(No Model.) 2 Sheets—Sheet 1.

J. M. GOODWIN.

TOWING BOATS, &c., IN CANALS.

No. 371,680. Patented Oct. 18, 1887.

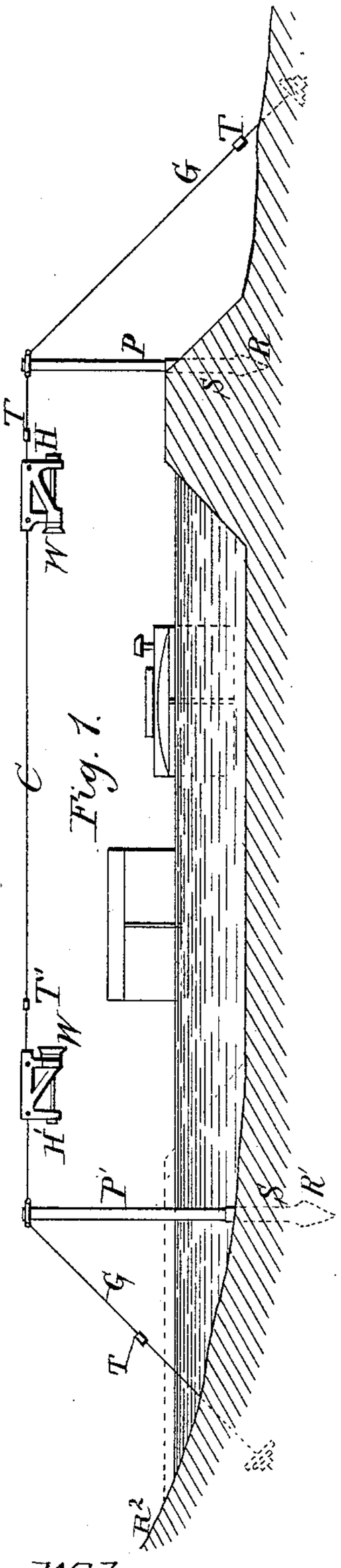

Fig. 1.

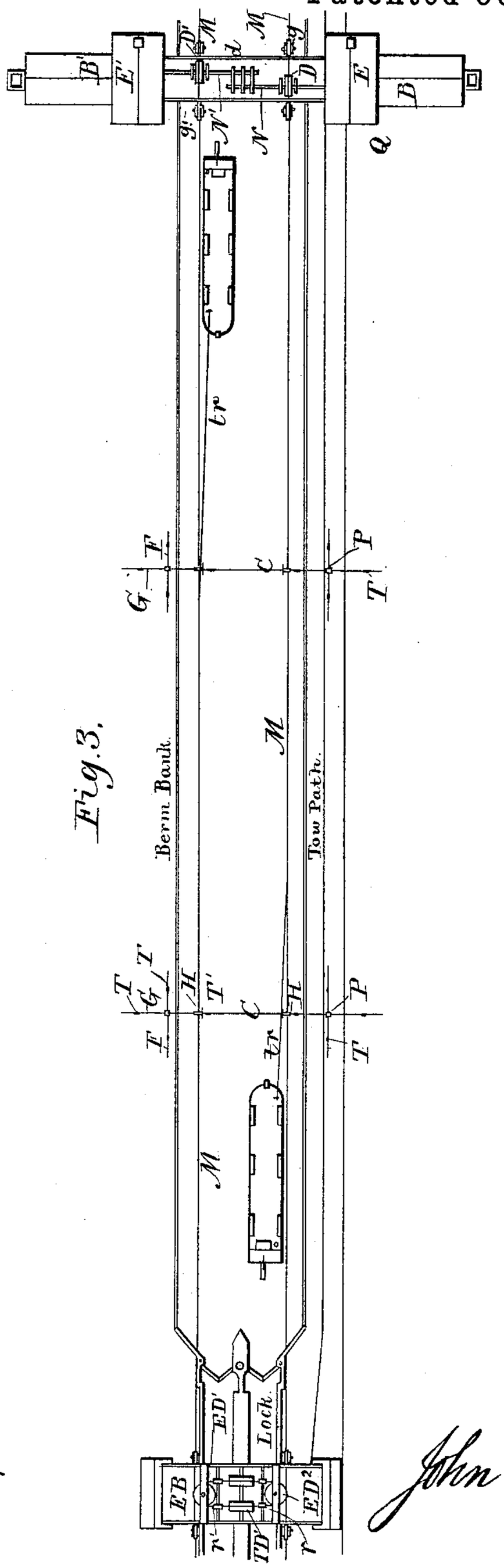

Fig. 3.

