F. METCALF & E. DALGLEISH.

TOWING MACHINE.

APPLICATION FILED MAR. 23, 1909.

977,322.

Patented Nov. 29, 1910.

4 SHEETS—SHEET 1.

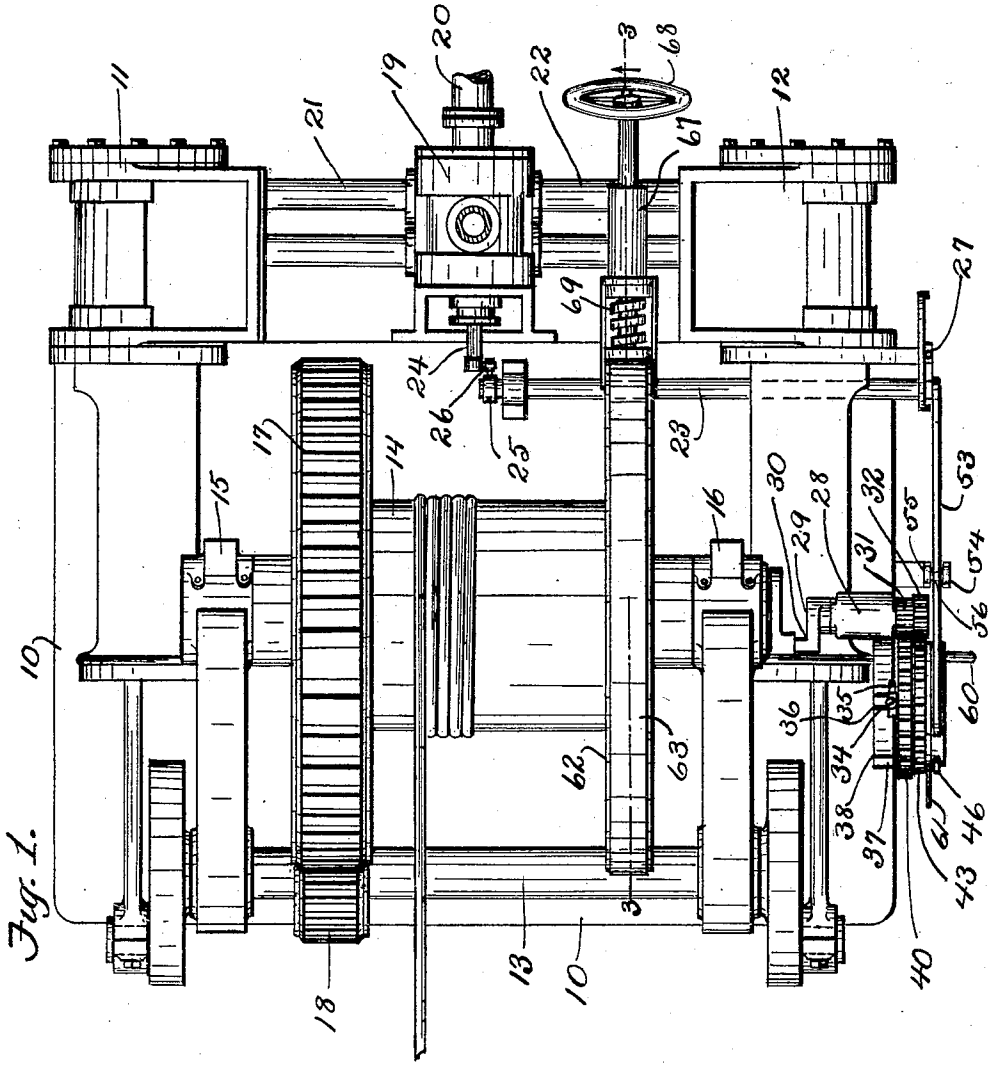

Fig. 1.

