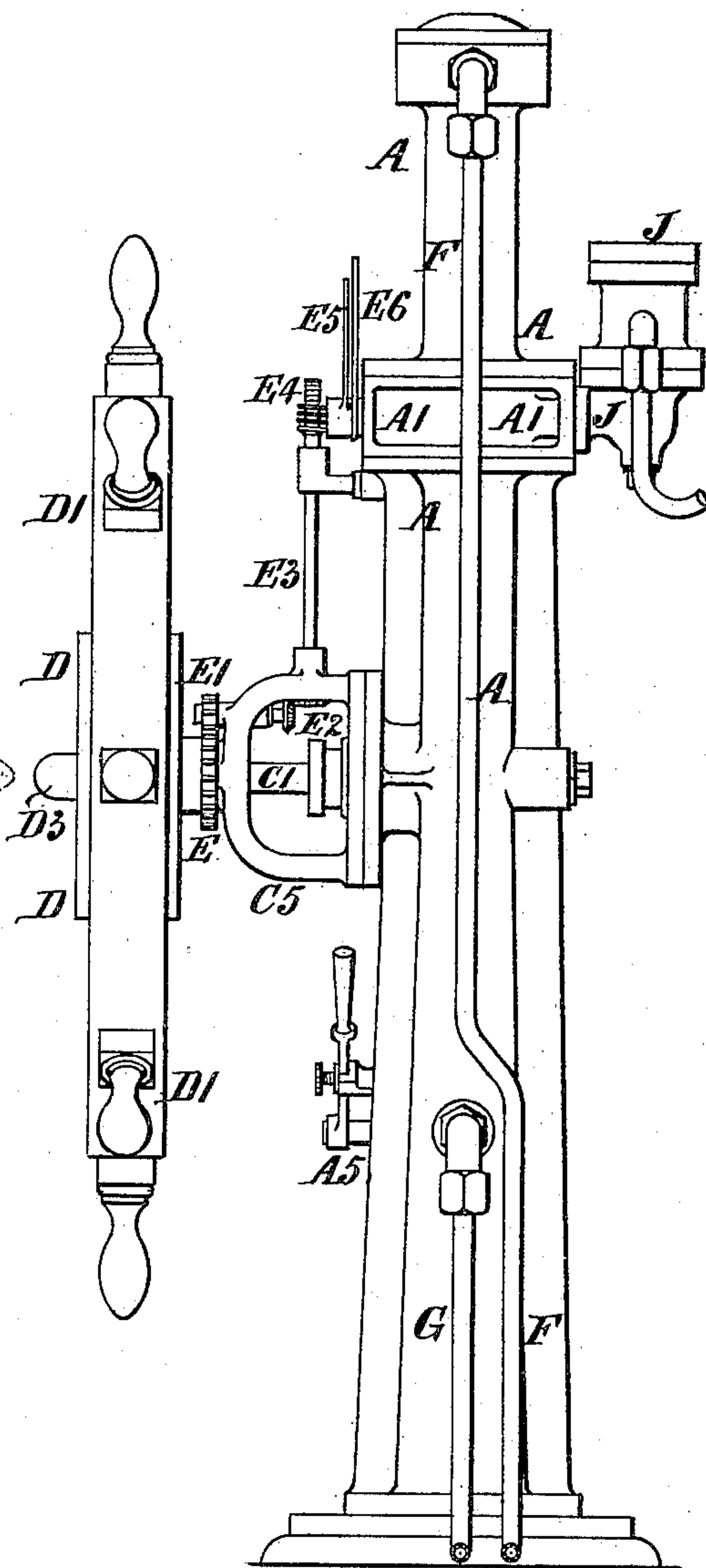