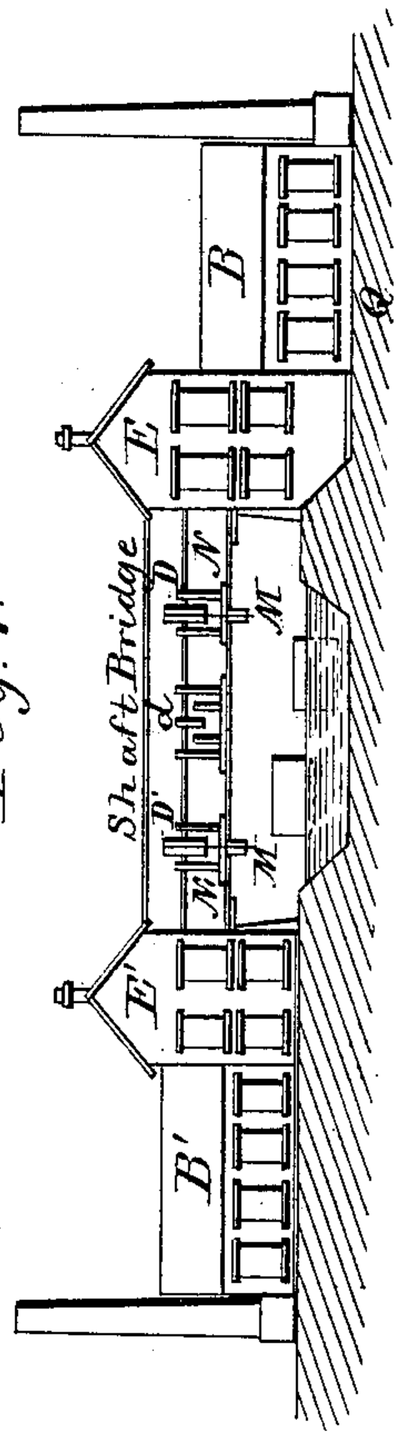

Fig. 4.

Witnesses:
S. H. Phelps
C. E. Agnew

Inventor
John M. Goodwin,

(No Model.) 2 Sheets—Sheet 2.

J. M. GOODWIN.

TOWING BOATS, &c., IN CANALS.

No. 371,680. Patented Oct. 18, 1887

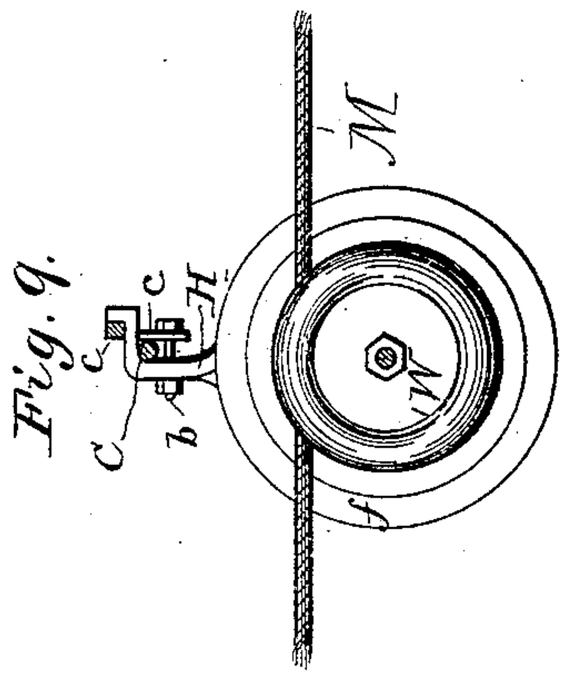

Fig. 9.