Witnesses:
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and
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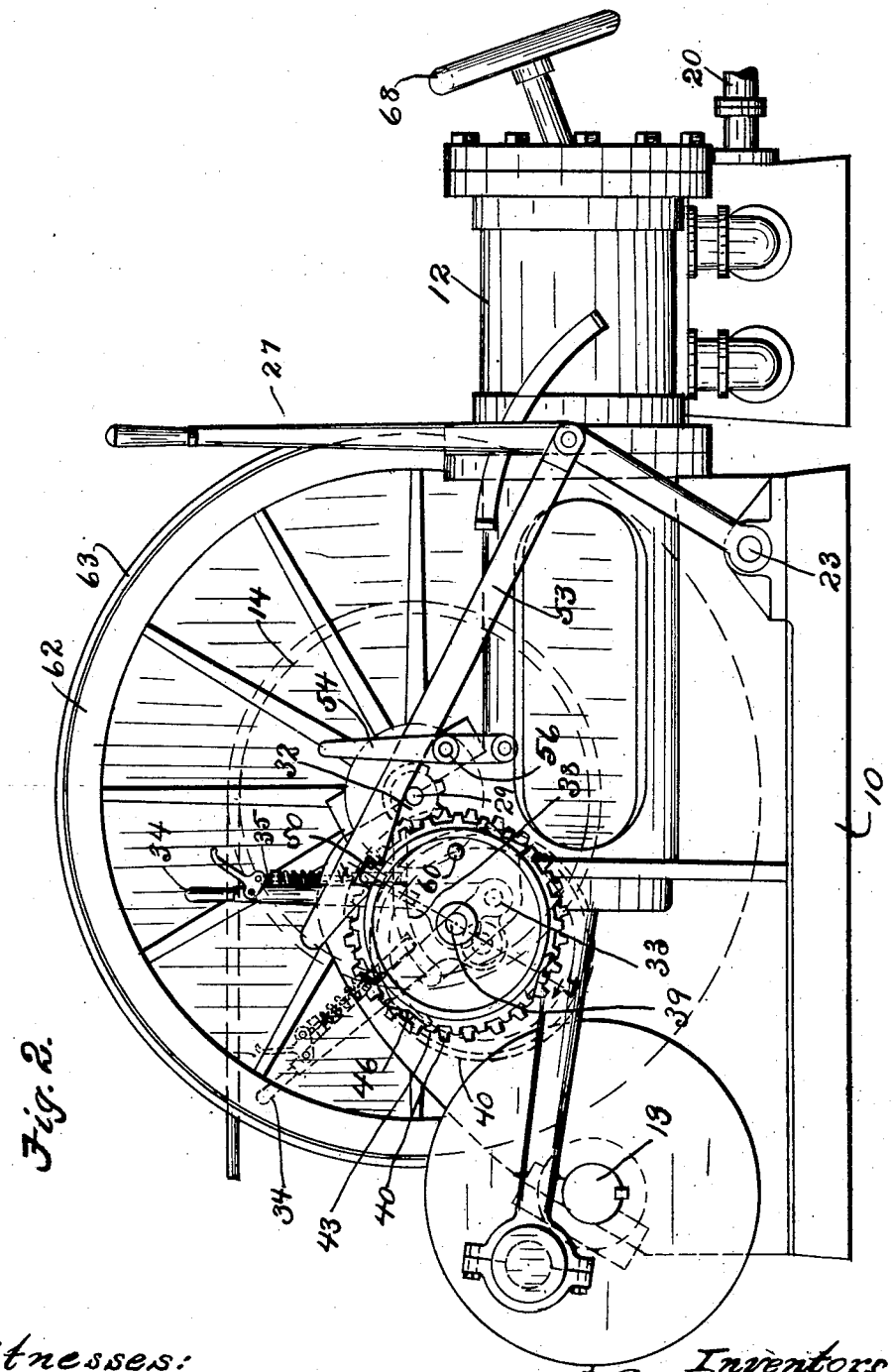

Fig. 2.

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4 SHEETS—SHEET 3.

