No. 619,074. Patented Feb. 7, 1899.

M. L. DEERING.

TOWING MACHINE.

(Application filed Jan. 11, 1896. Renewed Nov. 30, 1898.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

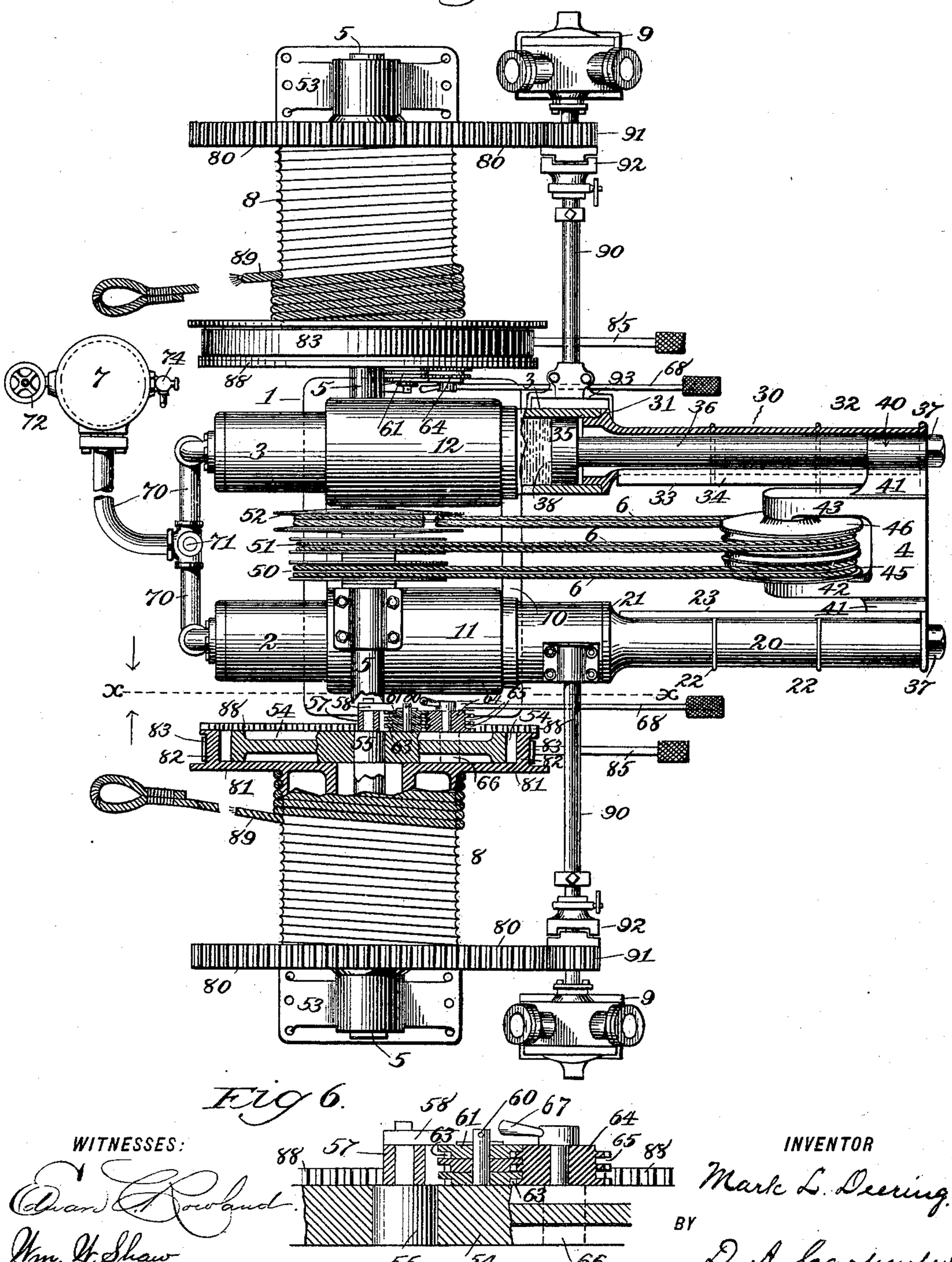

Fig 6.

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(No Model.) 2 Sheets—Sheet 2.

Fig. 2.