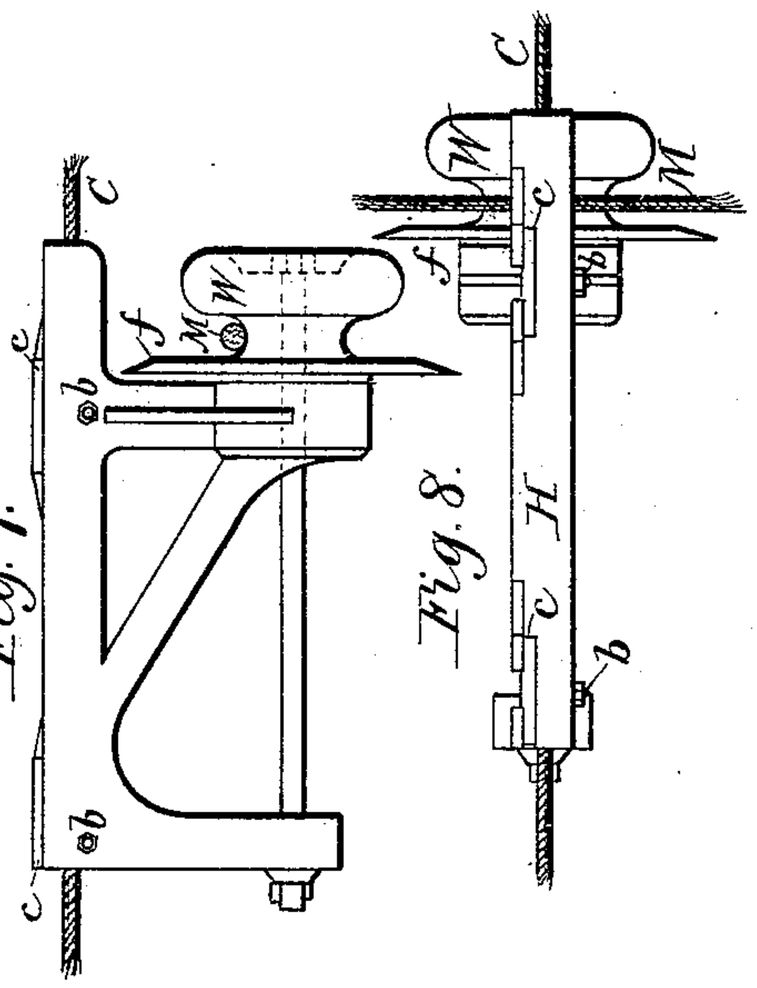

Fig. 7.

Fig. 8.

Fig. 5.

Fig. 6.

Witnesses:
S. H. B. Phelps
C. E. Agnew

Fig. 2.

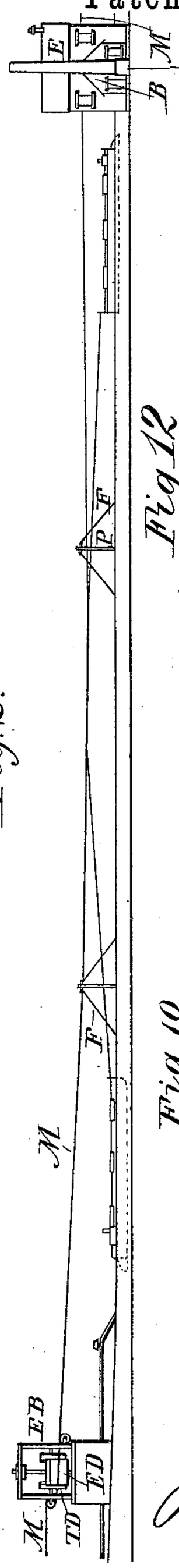

Fig. 13.

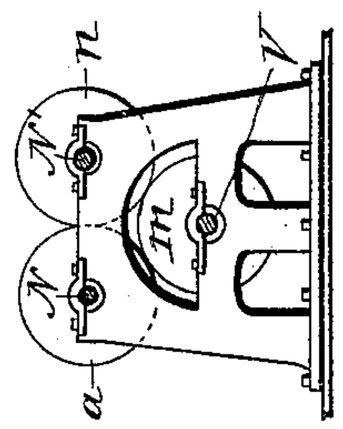

Fig 12

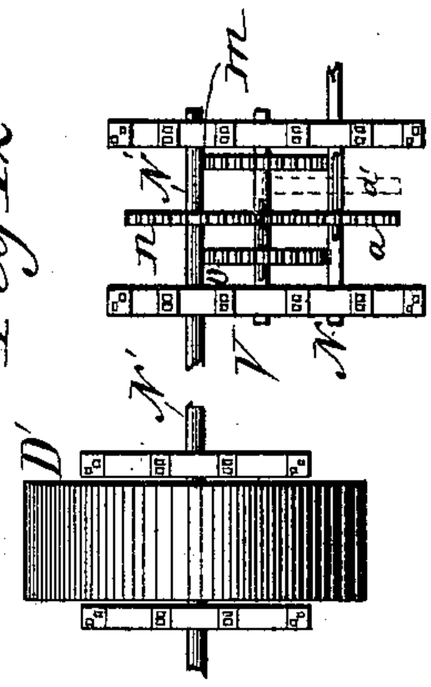

Fig. 10.

Fig 11.

Inventor
John M. Goodwin.

UNITED STATES PATENT OFFICE.

JOHN M. GOODWIN, OF SHARPSVILLE, PENNSYLVANIA, ASSIGNOR OF ONE-FOURTH TO IRVING A. EVANS, OF BOSTON, MASSACHUSETTS.

TOWING BOATS, &c., IN CANALS.

SPECIFICATION forming part of Letters Patent No. 371,680, dated October 18, 1887.

Application filed July 1, 1886. Serial No. 206,895. (No model.)

To all whom it may concern:

Be it known that I, JOHN M. GOODWIN, a citizen of the United States, residing at Sharpsville, in the county of Mercer and State of Pennsylvania, have invented certain new and useful improvements in towing boats, barges, and other crafts adapted to the navigation of such waters in and along canals and like water-ways, and certain devices, apparatus, and appliances contributory to the result sought through the operation of the said improvements, of which improvements and devices, respectively, the following is a specification, reference being therein had to the drawings accompanying and forming part of this my application for Letters Patent of the United States.