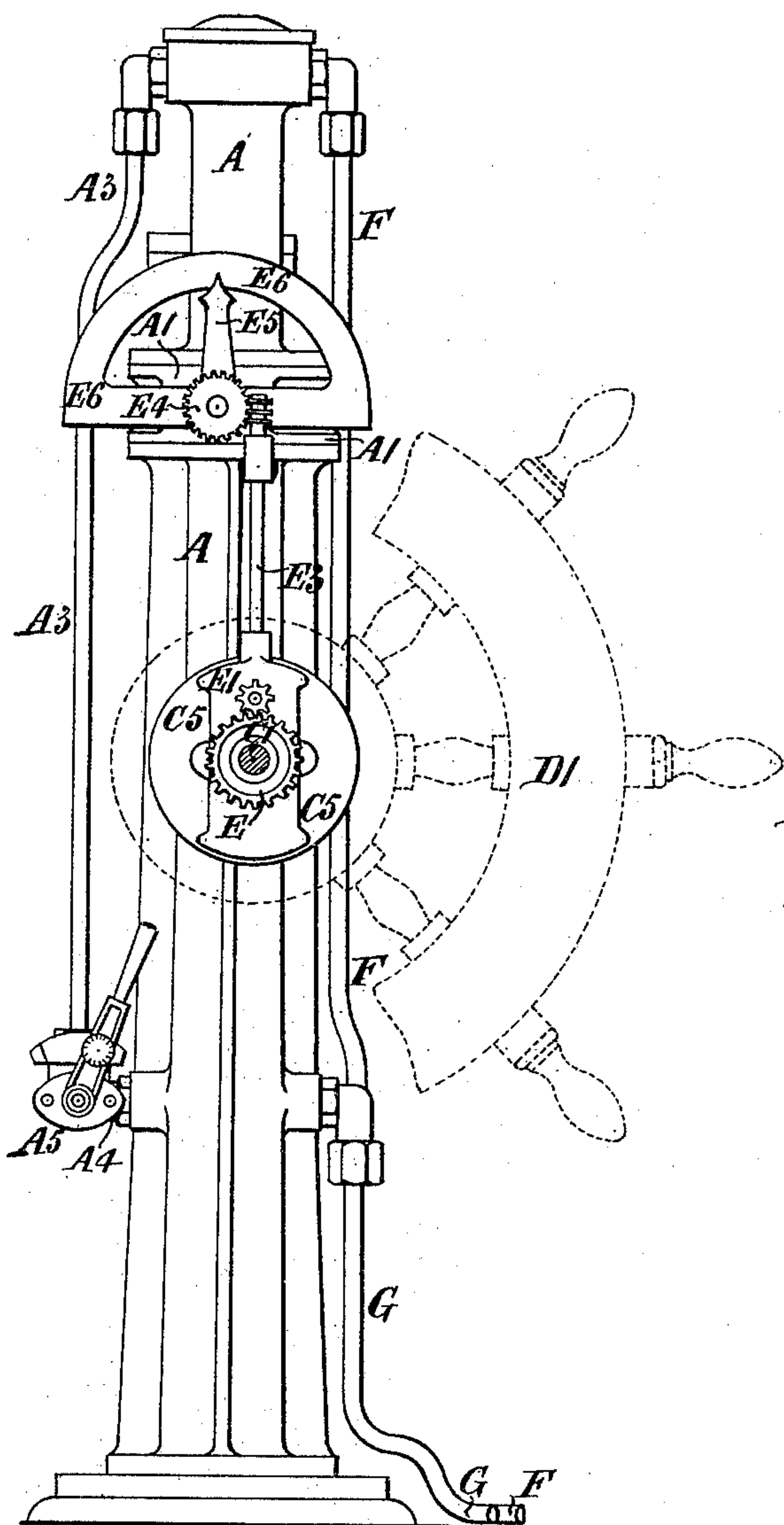
(Application filed Dec. 18, 1898.)