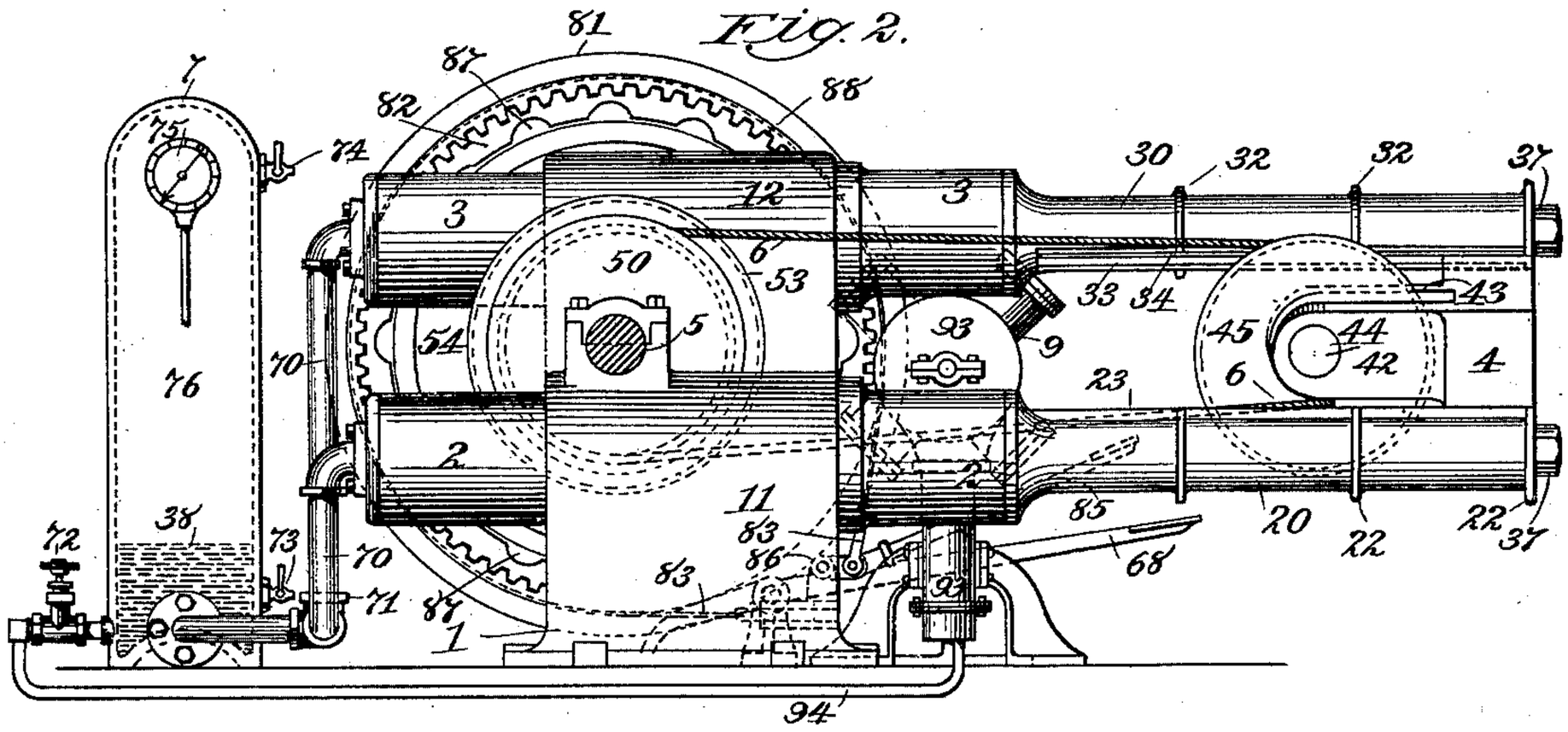


Fig 3.

