Feb. 16, 1937. B. H. KERSTING 2,071,168

BARGE SHIFTER

Filed May 25, 1934 4 Sheets-Sheet 1

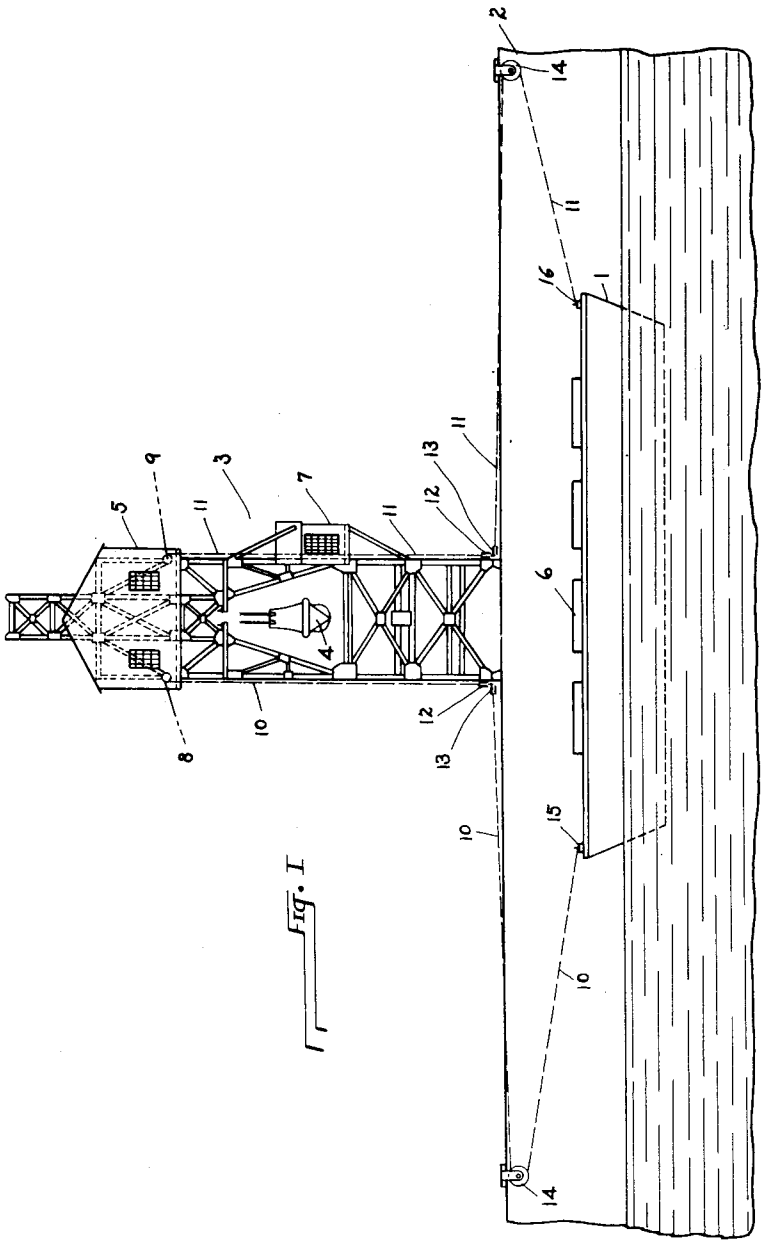


Fig. 1

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BARGE SHIFTER

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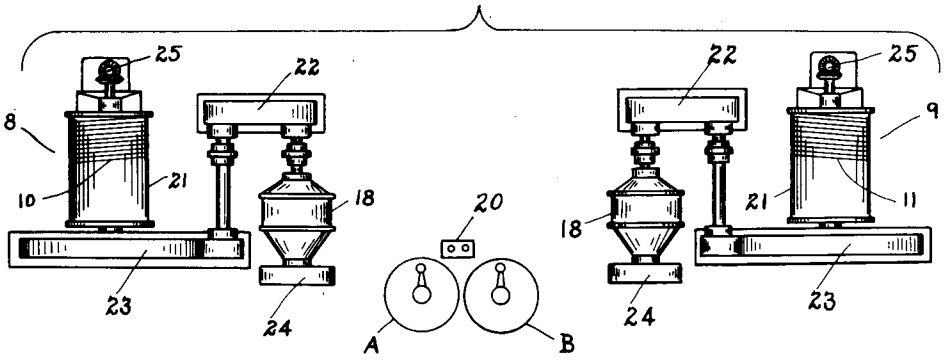