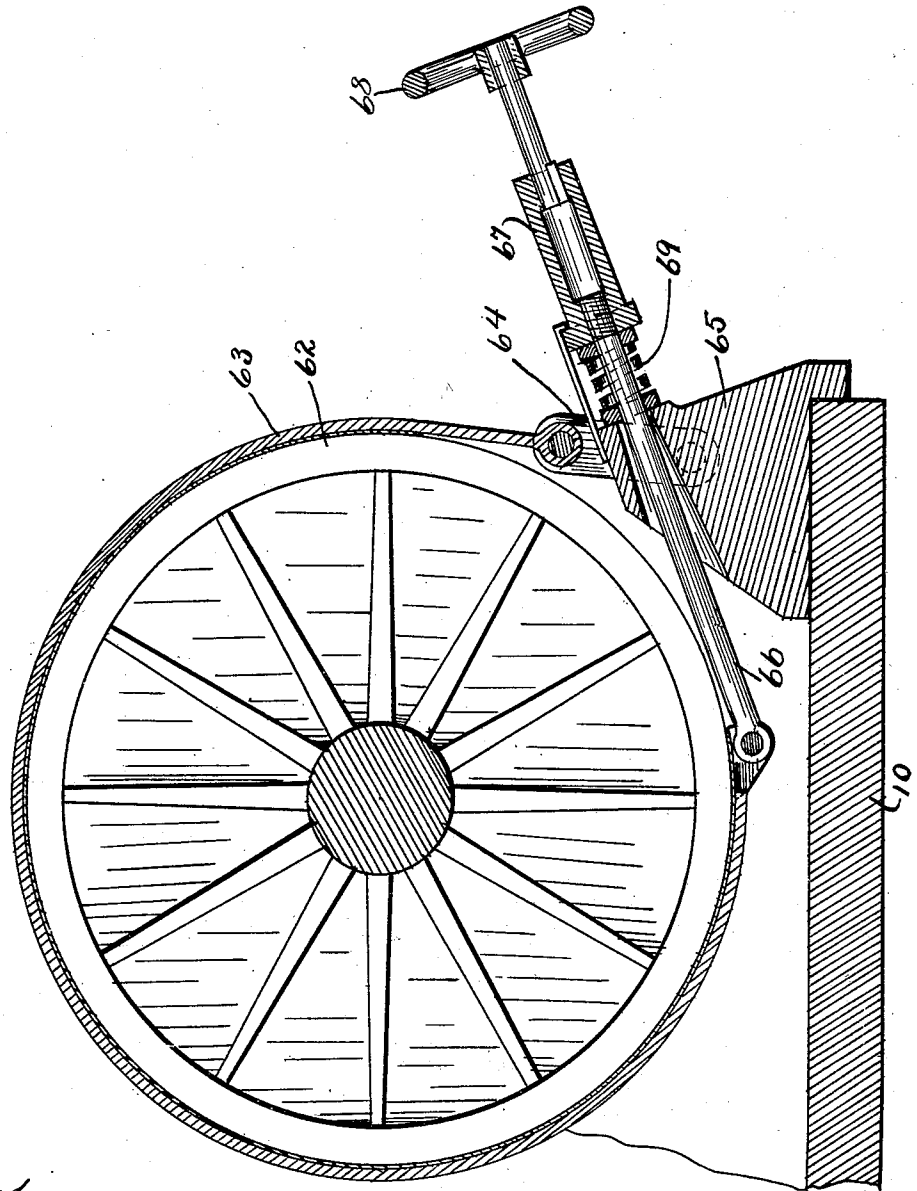

Fig. 3.

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4 SHEETS—SHEET 4.

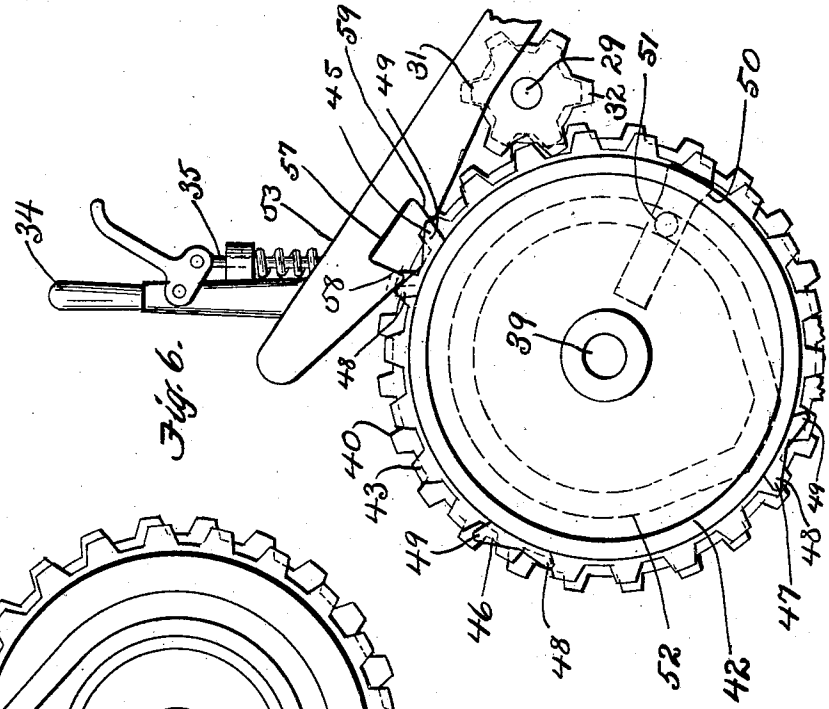

Fig. 6.