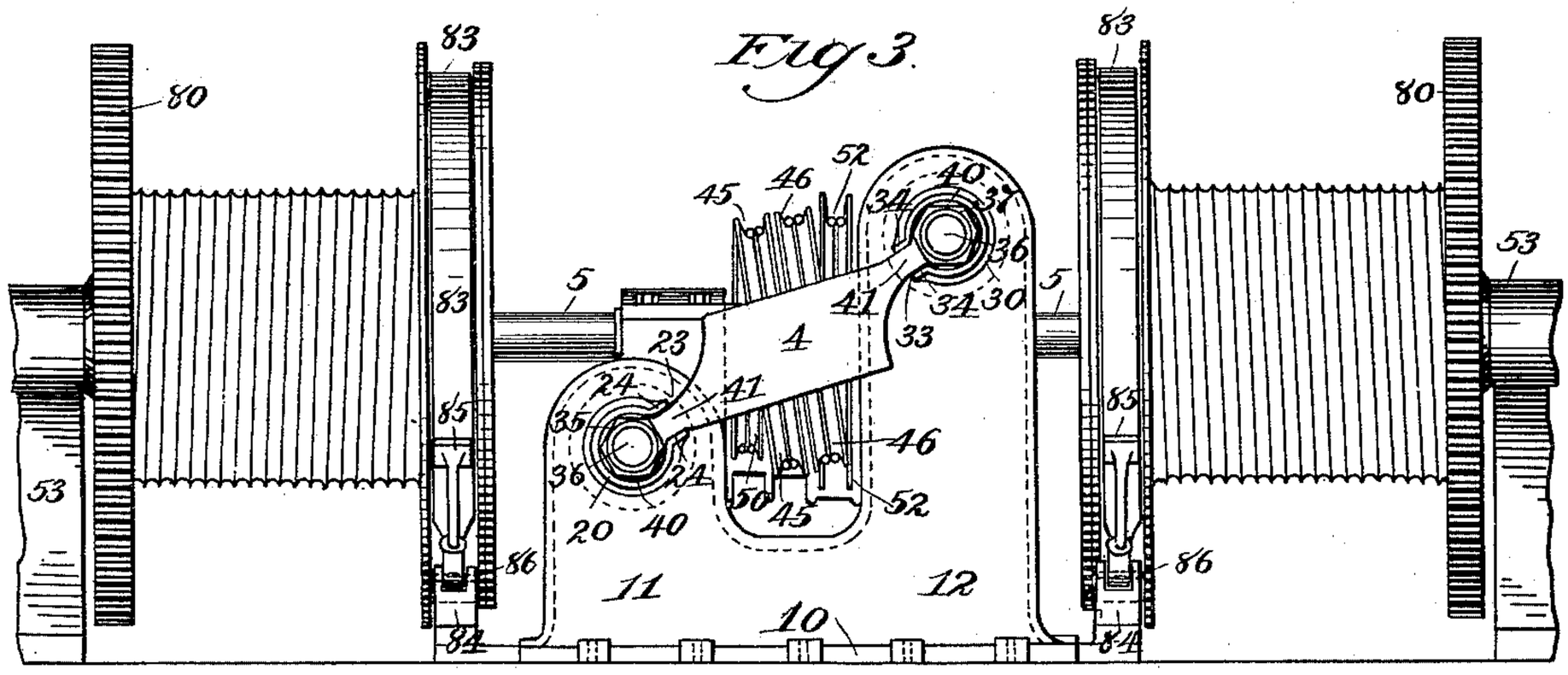
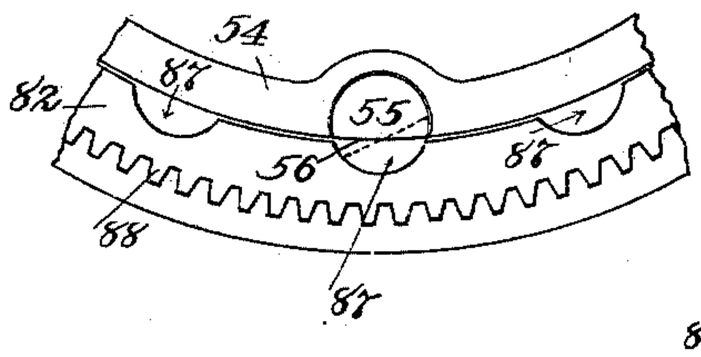
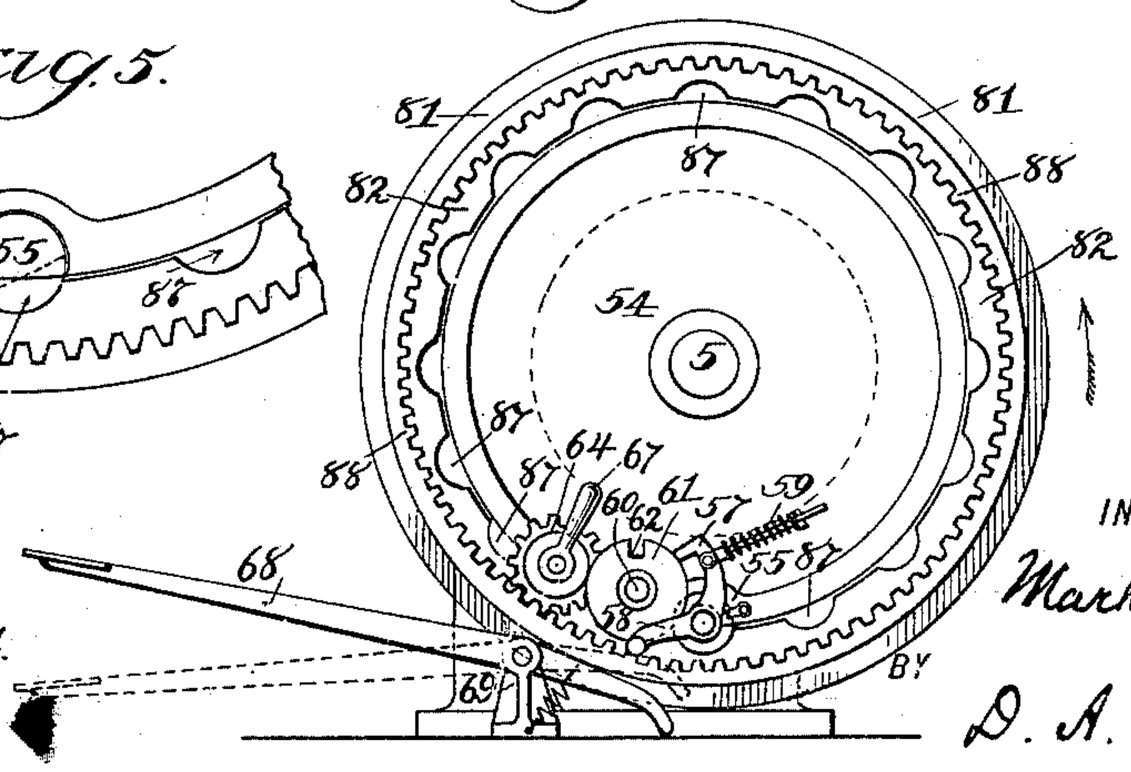


Fig 4.

Fig 5.





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UNITED STATES PATENT OFFICE.

MARK L. DEERING, OF NEW YORK, N. Y., ASSIGNOR TO FRANCIS H. STILLMAN, OF SAME PLACE.

TOWING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 619,074, dated February 7, 1899.

Application filed January 11, 1896. Renewed November 30, 1898. Serial No. 697,850. (No model.)

To all whom it may concern:

Be it known that I, MARK L. DEERING, of New York, (Brooklyn,) in the county of Kings and State of New York, have invented a certain new and useful Improvement in Towing-Machines, of which the following is a full, clear, and exact description, reference being made to the accompanying drawings, forming part of this specification.

This invention relates to improvements in machines which are employed in towing vessels and which automatically regulate the action of the towing hawser or hawsers by offering thereto a yielding resistance which is at times greater and at other times less than the force exerted by the hawser or hawsers; and the invention consists of a machine comprising one or more of the several combinations of parts herein specifically described and claimed.

On the accompanying sheets of drawings, Figure 1 is a plan of the machine; Fig. 2, a side elevation of the part shown in Fig. 1 above the line $x\,x$, the view being in the direction indicated by the arrow below that line; Fig. 3, a rear elevation; Fig. 4, an elevation of the part below the line $x\,x$ in Fig. 1, viewed in the direction indicated by the arrow above that line; and Figs. 5 and 6 are detail views, each on a larger scale than that of the other figures.