(No Model.)

3 Sheets—Sheet 1.

FIG. 1.

FIG. 2.



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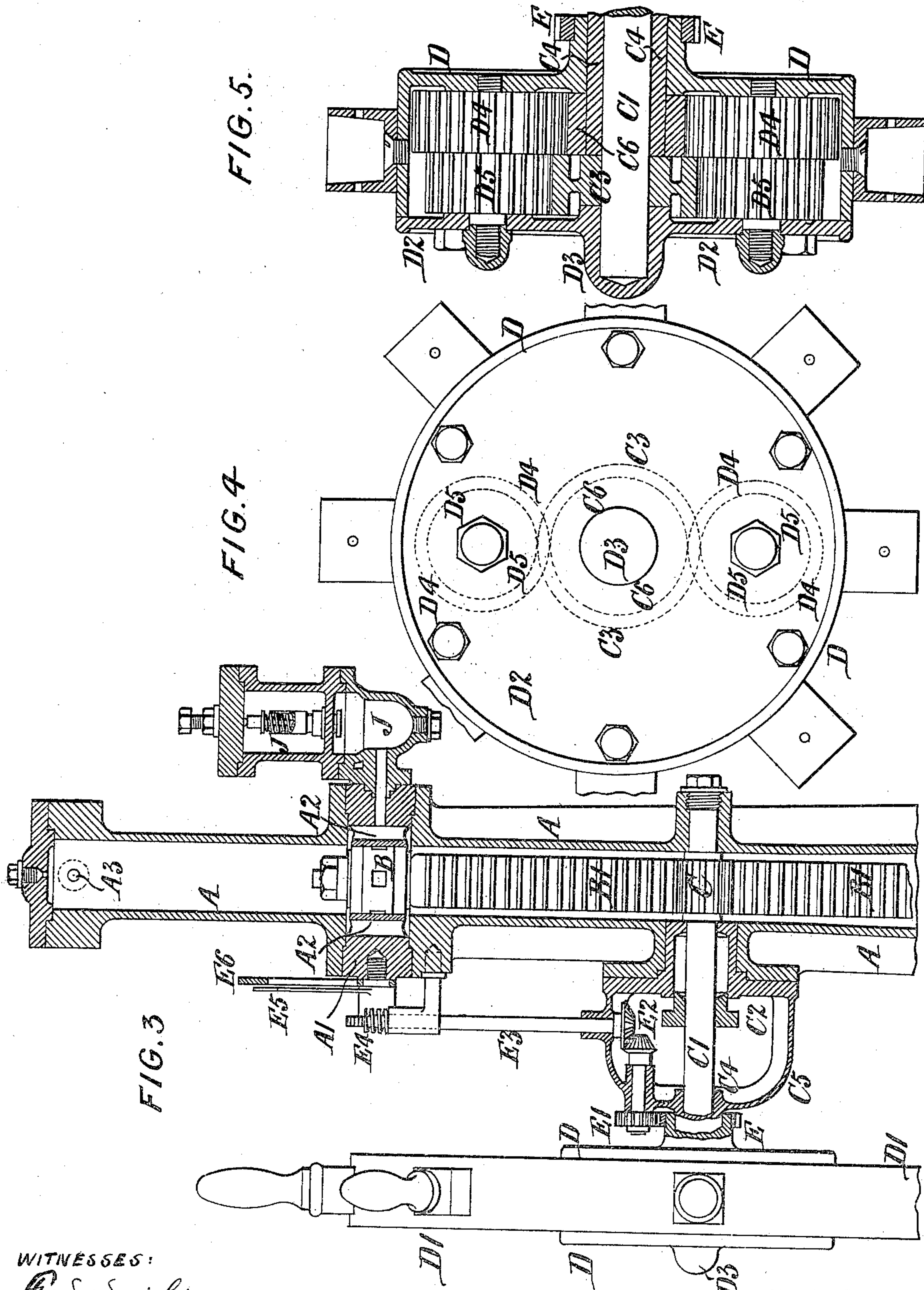
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(No Model.)