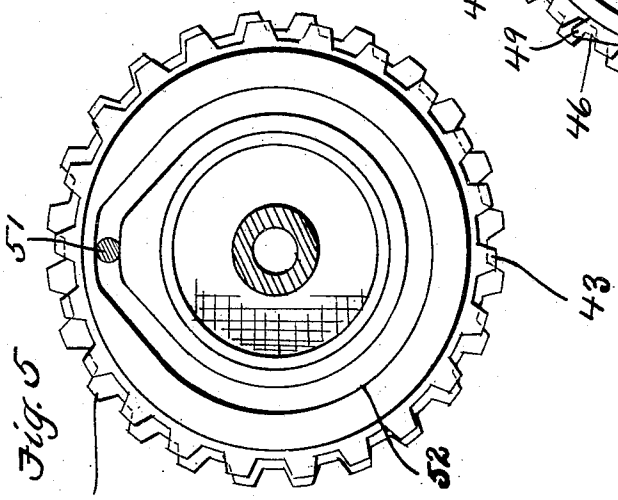

Fig. 5

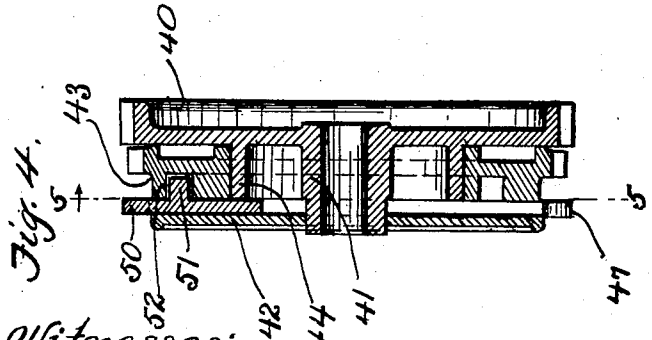

Fig. 4.

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UNITED STATES PATENT OFFICE.

FREDERICK METCALF AND EDMUND DALGLEISH, OF CLEVELAND, OHIO.

TOWING-MACHINE.

977,322. Specification of Letters Patent. Patented Nov. 29, 1910.

Application filed March 23, 1909. Serial No. 485,209.

To all whom it may concern:

Be it known that we, FREDERICK METCALF, a citizen of the United States of America, and residing at Cleveland, in the county of Cuyahoga and State of Ohio, and EDMUND DALGLEISH, a citizen of the United States of America, and residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Towing-Machines; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same.

This invention relates to steam balanced towing machines and has for its object the provision of a towing machine which is more reliable, efficient and economical than those heretofore employed.

An automatic steam towing machine ordinarily holds the load or normal drag of the tow with the valve between the steam admission pipe and engine cylinders open to an extent sufficient to maintain the required pressure in the cylinders,—that is, the valve opening is just large enough to admit sufficient steam into the cylinders to replace that lost by leakage and condensation.

As is well known, in machines of this type, when the load or drag increases for any reason, the tow line is automatically paid out and at the same time the steam pressure is automatically increased, opening the valve and when the engine overhauls the load, the line paid out is rewound on the drum, the valve being again restored to its normal position when the proper amount of line has been rewound on the drum.

When a barge is being towed behind a steamer with a short line, as is necessary in narrow and crooked channels and crowded harbors, the influence of the back water from the screw of the steamer disturbs the steering of the barge and there is likelihood of the barge sheering from its course. Any deviation from a direct course in the wake of a steamer increases the pull on the tow line and the greater the deviation the greater the pull. This increased pull or drag on the tow line causes the machine to pay out the line with the result that the barge deviates from the screw striking more on one bow of the barge than on the other, and as the tendency of the barge is to go in the direction in which it is pointed, there is danger of collision or grounding. It is therefore important that the steam pressure in the engine cylinders be increased extremely rapidly when the load or drag is increased, so that the engine can check the paying out of the tow line as quickly as possible and prevent the barge sheering from its course.

A towing machine constructed in accordance with our invention accomplishes the opening of the valve much more quickly than the machines heretofore employed, and also opens the valve to an extent greater than is necessary for forward running, as is desirable for the reason that the steam which is admitted to the cylinders must oppose the movement of the pistons, instead of actuating the same. Our improved towing machine also holds the valve open during a larger number of revolutions of the drum than the machine heretofore employed, and then closes the valve down to the position proper for forward running as soon as the engine starts to recover the tow line, and finally returns the valve to its first or normal position after the exact amount of tow line paid out has been rewound upon the drum.

Inasmuch as the engine is stopped after the exact amount of line paid out has been rewound upon the drum, it is essential to the working of the machine that it close the valve down to the normal valve opening when its drum is in the same angular position which it occupied before the valve was opened, and since the valve is operated with extreme rapidity (in practice the valve when opened being given a port opening or area of approximately four times the necessary port opening for forward running in less than two strokes of the engine, and the valve being closed down from its position or forward running to its normal position in approximately a half stroke of the engine) it is necessary that means be provided to prevent the momentum of the machine causing the valve to overrun, so to speak, and shut off the steam supply entirely. If this should occur, the engine could no longer hold the load, with the result that the line would pay out and at the same time the valve would be opened too far, and then the line would again be wound in, causing a sawing of the line on the guides and a probable injury to the line. To prevent this

sawing action and for the further purpose of saving steam by reducing the steam pressure necessary to hold a normal load, a friction brake is applied to the drum or other part of the machine so as to hold preferably a portion but not the entire normal load on the drum. The brake may, however, if desired, be set so as to carry the entire load if for instance no steam were available. In order that the brake may interpose more resistance to the unwinding of the tow line by the load, than to the winding of the line by the engine, we prefer to employ a form of brake in which the tension or resistance is applied by an adjustable spring which is connected to one end of the brake band.