Similar reference-numerals designate like parts in the different views.

The general object of this invention is to prevent a towing-hawser from breaking when it is subjected to an excessive strain by the plunging either of the towing-steamer or of the vessel or vessels being towed or by a sudden change of direction by the leading vessel and to effect this result not only when the towing is done with a single hawser, but also when it is done with two hawsers. In the latter case or when, for example, canal boats or barges are towed in a body, with two hawsers extending from the tug or towing-steamer to the outside vessels of the front row, the machine is stationed on the tug or towing-steamer; but in the other case it may be stationed on either of the vessels to which the hawser is secured.

This machine is an improvement especially on a certain other machine that is described in an application for a patent filed October 16, 1895, and bearing the Serial No. 568,881. It comprises a cylinder and piston or, preferably, a pair of cylinders and pistons, an air-reservoir in communication with the cylinder or cylinders, a system of sheaves with cables or else a single cable passing around the sheaves, drums on which the towing-hawsers are wound, and mechanism for actuating the drums and regulating the movement of each with respect to that of the other and to that of the piston or pistons. The improvements consist in constructing this machine with two cylinders and pistons as well as four, with a single standard instead of two standards supporting the main part of the machine, with hollow guides for the cross-head of the system of sheaves secured to and forming prolongations of the cylinders, with the shaft on which the rear sheaves are mounted inclined at a small angle to the horizontal plane that contains the axis of the main shaft, with two cables of medium size rather than one large cable passing around the system of sheaves and sheaves of proper size to carry the smaller cables, with two drums as well as with a single drum, and with the mechanism above mentioned for actuating and regulating the movement of each drum. By these improvements the main part of the new machine or that between the drums is made smaller, lighter, and cheaper than the corresponding part of the other, and this machine, including the drums, is adapted to perform work that was not within the capacity of the prior machine.

The drawings represent the machine in about one-sixteenth of its natural size.

The standard is a steel casting 1, composed of the base 10 and the uprights 11 and 12. In these uprights are fixed the cylinders 2 and 3, which project in front of and behind the standard and whose axes are parallel to each other. It will be observed that the cylinder 3 is above, but not directly over, the other cylinder 2. To the rear ends of the cylinders are fastened hollow guides 20 and 30, whose axes coincide with the prolonged axes of the cylinders. These guides are pressed into the

cylinders, as indicated at 21 and especially at 31, Fig. 1, and they are provided with strengthening-ribs 22 and 32. They are slotted where the plane of their axes cuts their sides between their axes, the slots 23 and 33 extending from the rear ends of the guides almost to the cylinders, and along the edges of the slots are broad bearing-surfaces 24 and 34. The cross-head 4 is fitted in these guides and adapted to slide freely therein. It extends from one guide to the other through the slots 23 and 33 and bears on the inner surfaces of the guides and on the bearing-surfaces 24 and 34. It has heads 40 conforming to the interior of the guides and the thin portions or necks 41 extending through the slots 23 and 33 and making contact with the bearing-surfaces 24 and 34. There are pistons in the cylinders, and the piston-rods extend into the guides 20 and 30, and the cross-head 4 is fastened on the rear ends of the piston-rods. Fig. 1 illustrates this part of the construction, the rear end of the cylinder 3 and the guide being there shown in section, with the piston 35 in the cylinder and the piston-rod 36 extending inside of the guide 30 to and through the head 40 of the cross-head, which is fastened on the piston-rod by the nut 37. The cross-head is fastened in like manner by a nut 37 on the other piston-rod 36 in the guide 20. The cross-head is provided with lugs 42 and 43, which project in front of the main part of the cross-head between the guides 20 and 30, and in these lugs is fixed a shaft 44. The end of this shaft that is in the lug 43 is higher than its other end, the axis of the shaft being inclined at a small angle to and being intersected in the middle by a horizontal plane that is equally distant from the axes of the guides. Two loose sheaves 45 and 46 are mounted on this shaft.

In the front part of the upright 12 and below the cylinder 3 and on the upright 11 and above the cylinder 2 are bearings in which is journaled the main shaft 5, the axis of this shaft being at right angles to vertical planes containing the axes of the cylinders and midway between horizontal planes containing those axes. On this shaft are mounted the loose sheaves 50 and 51 and a sheave 52, that is tightly fixed on the shaft. The groove in the sheave 52 is deeper than that in either of the loose sheaves. The angle of inclination of the shaft 44 to the horizontal plane containing the axis of the shaft 5 is such that the top of the sheave 45 and the top of the sheave 46 are directly behind the sheaves 50 and 51, respectively, while the bottom of the sheave 45 is directly behind the sheave 51 and the bottom of the sheave 46 is directly behind the sheave 52.

Two wire cables 6 of medium size are attached by their ends to the lug 42 of the cross-head and extend thence around the sheave 50, thence around the sheave 45, thence around the sheave 51, and thence around the sheave 46, passing first under and then over the shaft 5 around the sheaves 50 and 51, and first over and then under the shaft 44 around the sheaves 45 and 46, and from the sheave 46 they extend to the sheave 52 and around or partly around it from the under side, and they are fastened at their ends to that sheave.