3 Sheets—Sheet 2.



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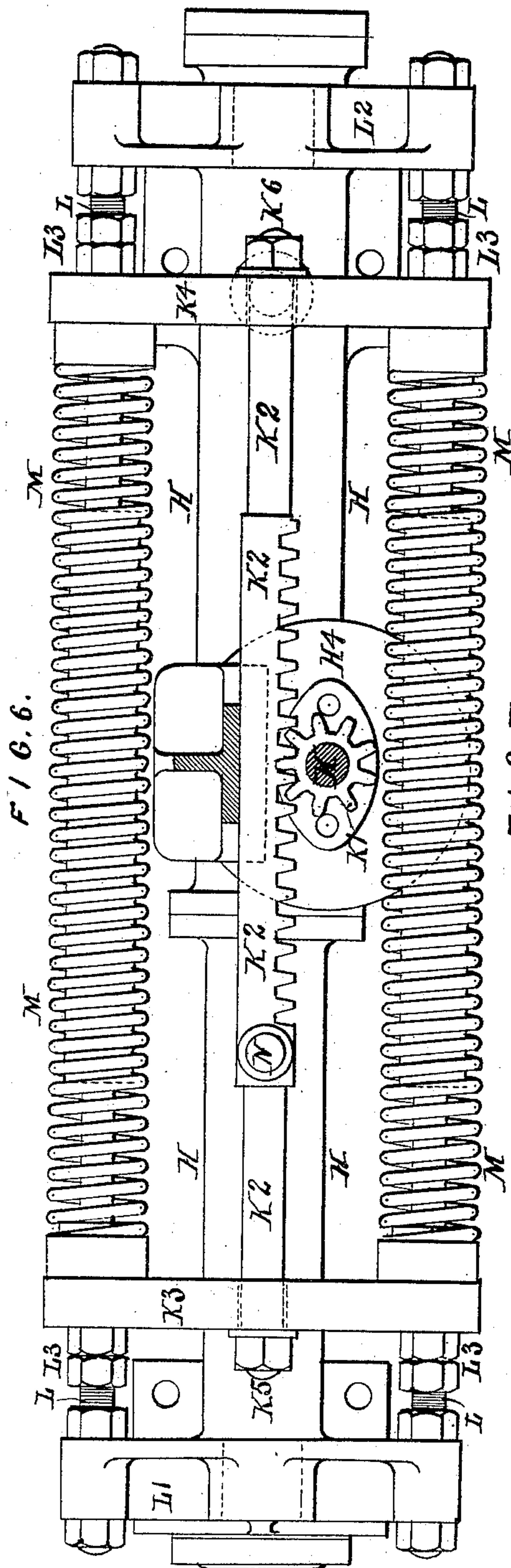
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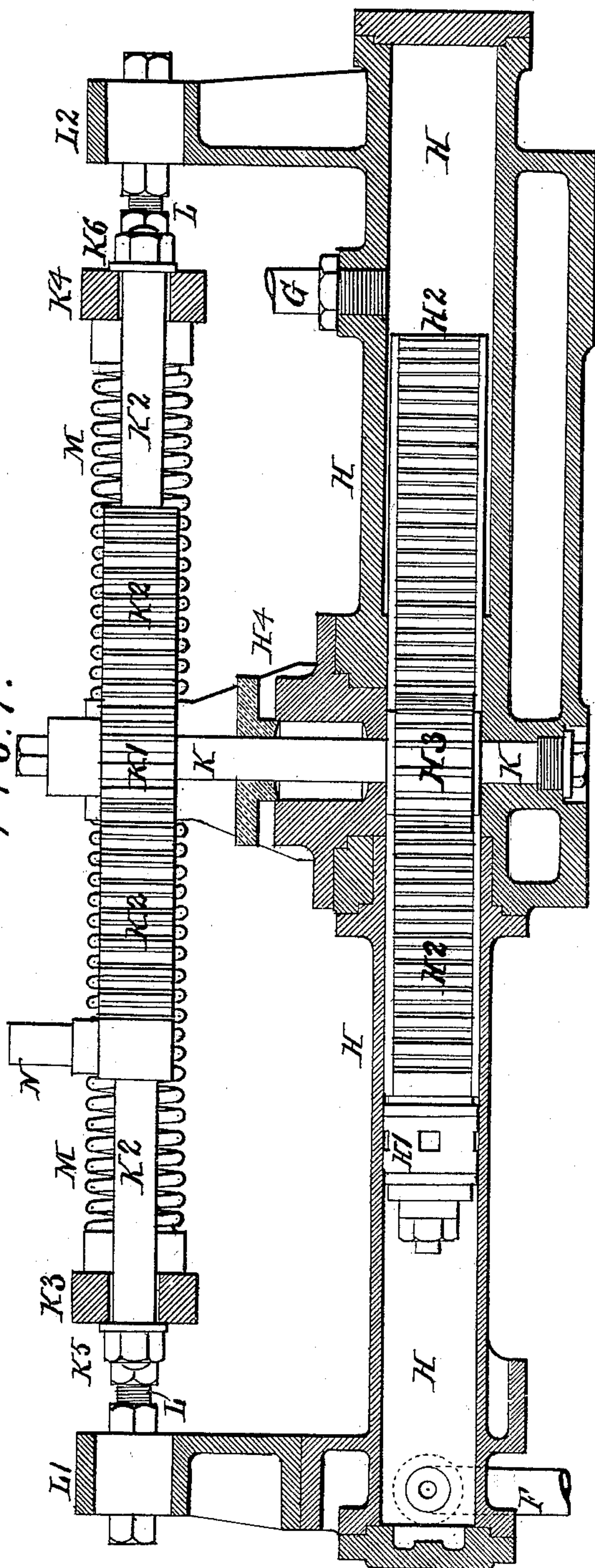
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(No Model.)