In the operation of our improved towing machine the brake may be set to hold nearly but not the entire normal load of the tow, in which case the steam pressure required to hold the remainder of the load will be low and the consumption of steam almost negligible, it being understood that the smaller the steam pressure in the cylinders the less will be the leakage and loss from cooling.

Since the engine winds in the tow line against the opposition of the load and of the brake, the motion will be slower and the momentum less and therefore the valve will not be actuated beyond the point necessary to maintain the normal load, and the port area or opening when the machines comes to and remains at rest, will be somewhat greater than if a brake were not employed. Consequently the sawing of the tow line will not take place. Although the steam pressure under normal conditions is thus greatly lessened, there will be sufficient circulation due to leakage, etc., even at the reduced pressure to keep the cylinders warm and ready for service.

We will now describe in detail, the preferred embodiment of our invention, reference being had to the accompanying drawings, in which—

Figure 1 is a plan view of a towing machine constructed in accordance with our invention. Fig. 2 is a side elevation of the same. Fig. 3 is a sectional view taken through the friction brake substantially along the line 3—3, Fig. 1. Fig. 4 is a section taken through a part of the automatic valve-controlling mechanism. Fig. 5 is a sectional view substantially along the line 5—5, Fig. 4, looking in the direction indicated by the arrow. Fig. 6 is a side elevation of part of the automatic valve-controlling mechanism.

Referring now to the figures of the drawings, 10 represents the base or frame of the towing machine which is provided with a double cylinder engine having cylinders designated 11 and 12 respectively, and which is connected to a crank shaft 13 in the usual manner. A drum 14 which carries the tow line, is mounted in suitable bearings 15 and 16 on the frame and is connected to the crank shaft by means of two intermeshing gears, one, designated 17 rigidly mounted upon the drum shaft, and the other, a smaller gear, designated 18, rigidly mounted upon the crank shaft. Between the steam supply (not shown) and the cylinders 11 and 12 of the engine is arranged a throttle valve 19 which as here shown is of the ordinary balanced piston type and which is connected to the steam supply by a pipe 20 and with the cylinders of the engine by pipes 21 and 22. A rock shaft 23 is mounted on the frame and this rock shaft is connected to the stem 24 of the throttle valve 19 preferably by means of a crank 25 on the rock shaft and a crank pin 26 on the stem. On the outer end of the rock shaft 23 is rigidly secured a lever 27 which may be operated by hand or automatically by mechanism to be referred to later so as to open or close the throttle valve 19 and thereby control the operation of the engine.

The automatic valve controlling mechanism is constructed and arranged as follows. Mounted in a bearing 28 on the frame of the machine is a short shaft 29 which is connected to the drum so as to rotate therewith, in the present case being connected to the ends of the drum by means of crank construction 30 so as to be virtually a continuation of the drum. Mounted on the outer end of the shaft 29 or upon the end opposite to the end which is connected to the drum are two pinions 31 and 32, which preferably have the same number of teeth although as here shown one is slightly greater in diameter than the other. Mounted upon a pin or stud 33 (shown in dotted lines in Fig. 2) on the frame of the machine is a hand lever 34 having a spring pressed locking pawl 35 the inner end of which is arranged to engage within either one of the two notches 36 and 37 (shown in full lines in Fig. 1 and in dotted lines in Fig. 2) of a sector plate 38 likewise carried by the frame of the machine. Mounted upon a pin or stud 39 carried by the lever 34 is a gear wheel 40 having a laterally extending boss 41 (shown in Fig. 4) which receives the supporting pin or stud 39 and said gear having teeth, which, when the lever is in the position shown in Fig. 2 with the end of the locking pawl in the notch 36 of the sector plate, will engage the teeth of the pinion 31 carried by the shaft 29.

Rigidly mounted upon the outer end of the boss 41 is a cover plate 42 which is preferably spaced from the gear 40 and interminate the gear 40 and cover plate 42 is a gear 43 (shown in Figs. 1 and 4) in the form of a ring which is mounted on and may rotate upon a flange 44 (see Fig. 4) which projects from the gear 40 and surrounds and

is concentric with the centrally located and laterally extending boss 41. This gear preferably has a few less teeth than the gear 40. When the hand lever 34 is in the position shown in Fig. 2, the teeth of the gear 43 mesh with the teeth of the pinion 32 as is shown in Fig. 1.

It will be seen from the construction so far described, that when the gears 40 and 43 are in engagement with the pinions 31 and 32 when the drum is rotating, the gear 43 will be driven at slightly greater speed than the gear 40.