For these two cables and these sheaves a single large cable and sheaves of the proper size to carry it might be substituted; but then either it would be necessary to make the machine larger than the particular machine herein described or else its action would be so restricted as to render it inferior to this particular machine, because the movement of the rear sheaves, and consequently that of the pistons, would be less in the one case than in the other by the difference between the diameter of the large sheaves and that of the small sheaves. Now as all parts of the cables 6 between the front sheaves and rear sheaves are parallel to each other each cable acts on both the front and rear sheaves in planes at right angles to their axes, so that there is no injurious lateral strain on any of the sheaves.

The air-reservoir 7, which is adapted to contain air or other gas under pressure, may be located in any convenient place near the rest of the machine—as, for example, where it is shown—and with this reservoir the cylinders 2 and 3 are connected by pipes 70. In the passage formed by these pipes is a valve 71, whereby the passage is contracted when water or other liquid is forced through it toward the cylinders. Near the bottom of the reservoir are a gate 72 and a cock 73 and near the top are a cock 74 and a pressure-gage 75.

The main shaft 5 extends on opposite sides of the standard 1, passing through the upright 12 to pillow-blocks 53, in which it is journaled. The drums 8 are mounted on this shaft between the pillow-blocks and standard, being adapted to turn on the shaft. On the outer flange of each drum is a gear 80. The inner flange of each drum, as will be seen in Figs. 1 and 4, consists of a plate 81 with an annular projection or ring 82 on the face that is next to the cylinders, and on this ring is a brake composed of a steel band 83, attached at one end to a bracket 84 on the standard 1 and at the other to a lever 85, having its fulcrum at 86 in the bracket. Within the ring 82 is a round block 54, which is fastened tightly on the shaft 5 and loosely surrounded by the ring. In the inner part of the ring are recesses 87, conforming to a section of a cylinder that is less than one-half of the cylinder, and on the side of the ring is an internal gear 88. A pin 55 is inserted in the block 54 near its edge, being adapted to turn therein. This pin is partly cylindrical; but on one side its surface is either flat or has the same curvature as the rim of the block 54, as indicated at 56. The pin is so placed in the block that the part 56 of its surface is flush with the rim of the block when the pin is in one position and that the pin projects into and

fits in one of the recesses 87 in the ring 82 when it is in another position, and it moves from either of these positions to the other by turning on its axis. A latch 57 and an arm 58 are fastened to this pin, the latch projecting inward from the edge of the block and the arm outward therefrom, as shown in Fig. 4. A spring 59, secured to the face of the block 54 behind the latch, bears against the latch and tends to force it forward. On a pin 60, fixed in the block 54, are loosely mounted several disks 61 of equal size, either three, as shown, or a larger number, and in the edge of each of these disks is a notch 62, and on one face of each is a gear 63, tightly fastened thereto, the diameter of the gears being less than that of the disks. These gears all have the same diameter; but each has a different number of teeth from either of the others. For example, one may have twenty-nine, another thirty, and the other thirty-one teeth. When the notches 62 of the disks are even with each other and the line of notches is in the proper position with respect to the latch 57 and the pin 55 is in front of one of the recesses 87 in the ring 82, then the latch extends into the notches in the disks and the pin 55 into the recess 87, as indicated by the dotted line in Fig. 5. Thus the pin 55, which may be termed a "stop," prevents the drum from turning in the direction indicated by the arrow on the right of Fig. 4 unless the block 54 and the shaft 5 also turn with it, but does not prevent the drum from turning alone in the other direction. If the drum turns in the other direction around the block 54, the stop 55 is turned on its axis from the position indicated by the dotted line to that indicated by full lines in Fig. 5 by the action of the ring 82 upon the face 56 of the stop. A gear 64, having grooves 65 in its face, is mounted on a pin in an eccentric 66 in the block 54, the eccentric being provided with a handle 67, and this gear engages with each of the gears 63, the disks 61 extending into the grooves 65. This gear is also so arranged that it engages naturally with the internal gear 88 on the flange of the drum, but may be moved out of engagement therewith by turning the eccentric on which it is mounted. A foot-lever 68, having its fulcrum in a block 69, is adapted to make contact with the arm 58 and to turn the stop 55 out of engagement with the flange of the drum.

Two steam-engines 9 are stationed behind the pillow-blocks 53, and with each of these engines a shaft 90 is connected. On each shaft are a pinion 91 and a clutch 92, adapted to lock the pinion on the shaft. These pinions engage with the gears 80 on the drums 8. Under the rear end of the cylinder 3 is an air-pump 93, which is operated by the nearest engine, through the shaft connected therewith. A pipe 94 extends from the air-pump to the gate 72 of the reservoir 7.

The towing-hawsers 89 are wound on the drums, as represented in the drawings, each hawser leaving the drum on its under side.

The machine is made ready for use by pumping water and air or some other liquid or gas into the reservoir 7 and admitting steam into the engines 9. The quantity of water required is enough to fill the cylinders 2 and 3 and the pipes 70 and to stand in the reservoir above the gate 72. The air is pumped by the air-pump 93 to a pressure that is great enough to overbalance the normal towing strain of the hawser or hawsers. The air forces nearly all of the water out of the reservoir and itself occupies the space 76 in the reservoir, and the water 38 then extends from the body of compressed air to the pistons in the cylinders, filling the pipes 70 and all the space in each cylinder in front of the piston and holding the pistons in the rear ends of the cylinders, as indicated in Figs. 1 and 2. The pressure of the steam in the engines is such that if the towing strain on the hawsers is relaxed and the hawsers thus become slack then the engines will pull in the hawsers, but not otherwise. The hawsers are also paid out by these engines. When the hawsers have been paid out to the desired extent, the mechanism in the inner flange of each of the drums is adjusted, so that the stop 55 engages the ring 82 of the flange. That is done by holding the drum with the brake, turning the disks 61 with the hand, and arranging them to receive the latch 57 in the notches 62, the gear 64 being meanwhile out of engagement with the gear 88, then turning the drum by the engine or allowing it to be turned under the brake by the force exerted by the hawser until the stop 55 enters the first recess 87 in the ring 82, and finally engaging the gear 64 with the gear 88 by turning the eccentric 66.