3 Sheets—Sheet 3.



F/G.6.



F/G.7.

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# UNITED STATES PATENT OFFICE.

ANDREW BETTS BROWN, OF EDINBURGH, SCOTLAND.

## STEERING MACHINERY.

SPECIFICATION forming part of Letters Patent No. 622,600, dated April 4, 1899.

Application filed December 19, 1898. Serial No. 699,744. (No model.)

*To all whom it may concern:*

Be it known that I, ANDREW BETTS BROWN, a subject of the Queen of Great Britain and Ireland, and a resident of Edinburgh, in the county of Mid-Lothian, Scotland, have invented certain Improvements in Telemotor Apparatus for Steering Machinery, (for which I have applied for British Patent No. 12,232, dated May 31, 1898,) of which the following is a specification.

My present invention comprises improvements in the construction of parts of telemotor apparatus for steering machinery and of the kind described in the specifications of my United States Patents Nos. 568,736 and 568,737, dated October 6, 1896, such apparatus having a transmitting-cylinder, which is at the bridge or steering-station and is connected by pipes to a receiving or motor cylinder arranged to act on the steering machinery.

My improvements are shown on three accompanying sheets of explanatory drawings.

Figures 1 and 2 are front and side elevations of the transmitting apparatus. Fig. 3 is an enlarged section showing part of the transmitting-cylinder. Fig. 4 is an elevation, and Fig. 5 a section, showing differential gearing through which the motion given to his hand-wheel by the steersman is communicated to the other parts. Figs. 6 and 7 are a sectional elevation and a vertical section of the receiving or motor cylinder.

In the drawings the same reference-letters are used to mark the same or like parts wherever they are repeated.

The transmitting part of my improved apparatus comprises a long double-acting hydraulic cylinder A, having working in it a piston B, to one end of which is fixed a toothed rack or bar B'. In Fig. 3 the piston B is shown at the middle of its stroke, and at that part the cylinder A is divided and a distance-piece A' is inserted between the two cylinder parts, which are flanged for being bolted to the distance-piece A'. The lower part of the cylinder A is made longer than the upper part sufficiently to contain a length of rack-bar B' at least equal to the full stroke of the piston B. The distance-piece A' is formed with spaces or passages A<sup>2</sup>, which when the piston B is in its middle position form a com-

munication between the upper and lower parts of the cylinder A, so as to then equalize the pressures of the liquid in the two parts.

In gear with the rack-bar B' there is a pinion C, fast on a shaft C', which extends out from the cylinder A through a stuffing-box C<sup>2</sup> and has fast on it, near its outer end, a pinion C<sup>3</sup>. The shaft C' passes through a tubular bearing C<sup>4</sup>, which is in the same piece with a bracket or small frame C<sup>5</sup>, fixed to the side of the cylinder A. On the tubular part C<sup>4</sup> there is fitted to rotate a cylindrical box D, which forms the central part of the steering hand-wheel D', a cover D<sup>2</sup>, fixed to the outer side of the box, having a central bearing D<sup>3</sup> for the end of the shaft C'. The fixed tubular part C<sup>4</sup> has fixed on it a pinion C<sup>6</sup>, which has gearing with it two diametrically opposite planet-pinions D<sup>4</sup>, rotating on studs fixed across the box D, and each pinion D<sup>4</sup> is in the same piece with a pinion D<sup>5</sup>, which gears with the pinion C<sup>3</sup>, fast on the shaft C'. When the hand-wheel D' and with it the box D are turned, the pinions D<sup>4</sup> D<sup>5</sup> are carried around and the pinions D<sup>4</sup> are turned by their action on the stationary pinion C<sup>6</sup>, their companion pinions D<sup>5</sup> acting on the pinion C<sup>3</sup> on the shaft C' and imparting to that shaft a rotatory motion having a ratio to the motion of the handle-wheel D' depending on the relative proportions of the toothed gearing which has been described. With the proportions shown in the drawings the hand-wheel D' makes about four turns for each turn of the shaft C'.