The cover plate 42 is provided with three equally spaced projections 45, 46 and 47 which are fixed with respect to the cover plate, and each of which has a pair of outwardly extending horns 48 and 49, each of the horns 49 extending outward a greater distance than the corresponding horn 48. The cover plate is also provided with a movable arm or horn 50 which is arranged to slide or reciprocate in a radial direction in a channel 42′ formed in the periphery of said cover plate, and to accomplish the reciprocating motion it is provided with a lateral pin or lug 51 which engages in an endless cam-shaped slot 52 (shown in Fig. 5) in the face of the gear 43. The projections 45, 46 and 47 having the horns 48 and 49, and the arm or horn 50 are equally spaced about the cover plate and are arranged angularly ninety degrees apart. The horn 50 is of such a shape and length that when the pin 51 is in the cam-shaped portion of the slot 52 or is in the portion of the slot nearest the periphery of the gear 43, the outer end of the arm or horn 50 projects outwardly a suitable distance beyond the periphery of the cover plate, and when the pin 51 is in any other part of the slot 52, the horn 50 will occupy its innermost portion with the outer end thereof substantially flush with or below the periphery of the cover plate.

It may be here stated that the proportion of the gears and cam slot are such that in one revolution of the gear 40 the arm or horn 50 will be shifted inward from its extreme outer to its extreme inner position, the difference between the angular speeds of the two gears 40 and 43 being such as to cause just the proper relative movement between the pin 51 and the cam slot to accomplish this movement.

Pivotally connected to the lever 27 is a valve operating link 53 which projects over the mechanism just described and has its free or outer end vertically above the cover plate 42. The lever is guided in its movements, to be described later, by a pair of guide arms 54 and 55 and normally rests upon a roller 56 mounted between these guide arms. On the lower side near the outer end of the lever 53 is a notch 57 so shaped as to form opposing shoulders 58 and 59. This notch and the shoulders 58 and 59 coöperate with the different projecting horns carried by the cover plate so as to shift the link 53 to produce the necessary movements of the latter required to control automatically the movements of the throttle valve, as will now be described.

The operation of the mechanism so far described will now be explained. The hand lever 34 will be swung to the position shown by dotted lines in Fig. 2 so as to shift the gears away from the pinions and leave the link 53 free of the automatic valve operating mechanism. The throttle valve can then be set by the hand lever 27 to a position such that the engine will hold the normal load. To place the automatic valve-controlling mechanism in operative relation with respect to the link 53, it is first necessary to shift the horn 50 to its extreme outer position. This can be done by moving the two gears 40 and 43 relative to each other, and in order that this may be accomplished readily, the cover plate 42 is provided with a laterally extending handle 60 and the gear 43 is provided with a handle 61. The hand lever 34 is then moved to the position shown in full lines in Fig. 2 and is locked in that position by the locking pawl. While this movement is taking place the horn 50 will be guided into the slot 57 in the lower side of the link 53 by turning the two gears 40 and 43 simultaneously.

When the lever 34, is locked in the position above stated, gears 40 and 43 will, as was previously described, mesh with the pinions 31 and 32, and therefore any movement of the drum will be transmitted through the pinions and gears to the different horns on the cover plate.

If the load falls off or is lessened, the engine will start to wind in the tow line and at the same time will turn the cover plate in a counter clockwise direction when viewed as in Fig. 2, providing the tow line is wound on the drum over the top of the same, as shown in Fig. 1, and the horn 50, which is in the slot 57, will shift the link 53 to the left, so as to close down the valve and admit less steam to the cylinders until the load balances the engine power. If the load increases and the engine is overpowered, causing the line to be paid out, the cover plate 42 will turn in a clockwise direction and the horn 50 will shift the link 53 to the right, moving the valve to its full open position. If the drum is not moved in either direction more than a predetermined angle of revolution, the link will be shifted back and forth by the horn 50 alone. If the line continues to pay out the horn 50 will leave the slot or notch 57 and will be drawn down to its innermost position by the cam slot 52, so that on the next revolution of the cover