If only a single hawser is ever to be used, a machine is constructed with but one drum, which may be either of those described; but a single hawser, as well as two, may be used if there are two drums, the hawser being on either drum and the other drum being loose on the shaft.

For convenience in explaining the operation of the machine it is now assumed that a machine is in use which comprises only the parts shown in Fig. 1 above the line *x x*. When the vessels move forward, the rear vessel being drawn by the hawser, the force exerted by the hawser is transmitted through the drum, stop 55, block 54, main shaft 5, sheaves, cables 6, cross-head, piston-rods, and pistons to the water in the cylinders and thence to the air in the reservoir, the air forming a cushion against which the force is finally directed. If the normal force is increased by a sudden excessive strain on the hawser, the hawser unwinds from the drum, the cables 6 are wound on the sheave 52, the cross-head and pistons are drawn forward, and the air in the reservoir is compressed. If the pistons should be forced forward to the front ends

of the cylinders, the rear sheaves being carried a distance of three feet, for example, then fifteen feet of the cables 6 would be wound on the sheave 52 and as many coils of the hawser would have been unwound from the drum as there were revolutions of the sheave 52 in winding up the fifteen feet of the cables 6; but as the air is compressed more and more by the forward movement of the pistons it offers to the action of the hawser a constantly-increasing resistance that soon becomes great enough to balance even the excessive force then exerted by the hawser, and as soon as the hawser is relieved of the extra strain upon it the air expands and drives the pistons back to the rear ends of the cylinders, while the drum is rotated and the hawser drawn in as far as it was drawn out when the strain upon it was suddenly increased beyond the normal strain. The valve 71 prevents the air from driving the pistons back rapidly enough to break the machine in case the hawser suddenly becomes slack just after it has pulled the pistons forward. If the headway of the leading vessel is quickly reduced and the hawser becomes slack when the pistons are at the rear ends of the cylinders, then the engine 9 automatically actuates the drum and draws in the slack hawser. As the drum rotates, the ring 82 revolving around the block 54 turns the stop 55 from the position indicated by the dotted line to that indicated by full lines in Fig. 5, and the latch 57 is thereby carried backward out of engagement with the notches 62 in the disks 61, and the disks are made to rotate by the action of the gear 88 upon the gear 64 and of the latter upon the gears 63. The notches 62 thereupon move out of line with each other, since the disks travel at different rates of speed, and the latch 57 is maintained by the edges of the disks in the position in which it is shown in Fig. 4 while the slack hawser is being wound on the drum. Then when the leading vessel afterward increases its headway it draws out the hawser again, the drum revolving around the block 54 and shaft 5, which remain at rest, the stop 55 being kept from engaging with the ring 82 of the drum by the disks 61 and the latch 57, and the hawser is thus drawn out until the drum has made the same number of turns as were made by it while the hawser was being drawn in by the engine. Then the disks 61, under the action of the gears, having returned to the positions in which they formerly rested and having restored the notches 62 to their former relations with the latch 57, the latch enters the notches and the stop 55 engages the ring 82, and thereafter the force exerted by the hawser is transmitted through the machine to the air in the reservoir. Thus whenever the slack of the hawser is taken up by the engine as much of the hawser as is drawn in is afterward paid out, so that a certain part of the hawser remains constantly between the vessels during the towing, the length of that part being regulated by the adjustment of the stop in the flange of the drum, as above described.

Now let it be supposed that a machine comprising two drums is in use and that it is located on a steamer having in tow a large body of canal-boats and that the hawsers are attached to the outside boats of the front row, and consequently diverge from each other as they extend away from the steamer. Then if the steamer advances in a straight course, with the mass of boats directly behind the steamer, the hawsers act equally on the machine, the force exerted by them being transmitted to the air in the reservoir, and the machine acts upon both hawsers as it does upon a single hawser; but should the steamer turn sharply to port or starboard, it being often forced to do that in following the course of a river or channel, so that in an instant one of the hawsers becomes slack, while the strain on the other is increased from one-half of the towing strain to the entire towing strain, then the machine counteracts in the regular way the force exerted by the taut hawser, and the engine geared to the drum of the slack hawser promptly draws in that hawser, thus preventing it from being broken or otherwise damaged by contact with the bottom, and as the body of boats is drawn around the bend and the relations that previously existed between it and the steamer are restored the hawser which was drawn in by the engine is paid out as far as it was drawn in and resumes its part of the joint action of the hawsers upon the towing-machine.

In order to change the length of the paid-out portions of a hawser, the headway of the steamer is diminished, and before the hawser becomes slack, so as to allow the drum to be rotated by the engine, the brake is applied to the drum and the drum is thus held still, while the gear 64 is disengaged from the gear 88 and while the stop 55 and latch 57 are forced out of engagement with the flange of the drum and the disks 61, respectively, by means of the foot-lever 68. Then the drum is released from the brake and the hawser is either paid out or drawn in to the extent desired, after which the regulating mechanism of the stop is adjusted and the stop made to engage with the flange of the drum, as previously described.