The objects of my invention are to provide means through use of which boats, &c., may be towed in and along canals and like water-ways with greater uniformity of progress and better dispatch than heretofore accomplished, and at the same time at an ultimate cost less than that ordinarily incident to such towing as heretofore performed, while as results of the substitution thereof, instead of means heretofore used, the effective capacity of any canal will be materially increased and the risk of collision of opposing boats diminished, and to effect these betterments of existing conditions by the use of apparatus no part of which will in any way occupy nor obstruct the tow-path or water-way of a canal, nor prevent or interfere with the passage along such tow-path of teams used for towing in the ordinary manner, nor the passage along such water-way of steamers and other craft of the kinds ordinarily used on canals. To attain the objects aforesaid I have invented the new and useful method of applying power to the towing of boats, &c., in canals hereinafter described, and to carry my said invention into effect have devised the appliances and mechanism herein described as of my invention, and illustrate the same by the accompanying drawings, throughout which similar letters refer to similar parts, and of which—

Figure 1 is a cross-section of a canal, with longitudinal elevation of one "suspension-frame" of my towing apparatus as applied to such canal. Fig. 2 is a side view taken along a canal equipped with my towing-plant, showing nominally one-half in length of a "stretch" to be operated by one set of engines as used in such plant. Fig. 3 is a sketch, in the manner of a plan, of the one-half of a stretch of canal equipped as aforesaid, showing disposition and relative positions of engines, drums, cable-tighteners, shaft-bridge, drum and end bridge, and other appliances used for operating such stretch. Fig. 4 is a sketch showing arrangement of engine-houses, shaft-bridge, and drums at a "station" at which power is to be applied for working a stretch of canal. Fig. 6 is a vertical section on long axis of a "post-socket," and Fig. 5 is a plan of post-socket. Fig. 7 is a side elevation of a roller-hanger and its appurtenances for carrying the towing-cable. Fig. 9 is an end view, and Fig. 8 a plan, of the hanger. Fig. 10 shows my combined tow-rope and slip-rope, such rope being applicable also to use as a "spring-line" or "breast-line," as and for the purposes herein described. Fig. 11 shows portions of the towing-cable with "stops" fixed thereon. Fig. 12 is a plan, and Fig. 13 an end view, of shafts and gearing in my device for adjusting gear-connections between my drum-shafts, (N and N′ in the appropriate figures,) so that such shafts may thereby be made to revolve both in one direction, or one to the right and the other to the left, as desired.

Subjoined is a detailed description of my invention and an explanation of the manner in which the same is to be applied and operated to effect my aforesaid objects.

At some convenient point outside of the tow-path of a canal, preferably immediately at the outside edge of the tow-path, as at R, Fig. 1, I drive into the ground (or, when necessary so to do, set by other process) a post-socket, as S, made, preferably, of cast-iron. Into this socket I fix, vertically, a post, P, preferably of wood, but it may be of metal, and secure the same against strains acting in the direction of the length of the canal, tending to pull the post out of perpendicular, by guys F F, Fig. 2, each guy being preferably anchored at its foot, and having in it a turn-buckle, by means of which the guy may be shortened or lengthened, as necessary, for the purpose of keeping the post upright in the line of these guys.

On the side of the canal opposite R, and preferably about five feet out from the top of the slope of the berme bank of the canal, I in like manner fix a post, P′, Fig. 1, similar to the post P.

Where the berme side of the canal is not embanked, and the waters of the canal consequently extend beyond the limits of the standard prism of the canal, thereby forming a bayou or basin, I prefer to set the post P′ in the basin or bayou outside of the limits of the standard prism aforesaid, but as nearly as may be at a point, as R′, located with reference to P, as it would be were it set, as aforesaid, about five feet out from the top of the berme slope of the canal as ordinarily formed; but if any such bayou or basin be deep enough for use by boats, or if for any reason the post P′ placed in the bayou would obstruct any desirable movement of boats, I set such post so as to avoid such obstruction—as at R², for example.

The post-socket S, Figs. 5 and 6, has been shaped externally, as shown, with a view to fitting it, first, to penetrate the material forming the embankment of a canal or the bottom of a basin without abrupt displacement of such material, and, second, to resist, when in place, any force tending to withdraw it. It has been proportioned with a view to rendering it capable of withstanding any blows necessary to the driving of it into place and any strain to be caused by any necessary wedging of a post into it. The "socket" proper is shaped so that withdrawal of a post for renewal, for instance, may be effected without disturbing the socket as a whole, or the ground about it. Any excavation made in a canal-bank permanently injures the bank. In case of a post set in a "post-hole" excavated in earth a permanently sufficient establishment of the post in the ground at the time of setting is not practicable.

I have devised the post socket shown and described herein in order to obviate necessity for making excavations in the canal banks and bottoms and to afford the posts of my suspension-frames firm foundation and base-support at the outset.