On the neck of the box D, where it bears on the fixed tubular part C<sup>4</sup>, there is fixed a pinion E, which gears with a pinion E' on a short spindle carried by the bracket C<sup>5</sup>, and this spindle, by bevel-wheels E<sup>2</sup>, drives a vertical spindle E<sup>3</sup>, which, by a worm and worm-wheel E<sup>4</sup>, moves a pointer E<sup>5</sup>, working over a scale E<sup>6</sup> to show the position corresponding to the extent of the movement imparted to the hand-wheel D'.

The opposite ends of the transmitting-cylinder A are connected by pipes F G to the opposite ends of the receiving or motor cylinder H, Figs. 6 and 7. There are also connecting-pipes A<sup>3</sup> A<sup>4</sup> to a by-pass valve A<sup>5</sup>, which can be used for equalizing the pressures in opposite ends of the cylinder by



hand at any time. There is also, as in my original apparatus, provision for compensating differences caused by changes of temperature in the volume of the liquid in the pipes and cylinders, the distance-piece A' between the two parts of the cylinder A being formed with a passage communicating with a valve-box J, connected to a cistern. (Not shown.)

In the receiving apparatus, Figs. 6 and 7, the cylinder H is (like the transmitting-cylinder A) constructed to have a double-acting piston H' working toward one end of it, the other end being extended to inclose a rack-bar H<sup>2</sup>, fixed to one side of the piston. This rack-bar H<sup>2</sup> gears with a pinion H<sup>3</sup>, which is fast on a shaft K, extending out through a stuffing-box H<sup>4</sup>. The shaft K has on it a pinion K', which gears with a rack-bar K<sup>2</sup>, having round end parts passing loosely through central holes in cross-heads K<sup>3</sup> K<sup>4</sup> and having washers and screw-nuts K<sup>5</sup> K<sup>6</sup> on their extreme ends. The cross-heads K<sup>3</sup> K<sup>4</sup> are guided on rods L, fixed to the frame-pieces L' L<sup>2</sup>, and helical springs M are placed on the rods L between the cross-heads K<sup>3</sup> K<sup>4</sup>. The springs M are for the purpose of giving the moving parts a tendency to return to the middle position in whichever direction they may have been moved from it. Thus if the rack-bar K<sup>2</sup> is moved to the right hand the washer and nut K<sup>5</sup> at its left-hand end moves the cross-head K<sup>3</sup>, the other end of the bar K<sup>2</sup> moving through the other cross-head K<sup>4</sup>. This action compresses the springs M between the cross-heads, the outward movements of the cross-heads being limited by adjustable screw-nuts L<sup>3</sup> on the guide-rods L.

The rack-bar K<sup>2</sup> has fixed to it a pin N, on which may be jointed a rod for communicating the movement to the controlling-valve or other part of the steering-engines.

What I claim as my invention is—

1. In telemotor steering apparatus having a transmitting-cylinder connected by pipes to a receiving or motor cylinder, a transmitting-cylinder in one part of which works a double-acting piston, the other part being elongated to inclose a rack-bar fixed to one end of the piston, a pinion gearing with the rack-bar and fast on a shaft extending out through a stuffing-box, and means to turn the shaft by a hand steering-wheel, substantially as herein set forth.

2. In telemotor steering apparatus having a transmitting-cylinder and receiving-cylinder and connecting-pipes, the combination of the transmitting-cylinder and piston and rack-bar therein, with a shaft having a pinion gearing into said rack-bar, a hand steering-wheel and intermediate differential planetary gearing between said wheel and shaft, substantially as and for the purpose described.

3. In telemotor steering apparatus, a receiving or motor cylinder, a piston and rack therein, and a shaft having a pinion gearing with said rack and an external pinion in combination with an external rack-bar gearing with said external pinion, two cross-heads through which the ends of the rack-bar turn freely, nuts on the end of the rack-bar, fixed guide-bars for the cross-heads, means for limiting the outward movement of the latter, and springs between the cross-heads, as and for the purpose described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ANDREW BETTS BROWN.

Witnesses:

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J. D. MCCULLOCH.