If two drums or reels, mounted on a fixed shaft and provided with the mechanism contained in the inner flanges of these drums and connected to engines 9, as shown and described, without any of the other parts of the machine except a standard, are stationed on the towing-steamer, it is plain that each of the hawsers will be drawn in when it becomes slack and paid out again, as explained above, yet in that case the force exerted by the hawsers in advancing the mass of boats is directed against rigid fastenings instead of an elastic resistance, such as the complete machine offers to it.

It may sometimes be desirable to use only

the main part of the machine without either of the drums. The sheave 52 is then not needed and the hawser is attached directly to the cables 6 in front of the sheave 46.

Should the weather be so cold that water would be apt to freeze in the machine, it is proposed to substitute for the water a liquid that would not freeze—for example, oil, alcohol, or glycerin and water mixed together.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination of two cylinders with their axes parallel to each other, hollow guides on the ends of the cylinders, pistons in the cylinders, the piston-rods projecting into the guides, a traveling cross-head extending into the guides and fastened on the piston-rods, means for maintaining pressure on the pistons, a system of sheaves, and a cable passing around the sheaves, substantially as described.

2. The combination of two cylinders with their axes parallel to each other, hollow guides on the ends of the cylinders, pistons in the cylinders, the piston-rods projecting into the guides, a traveling cross-head extending into the guides and fastened on the piston-rods and having heads 40 conforming to the interior of the guides, means for maintaining pressure on the pistons, a system of sheaves, and a cable passing around the sheaves, substantially as described.

3. The combination of cylinders 2 and 3, guides 20 and 30 having slots 23 and 33 and bearing-surfaces 24 and 34, pistons in the cylinders having the piston-rods 36 within the guides, a cross-head fastened on the piston-rods and having the heads 40 and portions 41 extending through the slots in the guides and making contact with the bearing-surfaces 24 and 34, means for maintaining pressure on the pistons, a system of sheaves, and a cable passing around the sheaves, substantially as described.

4. The combination with mechanism comprising a cylinder and piston and means for maintaining pressure on the piston, of parallel guides, a cross-head or block fastened on the piston-rod and adapted to travel in the guides, a shaft 5 in a stationary support and with its axis transverse to the length of the guides, a shaft 44 in the traveling block, sheaves on the shafts, and a cable passing around the sheaves, the axis of one shaft being inclined to the plane that is parallel to the length of the guides and contains the axis of the other shaft, substantially as described.

5. The combination of parallel guides, a cross-head or block adapted to travel thereon, sheaves mounted in a fixed support and in a traveling block, and a cable or cables passing around the sheaves, the axis of the sheaves in the block being inclined to the plane that is parallel to the length of the guides and contains the axis of the other sheaves, substantially as described.

6. The combination of two cylinders with their axes parallel to each other, a shaft 5 between the cylinders with its axis transverse to their axes, pistons in the cylinders, means for maintaining pressure on the pistons, a cross-head fastened on the piston-rods, guides on which the cross-head travels, a shaft 44 fixed in the cross-head between the prolonged axes of the cylinders and having its axis inclined to the plane that contains the axis of the shaft 5 and cuts the shaft 44 midway between the prolonged axes of the cylinders, sheaves on these shafts, and a cable passing around the sheaves, substantially as described.

7. The combination of the cylinders 2 and 3 fixed in the uprights 11 and 12 of the standard 1, the horizontal shaft 5, the guides 20 and 30 on the cylinders, the pistons, means for maintaining pressure on the pistons, the piston-rods within the guides, the cross-head 4 with the shaft 44 fixed therein, its axis being inclined to the horizontal plane containing the axis of the shaft 5, sheaves on the shafts, and a cable passing around the sheaves, substantially as described.

8. Towing machinery comprising the combination with a drum or reel, of an engine adapted to turn the same in one direction, an adjustable stop adapted to transmit strain from the drum when it tends to turn in the other direction, and regulating mechanism whereby said stop is held out of engagement with its counterpart, after a movement of the drum by the engine, during the return movement of the drum, substantially as described.

9. Towing machinery comprising the combination of a drum or reel, an engine adapted to turn it in one direction, an adjustable stop adapted to transmit strain from the drum when it tends to turn in the other direction, automatic mechanical means for disengaging the stop from its counterpart, a holding device for thus holding the stop, and mechanism controlling the action of the holding device, substantially as described.

10. Towing machinery comprising the combination of a drum or reel, an engine adapted to turn it in one direction, an adjustable stop adapted to transmit strain from the drum when it tends to turn in the other direction, mechanical means for disengaging the stop from its counterpart, a holding device for then acting on the stop, that device having motion in opposite directions during its action, and mechanism connecting the holding device with the drum, substantially as described.

11. Towing machinery comprising the combination of a drum or reel, an engine adapted to turn it in one direction, a block 54 adjacent to the drum, an adjustable stop whereby strain is transmitted from the drum to the block, a holding device adapted to act on the stop and having motion in opposite directions, and mechanism connecting the holding device to the drum, whereby to the holding device is imparted first movement in one direction and

then an equal movement in the opposite direction, with the movement and return movement of the drum, substantially as described.

12. Towing machinery comprising the combination of a drum or reel, an engine adapted to turn the drum in one direction, a block 54, an adjustable stop carried by the block, surfaces on the drum with which the stop engages, a holding device adapted to act on the stop and comprising parts movable in relation to one another, and mechanism between the holding device and drum, whereby motion is transmitted from the drum to the parts of the holding device through different distances in the same time, substantially as described.