Between the posts P P′, I stretch a suspension-cable, C, in which are turn-buckles T T′, to be used for setting and keeping the cable taut. The cable C is attached at either end to an eye in a strap surrounding the head of the corresponding post if the post be of wood, or to an eye fixed in the post if the post be of metal. To a similar eye fixed on the outer side of each post I attach a guy, as G or G′, having in it a turn-buckle, and secure the foot of such guy to an anchor in the ground, or to some suitable anchorage conveniently accessible. These guys G G′ serve to resist the pull on the posts that the cable C will continuously exert when that member of the suspension-frame described is set taut and equipped with its appendages and the increased pull thereon that will be caused by the down-drag of the tow-rope in the operation of towing, hereinafter described. Upon the cable C, I place a hanger, H, (shown in detail in Figs. 7, 8, and 9,) carrying a roller, W, preferably adjusting this hanger so that its roller will be suspended directly above the foot of the inside slope of the tow-path bank of the canal. In a corresponding position, so that its roller will be directly above the foot of the slope of the berme bank of the canal, or at a distance from H equivalent to the standard width of the bottom of the canal, I adjust a similar hanger, H′. As indicated in the drawings aforesaid, the roller of each hanger faces the canal.

Each hanger has a clamp-plate, *c*, and clamp-bolts *b b*, by means of which it is fixed on the suspension-cable. This mode of attachment renders readily practicable any necessary or desirable change of position of a hanger on this cable. At bends of the canal, and possibly at other places, and for the purpose of leading boats along some particular part of the water-way, or in some particular direction or manner rendered necessary by extraordinary conditions, (as, for instance, the presence of a wreck or other obstruction in the canal,) adjustments of the hangers varying from those shown in the drawings may be made. The hanger should, however, be placed so that the lead of the rope or ropes, whether tow-ropes, breast-lines, or spring-lines, connecting a boat with the towing-cable shall be such that any such rope shall in passing the hanger encounter and pass over the circular head or face member of the roller W, and not stray in a direction that would bring it against the vertical arm of the hanger. The back of the roller W is provided with a cutting-edge for the purpose of severing any tow-rope or spring-line coming in contact therewith.

The duty of the rollers attached to the hangers is primarily to support and guide the towing-cable M. (Figs. 2, 3, 7, 8, and 9.)

The office of the capstan part or face member of the roller is to fend off from that portion of the roller in which the towing-cable travels and carry clear of the same any tow-rope, breast-line, or spring-line attached to said towing-cable for the purpose of towing or sheering a boat, and at the same time to accelerate the movement in the direction of the travel of the towing-cable of that part of any such tow-rope, breast-line, spring-line, or slip-line coming against the face member.

The hanger constructed as shown serves for use on either side of the canal.

The towing cable M is a cable made, preferably, of steel wires, extending along the berme side of the canal, and supported by and traveling on the rollers, respectively, of the several hangers, as described and shown, and around the driving-drum D′, Fig. 3, thence to and partly around the end drum E D′ on the end bridge, E B, thence beneath a roller, *r′*, alongside the tightening-drum T D′, thence over this tightening-drum and under a roller, *r*, alongside said drum, thence to and partly

around the end drum E D², thence along the tow-path side of the canal, supported by and traveling on the rollers of the hangers fixed along that side of the canal to and around the driving-drum D, and so on for the other portions of the stretch of canal operated by the motive power at the station Q, around, under, or over end drums, rollers, and tightening-drum, respectively, situate at the end of the stretch not shown in the drawings, and back to the berme side of the canal and to the drum D′, before named.

The driving-drums operating a stretch may be placed at any point in the length of that stretch.

Boats will necessarily cast loose from the towing-cable when about to pass a driving-drum, as well as when about to pass from one stretch of cable to the next beyond. They will, likewise, cast loose preparatory to entering a lock. Whenever practicable, therefore, the driving-drums and motive power of a stretch should be placed at a lock, and each end of that stretch should be at a lock; but presumably in practice an arrangement exactly like that suggested as desirable will not always be practicable.

The motive power may be placed at a lock and the ends of the stretch, respectively, at suitable points equidistant from the lock; or the motive power may be placed midway of a long level of the canal and each end of the stretch at a lock.

As conducing to convenience in operation, the motive power should be placed midway between the ends of the stretch; but on occasion the power may be applied near one end of a stretch. The effectiveness of the apparatus would not be thereby impaired.

To secure certain economies, engines and machinery to be used in operating the towing-cables should be throughout the canal of uniform size, pattern, and power. At the same time the speed of the cable and effective towing power with that speed should be practically uniform throughout. In order that these conditions may be compatible, the engineer laying out the towing-plant, after having adopted a standard motor and a standard length of stretch—a length preferably the greatest that may be effectively operated with his standard motor under the most favorable circumstances of alignment, &c., found on the canal with which he has to deal—must determine the length of each stretch according to the character of the alignment and other features of that portion of the canal along which it is to extend. The more tortuous alignment of course indicates greater resistances to movement of cable and boats, respectively, and suggests a correspondingly shorter stretch. He should be careful to arrange each stretch so that the work ordinarily to be done on it will be well within the ultimate power of his motor.