plate the horn 50 will not engage the slot 57. During this movement of the cover plate in a clockwise direction when the line is being paid out, the link having been shifted, as was before stated, to the right, the horns 48 and 49 will not engage the shoulders 58 and 59 formed by the notch 57 so as to cause any movement of the link in either direction, the parts being so designed that positive engagement cannot take place between the shoulder 59 of the link and the leading horns 49 (leading with respect to the direction of rotation) when the link 53 has been shifted by the horn 50 its full amount to the right. When the engine finally overpowers the load and begins to wind in the line, the direction of rotation of the cover plate will of course be reversed and almost immediately one of the horns 48 which are now the leading horns (when the cover plate is rotating in a counter clockwise direction) will engage the shoulder 58 of the link so as to shift the link to the left an amount sufficient to close down the valve the predetermined amount necessary to permit an ample admission of steam for forward running at suitable speed, but not a sufficient pressure of steam to cause the engine to race under any circumstances. The shoulders 58 and 59 and the horns 48 and 49 are so shaped that, although none of the horns 49 can engage the shoulder 59 after the link is moved its full distance to the right (as shown in Fig. 6) when the cover plate is rotating in a clockwise direction, as soon as the rotation is reversed one of the horns 48 will almost immediately engage the shoulder 58 so as to close down the valve the predetermined amount, as was stated above. The engine will then continue to wind in the line at slow speed until it has made the same number of revolutions that was made when the line was being paid out, and then the horn 50 will once more be thrust out to its outermost position and will engage in the notch 57, so as to shift the link the remaining distance to the left and bring the engine to rest at the same position it occupied when overpowered by the load. It will of course be understood that the number of rotations of the drum in either direction is fixed at the outset by the ratios of the several gears to each other. If, however, it should happen that while the engine is winding in the line, the load is again augmented and the engine overpowered, one of the longer horns 49 will immediately engage the shoulder 59 so as to again shift the link the full distance to the right and again open the valve to its fullest extent, it being understood that when the engine is running forward and the link has been shifted partly to the left so that the valve is partially closing down, the link will occupy a position such that if the rotation of the cover plate is reversed, any one of the longer horns 49 can readily engage the shoulder 59 and again move the link to the right, although when the link is to the extreme right the horns cannot engage the shoulder 59.

As was before stated, to lessen the consumption of steam and to cause the movement of the engine to be sufficiently slow that the momentum of the parts cannot affect the proper operation and movements of the valve, in other words, to avoid the sawing of the tow line, we employ a form of friction brake which will now be described, reference being had particularly to Figs. 1 and 3. The brake wheel which is shown at 62 is mounted, in this case, directly upon the drum shaft. The periphery of the wheel is engaged by a brake band 63 one end of which is connected by a link 64 to a stationary abutment 65 forming a part of the frame of the machine, and the opposite end of which is connected to a rod 66 forming a part of the band tightener, the end of the rod 66 being threaded and engaging in a correspondingly threaded portion of an elongated nut 67 to which is secured an adjusting hand wheel 68. Between the abutment 65 and the adjacent end of the nut 67 is placed a yieldable member in the form of a coil spring 69. When the drum is turning in a counter clockwise direction, when viewed as in Fig. 3, that is, when the line is being paid out—the brake wheel pulls against the link 64 or the tight end of the brake band. When, however, the drum is rotating in a clockwise direction, that is, when the engine is winding in the line, the brake wheel is pulling against the rod 66 or the loose end of the band. It will be apparent therefore that rotation in the direction which causes the line to be wound in, will be accomplished with less effort than rotation which causes the line to be paid out.

We do not desire to be confined to the exact details shown but aim in our claims to cover all modifications which do not involve a departure from the spirit and scope of our invention.

What we claim is,—

1. In a towing machine, a drum adapted to carry a tow line, an engine connected to the drum, a valve controlling the supply of motive fluid to the engine cylinder, valve operating means directly connected with said valve and means for automatically actuating said valve operating means comprising a rotatable member operatively connected to said drum, a member mounted on said rotatable member and capable of being shifted radially thereon and adapted when in its operative position to engage with said valve operating means and means operatively connected with the drum and adapted to engage with said shiftable member so as to cause

said shiftable member to travel radially on said rotatable member during the rotation of said rotatable member.

2. In a towing machine, a drum adapted to carry the tow line, an engine connected to said drum, a valve, means for automatically controlling said valve comprising a member which is rotated by the drum, and a valve shifting member, a device movably mounted on said rotatable member and arranged so that in its operative position it will engage said valve operating mechanism, means for shifting said device after a predetermined number of rotations of the drum in one direction to a position such that during further rotation in the same direction said device will not engage said valve operating member, and other means carried by said rotatable member for engaging said valve operating member so as to partially close the valve when the direction of the rotation of the drum is reversed.

3. In a towing machine, a drum adapted to carry the tow line, an engine connected to the drum, a valve, means for automatically controlling said valve, said means comprising a member which is rotated by the drum, and a valve shifting link operatively connected to the valve, said rotatable member having a plurality of link shifting devices, one of said devices being movable relative to the rotatable member and serving to shift said link to close the valve, or to open the valve beyond its normal position when the load is augmented beyond the normal load, means serving to shift said device to an inoperative position if the drum is rotated beyond a predetermined amount to pay out the line and to again restore said device to an operative position with respect to the link when the engine overhauls the load and reverses so as to wind on the drum the line previously paid out, and another of said devices being fixed relative to said rotatable member and serving to partially close the valve to a position suitable for the forward running of the engine when the engine overhauls the load and reverses.