13. Towing machinery comprising the combination of a drum or reel, an engine adapted to turn it in one direction, an adjustable stop adapted to transmit strain from the drum when it tends to turn in the opposite direction, a holding device adapted to act on the stop and comprising disks movable in relation to one another, and mechanism between the disks and drum whereby the disks are actuated at different rates of speed, substantially as described.

14. Towing machinery comprising the combination of a drum or reel, an engine adapted to turn it in one direction, an adjustable stop adapted to transmit strain from the drum when it tends to turn in the other direction, a holding device adapted to act on the stop and comprising disks 61 and gears 63, a gear 88 on the drum, and a gear 64 engaging the gears 63 and 88, substantially as described.

15. Towing machinery comprising the combination of a drum or reel, an engine adapted to turn it in one direction, an adjustable stop adapted to transmit strain from the drum when it tends to turn in the other direction, a latch 57 on the stop, a holding device adapted to act on the stop through the latch and comprising disks 61 having notches 62 therein and gears 63 on their faces, a gear 88 on the drum, and a gear 64 engaging the gears 63 and 88, substantially as described.

16. Towing machinery comprising the combination of a drum or reel, an engine adapted to turn it in one direction, a block 54, a stop 55 secured in the block and adapted to turn therein, a ring 82 on the flange of the drum having recesses 87 with which the stop engages, a latch 57 on the stop, disks 61 mounted on a pin and provided with notches 62 and gears 63, a gear 88 on the drum, and a gear 64 engaging the gears 63 and 88, substantially as described.

17. Towing machinery comprising the combination with a drum or reel, of an engine adapted to turn it in one direction, a ring 82 on the drum having notches 87 therein, a gear 88 on the ring 82, a block 54 fastened on the shaft within the ring 82, a stop 55 in the block having the surface 56 on one side, a latch 57 on the stop, disks 61 mounted on a pin and provided with notches 62 and gears 63, and a gear 64 engaging with the gears 63 and 88, substantially as described.

18. A towing-machine comprising the combination of mechanism that transmits power to counteract the force of the towing-hawser, a shaft 5 actuated by said mechanism, a drum on the shaft, an engine adapted to turn the drum in one direction, an adjustable stop adapted to transmit strain from the drum to the shaft when the drum tends to turn in the other direction, and regulating mechanism whereby said stop is held out of engagement with its counterpart, after a movement of the drum by the engine, during the return movement of the drum, substantially as described.

19. A towing-machine comprising the combination of mechanism that transmits power to counteract the force of the towing-hawsers, a shaft 5 actuated by said mechanism, two drums on that shaft, engines adapted to turn the drums in one direction, adjustable stops adapted to transmit strain from the drums to the shaft when they tend to turn in the other direction, and systems of regulating mechanism each adapted to hold one of said stops out of engagement with its counterpart, after a movement of the drum by the engine, during the return movement of the drum, substantially as described.

20. Towing machinery comprising the combination of two drums, engines adapted to turn the same in one direction, adjustable stops adapted to transmit strain from the drums when they tend to turn in the other direction, and systems of regulating mechanism each adapted to hold one of said stops out of engagement with its counterpart, after a movement of the drum by the engine, during the return movement of the drum, substantially as described.

21. Towing machinery comprising the combination of two drums, adjustable stops whereby the length of the paid-out parts of the hawsers is regulated, and automatic mechanism whereby either hawser whenever it becomes slack is hauled in, substantially as described.

22. A towing-machine comprising the combination of a shaft 5 mounted in a standard, the cylinders 2 and 3 fixed in the standard on opposite sides of that shaft, an air-reservoir in communication with the cylinders, pistons in the cylinders, a cross-head fastened to the piston-rods, a system of loose sheaves, part of them mounted on the shaft 5 between the cylinders, and the others on a shaft in the cross-head, a sheave 52 tightly secured on the shaft 5, a cable passing over the loose sheaves and attached to the sheave 52, and a drum on the shaft 5, substantially as described.

23. A towing-machine comprising the combination of two horizontal cylinders fixed in a standard and having their axes parallel to

each other, pistons in the cylinders, an air-reservoir in communication with the cylinders, a shaft mounted in the standard with its axis transverse to those of the cylinders, a cross-head fastened to the piston-rods, guides on which the cross-head travels, sheaves mounted on said shaft and in the cross-head, and a cable passing over the sheaves, substantially as described.

24. A towing-machine comprising the combination of two horizontal cylinders 2 and 3 fixed in the uprights 11 and 12 of the standard 1, pistons in the cylinders, an air-reservoir in communication with the cylinders, a shaft mounted in the standard above the cylinder 2 and below the cylinder 3 and with its axis transverse to their axes, a cross-head fastened to the piston-rods, guides on which the cross-head travels, sheaves mounted on the shaft and in the cross-head, and a cable passing over the sheaves, substantially as described.

25. A towing-machine comprising the combination of two cylinders fixed in a standard and having their axes parallel to each other, pistons in the cylinders, an air-reservoir in communication with the cylinders a shaft mounted in the standard with its axis transverse to those of the cylinders, a cross-head fastened to the piston-rods and having lugs projecting forward from its main part and adapted to pass between the cylinders, sheaves between the lugs of the cross-head, and a cable passing over the sheaves, substantially as described.

MARK L. DEERING.

In presence of—
FRANCIS H. STILLMAN,
ARTHUR F. THOMPSON.