The shafts N N′, Fig. 3, carrying the driving-drums, should be operated by one engine—say that in the house, E. The drum D should ordinarily revolve in a direction reverse to that of D′, the reversing to be effected by means of suitable gearing situate, preferably, at *d*. Provision should be made, moreover, for readily disconnecting the shafts N N′, and, further, for revolving both shafts and their drums in one and the same direction. A device for effecting these operations, respectively, is shown in Figs. 12 and 13, in which N N′ are main shafts carrying the driving-drums. V is a supplementary shaft. *n* is a gear-wheel fixed on N′. *a* is a similar gear-wheel movable along N. *m* is a similar wheel fixed on V. *v* is a similar wheel movable along V.

With *a* engaged with *n* and the shaft N revolving, as indicated by the single-barbed arrow, *n* (with the shaft N′) revolves, as indicated by the double-barbed arrow, in direction opposed to that of N. Now slip *a* to the position *a′* and the shafts are disconnected. Now engage *a* with *m* and slip *v* along on V and engage it with *n*, then *n* and *a* with their respective shafts and drums will revolve in one and the same direction.

The shafts and the machinery in the engine-houses E E′ should be so arranged that the two shafts N and N′ may be operated either by the engine at E or by that at E′, or by the two engines acting together.

I prefer to supply at each power-station, as Q, two separate and distinct engines, each capable of doing all the ordinary work of the stretch, and boilers and other appurtenances for each engine, the whole arranged substantially as indicated by Figs. 3 and 4. I would further arrange steam-pipes so that the boilers at B may supply steam to the engine at E′, or those at B′ to the engine at E, and, further, so that the boilers at B or any of them may be used in connection with all or any of those at B′. Then, with either engine or either battery of boilers disabled, the engine and boilers not disabled may be used to operate the stretch. As the presence of the towing plant described does not interfere with the operation of the canal in the ordinary way, any stretch may, in case of necessity, be temporarily operated with teams.

The driving-drums D D′ should be about twelve feet in diameter; if twelve feet in diameter and making seven revolutions per minute, the cable operated by them will have a speed of about three miles per hour; making ten revolutions per minute, the cable would have a speed of something more than four and one-quarter miles per hour if there were no slip of the drums under the cable.

I regulate the grip of the cable on the driving-drums, respectively, by means of suitable rollers, (indicated at *g* and *g′* in Fig. 3,) one of which is situate near each of said drums and arranged so as to be under control of the engineer in charge at the station, and purpose

restricting this grip so that it will never exert more than a certain allowable maximum of pulling-strain on the towing-cable.

I regulate the slack of the towing-cable between the driving-drums and the ends of the stretch by means of the tightening-drums T D aforesaid, except in periodical distributions of slack, in which I should use the driving-drums, and for the purpose of making the driving-drums applicable to this service I have devised the gearing shown in Figs. 12 and 13.

On nearly straight stretches of the canal the suspension-frames (composed of the two posts P and P′ and their guys and the suspension-cable C, set and combined as aforesaid) should be spaced so as to use about twenty-two frames per mile of canal, the intervals between frames being made as nearly uniform as may be. On bends the intervals should be lessened in proportion to increase of abruptness of the bend.

The suspension-cables should be fixed at an elevation sufficient to make them clear the head of a man standing erect on the top of any boat or boat-load that can pass under the lowest bridge spanning the stretch of canal on which such cables are to be placed. This being done, the lowest part of the rollers on the "hangers" will be out of the way of any necessary passage of persons or freights from the tow-path to boats on the canal. Suppose the towing-cable to be in motion, actuated and operating as described, and traveling on its round, hereinbefore specified, and suppose that portion of the cable that follows the tow-path side of the canal to be traveling eastward. Then any boat to be thereby towed eastward along the canal will be attached by a suitable tow-rope to that portion of the cable traveling along the tow-path side of the canal, and the course of such boat will be along the tow-path half of the canal, while boats bound in the opposite direction will move along the berme side half of the water-way, thus avoiding the risks of collision and the inconveniences and delays incident to the meeting of boats towed by teams traveling on a tow-path, according to the practice heretofore general.

Were a cable-towed boat to meet a boat towed by team, the former would sheer out into the canal, thereby enabling the team-towed boat to pass along the tow-path side of the canal without slacking her tow-rope and without any of the interruption of progress that one or the other of two team-towed boats must suffer in case of meeting. Were a canal-boat at rest to be firmly hitched by an ordinary tow-rope to a towing-cable traveling at a rate of something more than three miles per hour, no means being used to effect a gentle start and a gradual communication of motion to the boat, the resulting shock would, presumably, part the tow rope, and were a tow-rope hitched to the towing-cable used in my apparatus so as to encumber the cable with a mass of rope, or so as to leave loops or ends of rope hanging from the cable or from the tow-rope itself, such rope so hitched, when carried along by the travel of the cable, would probably catch on some part of a hanger with the effect of parting the tow-rope, and, perhaps, "jamming" a hanger-roller.