4. In a towing machine, a drum adapted to carry the tow line, an engine connected to the drum, a valve, means for automatically controlling said valve, said means comprising a member which is rotated by the drum, a valve shifting link operatively connected to the valve, and a plurality of horns carried by said rotatable member and adapted to engage and shift said link, one of said horns being movable relative to the rotatable member and when in its normal position serving to engage and shift the link during a predetermined number of rotations of the drum in either direction, means for moving said horn to an inoperative position when the drum is moved in one direction more than the predetermined number of rotations and to restore said horn to its normal position after the engine reverses and the drum is moved in the opposite direction, and a plurality of fixed horns carried by said rotatable member, one of said horns serving to engage and shift the link in one direction so as to partially close the valve to a position suitable for forward running of the engine, and another fixed horn serving to shift the link in the opposite direction so as to open the valve to its full extent if the load is again augmented before the proper amount of line is rewound upon the drum.

5. In a towing machine, a drum adapted to carry the tow line, an engine connected to the drum, a valve, means for automatically controlling said valve comprising a pair of adjacent gear members adapted to be rotated by the drum at slightly different angular speeds, a valve shifting link connected to the valve, and a plurality of horns carried by one of said gear members and adapted to engage and shift said link, a cam slot in the other of said gear members, one of said horns being movable in a radial direction and engaging said cam slot, said movable horn being normally in a position to engage said link and being drawn inward after a predetermined number of rotations of the drum in one direction and then moved outward when the engine reverses and the drum is moved in the opposite direction through a number of rotations, and the other horns being fixed relative to said gear member, one of said fixed horns serving to engage and shift the link so as to partially close the valve after the tow line has been paid out and after the engine overhauls the load and begins to wind in the tow line, and another fixed horn serving to engage and shift the link so as to again open the valve in case the load is again augmented and the line is paid out before the proper amount of line previously paid out has been rewound on the drum.

6. In a towing machine, a drum adapted to carry the tow line, an engine connected to the drum, a valve, means for automatically controlling said valve, said means comprising a valve shifting link having a notch or slot, and a pair of adjacent gear members operatively connected to and adapted to be rotated by said drum at slightly different angular speeds, one of said gear members having a cam slot, and the other having a plurality of horns adapted to engage in the slot of said link, one of said horns being movable in a radial direction and engaging said cam slot, said movable horn engaging said notch or slot in the link when the load is normal and serving to shift the link when the drum is rotated a predetermined amount in either direction, and said cam slot serving to draw said horn inward to an inoperative position if the rotation of the drum

in one direction exceeds a predetermined amount and serving to again restore the horn to its normal position when the engine is reversed and the drum is rotated in the opposite direction, the remaining horns being fixed relative to said gear member and one of the latter serving to engage said notch or slot and to partially close the valve after the line has been paid out and after the engine reverses so as to again wind in the line, and another of said fixed horns serving to engage and shift the link so as to again open the valve in case the load is augmented and the drum is rotated so as to pay out the line before the full amount of line previously paid out has been rewound on the drum.

7. In a towing machine, a drum, an engine connected to said drum, a valve, mechanism operated by the rotation of said drum for automatically controlling said valve, a friction brake for constantly supporting a portion of the normal load and means for resiliently mounting said brake so that the brake will oppose to a greater extent the rotation of the drum when paying out the line than when winding in the line.

8. In a towing machine, a drum adapted to carry the tow line, an engine connected to the drum, a valve, means for automatically controlling said valve, a friction brake adapted to support a portion of the normal load, said brake comprising a brake wheel and a brake band engaging the periphery of said wheel, one end of said band being fixed so as to oppose to a certain extent the rotation of the drum when the line is being paid out and the other end of the band being yieldingly supported, so that the brake will afford less opposition to the rotation of the drum when the line is being wound upon the latter, than when it is paid out.

9. In a towing machine, a drum adapted to carry the tow line, an engine connected to the drum, a valve, means for automatically controlling said valve, a friction brake comprising a brake wheel mounted on the drum, a brake band engaging the periphery of said wheel, one end of said band being connected to the frame, a band tightener connected to the opposite end of the band and adjusted so as to afford a certain amount of opposition to the rotation of a drum when the line is being paid out, and a spring interposed between the band tightener and the frame so that said brake will afford less opposition to the rotation of the drum when the line is being wound on the latter than to the rotation of the drum when the line is being paid out.

In testimony whereof, we sign the foregoing specification in the presence of two witnesses.

FREDERICK METCALF.
EDMUND DALGLEISH.

Witnesses:
VICTOR C. LYNCH,
N. L. MCDONNELL.