To supply means whereby a boat at rest may be readily attached to the traveling towing-cable in such manner as to effect the gentle start of and gradual communication of motion to the boat that, as above indicated, are desirable, and at the same time to avoid the objectionable incumbrance of the towing-cable that might be caused by knotting onto it an ordinary tow-rope, I have devised my combined tow-rope and slip-rope illustrated in Fig. 10. To construct this appliance, take a smooth rope, preferably a braided cord, because such cord is free from the tendency to "kink" that ordinary cordage formed by twisting has. Make the length of the rope about twice that of the ordinary canal tow-rope. Midway of this length form in or on the rope a flat loop, preferably about one yard in length. (See Fig. 10.) This loop may be formed by splicing into the rope each end of a piece of cordage of a make like that of the rope itself, or by seizing onto the rope each end of a strap of harness-leather or some other approved material. The loop-piece should be proportioned and adjusted so that when attached to the rope by either of the processes described it will, when the standing part of the rope is hauled taut, be at the same time hauled taut and lie closely along the rope, thus forming what I have called a "flat" loop.

The rope extending from either end of the loop aforesaid may be used as a tow-rope. In case of use of one half of the rope as a "tow-rope," the other half becomes what I have called a "slip-rope."

To make attachment to the towing-cable, the boatman should throw one end of the rope made as described over the towing-cable, haul in on that end and pass it through the loop, and continue to haul in on it until the leading end of the loop shall have passed over the towing-cable, returned through the loop itself, and formed a four-part noose embracing the towing-cable. The running knot thus formed will grip the towing-cable (relative lead of cable and tow-rope being constant) with a tenacity directly in proportion to the strain put on the tow-rope. The slip-rope should meantime be kept taut enough to prevent it swaying about; but with the full strain caused by ordinary towing this grip of the tow-line on the smooth cable will be hardly severe enough to prevent all slip of the noose along the cable. This is, as hereinafter indicated, a desirable condition.

I provide for timely arrest of the gripping-knot or noose certain "stops" in the shape of tapering sleeves, made of leather or other approved material, fixed along the towing-cable, as shown in Fig. 11, preferably about five hundred feet apart, all along the cable.

The boatman about to hitch to the traveling cable should place his boat with her stern only a little in advance (in the direction of intended movement of boat) of a hanger, and should cast his tow-rope, constructed as described, over the towing-cable immediately behind one of the stops aforesaid, he at the time standing at or near the stern of his boat. Then, walking forward at a speed equal to that of the cable, he will be able to form his noose and fix it on the cable before any towing strain comes on the tow-rope. Then, having taken a turn with the tow-rope around a kevel on the boat, he may, by tightening or slacking on the slip-rope, decrease or increase the grip of the noose on the towing-cable, as desired. Ordinarily the slip of the noose along the towing-cable will suffice to prevent too great a strain on the tow-rope. The pull necessary to the slipping of the noose along about five hundred feet in length of the towing-cable will ordinarily give the boat headway enough to warrant the slacking up of the slip-rope and the handling of the boat by gradually paying out and finally making fast the tow-rope; but in case of need the noose may be made to pass over the stop first encountered by it simply by giving a strong pull on the slip-rope, thereby opening the noose and relaxing its grip.

A boat should not attempt to hitch to the traveling cable at a point less than one thousand feet ahead of a boat already attached.

To cast loose from the towing-cable, the boatman will let go his tow-rope altogether and hold fast on his slip-line, thereby causing withdrawal of the noose from the cable, whereupon the tow-line may be hauled home. Thus a boat towed by cable may be brought to a standstill as readily as if towed by team.

The looped rope shown in Fig. 10 may be on occasion utilized as a spring-line or as a breast-line. Noosed onto the towing-cable as when used as a tow-rope, it may be made to hold a boat up to that bank of the canal along which she is traveling or to sheer her toward or away from that bank, as desired, and to largely facilitate the steering of the boat generally, thereby reducing the labor of the helmsman. The point of attachment of the breast-line to the towing-cable should bear somewhat abaft the beam of the boat. The point of attachment to the boat will vary with the character of the maneuver to be performed.

Obviously, all boats attached to the towing-cable will have one rate of progress, and by a properly-calculated distribution of boats along the cable and regulation of the speed of the cable boats may be made to arrive at any given point on the canal—as a lock, for instance—in such order of time as will best suit conditions existing at such point, whereby the business of the canal as a whole will be expedited.

I am aware that prior to my invention—to wit, in the year 1820—Letters Patent of the United States were granted for a machine and apparatus for towing boats along canals, &c., and across rivers, in the specification accompanying which patent the inventor describes and claims "a cord, rope, or chain" acting "upon the principle of a band or strap," the same to be "kept above and out of water by means of standards or posts planted from place to place along the middle of the canal, or by means of transverse pieces of timber laid from place to place across the canal," such endless band or chain to be actuated by water-power and made to serve the purpose of a towing-cable, to which boats, &c., are to be hooked by short hawsers or tow-lines.

I am aware, further, that the specification forming part of Letters Patent of the United States No. 130,080, for improvement in towing canal-boats, dated July 30, 1872, describes a towing apparatus wherein "the traction-power is obtained through a horizontal arrangement of endless chains" to be worked by means of "the overflow of the waste weir on the side of the lock," or, in lack of sufficient water-power, by stationary steam-power.

I am aware, further, that the patentees under French Patent No. 56,211, of date of November 12, 1862, describe their invention as a system for towing boats in canals, &c., composed, essentially, of an endless towing cable or cables driven by pulleys actuated by stationary steam-power, the driving-pulleys to be fixed above the canal or water-way, or alongside of it, according to circumstances, and the rollers for carrying the cable or cables to be fixed above the water-way upon beams spanning the same, or upon posts set alongside the canal or stream where the water-way is of a width rendering impracticable the spanning of it with beams; but they do not indicate nor suggest appliances for supporting and operating the driving-pulleys in position above the water-way; nor do they suggest the possibility of maintaining cable-carrying rollers above a water-way that is of a width rendering impracticable the spanning of such water-way with beams.

In view of the patents named I do not broadly claim as new the application of an endless cable to the purpose of towing boats, &c., in canals, nor the combination, in a towing apparatus, of an endless cable with carrying-rollers supported above the water-way of a canal, and with driving-pulleys or drums operated by stationary engines; nor do I in this application specifically claim the method or system of towing boats in canals and like waters described herein, having made such claim the subject of a separate and independent application for Letters Patent of the United States, filed July 13, 1885.

What I do hereby claim as of my invention, and desire to secure by Letters Patent, is—

1. The improved towing apparatus herein described, comprising the transverse suspension-frames, the hangers supported on and adjustable along said frames and provided with rollers, the driving-shafts provided with drums and gear-wheels, the shaft-bridge supporting

said shafts, the end drums and cable-tightening drums, the end bridges supporting said drums, the towing-cable provided with stops, and the tow-rope for connecting with said towing-cable the boat or other object to be towed, substantially as set forth.

2. In an apparatus for towing, a hanger or support provided with a spindle having journaled thereon a cable-carrying roller, W, said roller being provided with a rear member, *f*, having a cutting-edge, substantially as set forth.

3. In an apparatus for towing, the combination of the shafts N N′, having gear-wheels *a n*, and the counter-shaft V, having gear-wheels *v m*, the gear-wheels *v* and *a* being each adjustable along its shaft, whereby the said shafts N N′ may be geared to revolve in one and the same direction or in opposite directions, or be ungeared and rendered independent, substantially as set forth.

4. In an apparatus for towing by means of a driven cable, a connection for joining with such cable the object to be towed, such connection consisting of a rope or cord provided between its ends with a loop, the portions of such rope on opposite sides of the loop forming the one a tow-line and breast-line and the other a slip-line, substantially as set forth.

5. In an apparatus for towing, a towing-cable having at intervals protuberances forming stops, the same having their ends tapered, thereby to facilitate on occasion the slipping of the gripping-loop of the tow-line over and past any one of said protuberances, substantially as set forth.

6. In an apparatus for towing, the combination of the towing-cable having protuberances the extremities of which are tapered, and the tow-line consisting of a rope or cord provided between its ends with a loop, the portions of the rope extending, respectively, from opposite extremities of the loop forming the one a tow-line and breast-line and the other a slip-line, substantially as set forth.

7. In an apparatus for towing, the combination, with the water-way and the engine-houses located on opposite sides thereof, of the driving-shafts extended over said water-way, the gearing connecting said shafts, and the bridge extending across said water-way and supporting said shafts, substantially as set forth.

8. In an apparatus for towing, the combination of the end drums, E D′ E D², the drums T D, located between drums E D′ E D², the rollers *r r′*, located adjacent to said drums T D, the cable M, and the end bridges, E B, substantially as set forth.

9. In an apparatus for towing, the combination of the suspension-cable, the hanger suspended therefrom and having the clamp-plate *c*, and the clamp-bolts, substantially as set forth.

10. In a towing apparatus, the combination with the endless towing-cable and the end drums and rollers around, under, and over which, respectively, such towing-cable travels, of the suspension-frames provided with guide-rollers for said cable and the drive mechanism situate between said end drums, and having driving-drums engaging said towing-cable, whereby to drive the same, substantially as set forth.

11. In an apparatus for towing, having an endless towing-cable and drums and rollers for carrying, guiding, and regulating the same, the drive-drums and the shafts carrying such drive-drums, respectively, combined with gearing, whereby said shafts may be connected, disconnected, and operated, substantially as set forth.

JOHN M. GOODWIN.

Witnesses:
WM. H. BARNES,
P. J. BARTLESON.