Fig. II

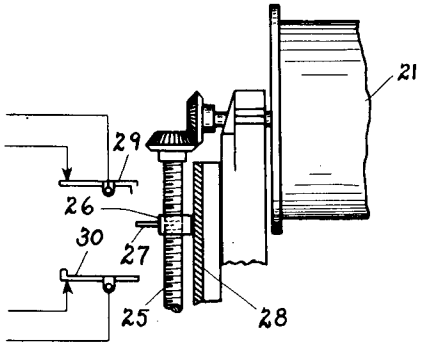


Fig. III

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BARGE SHIFTER

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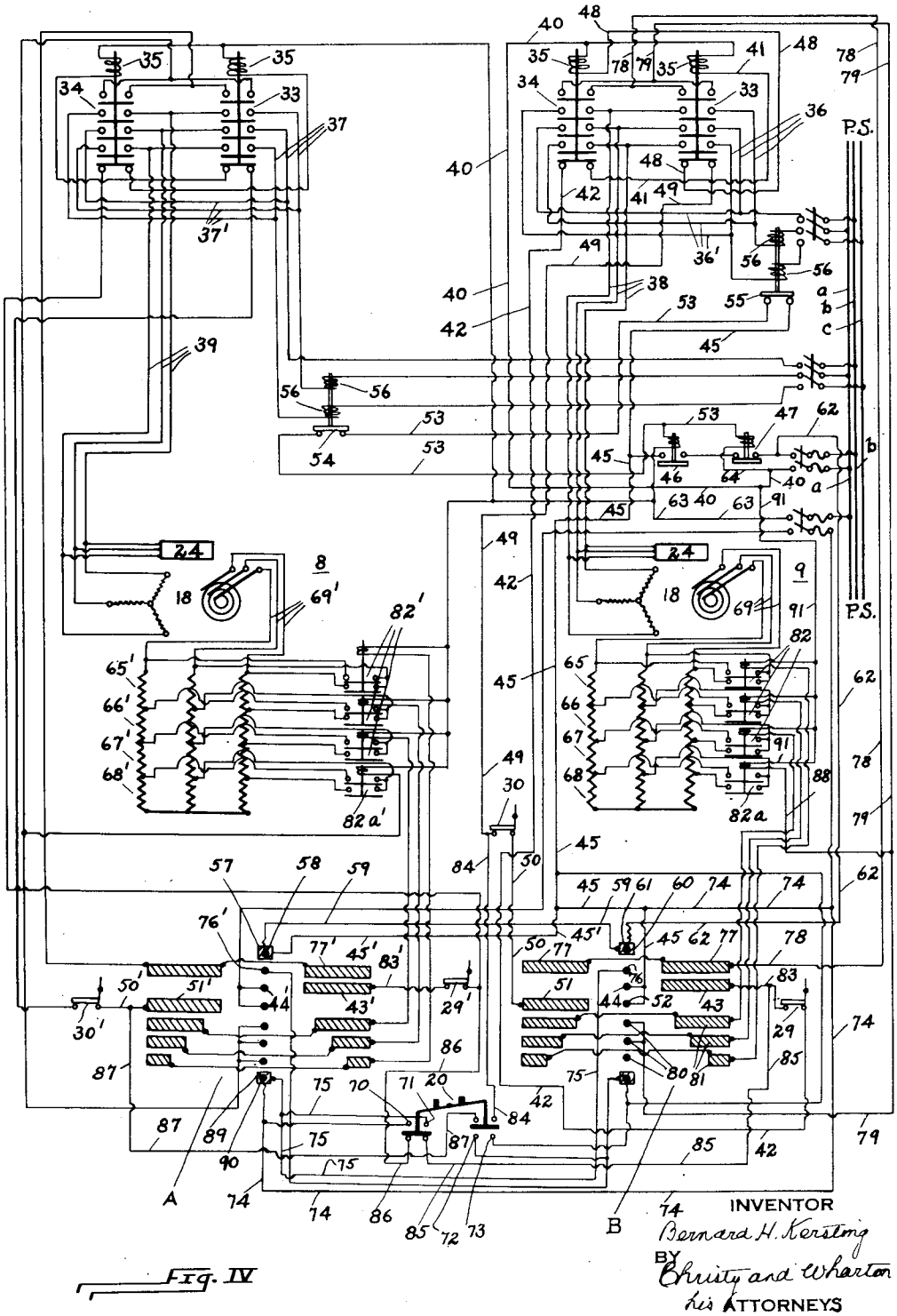


Fig. IV

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BARGE SHIFTER

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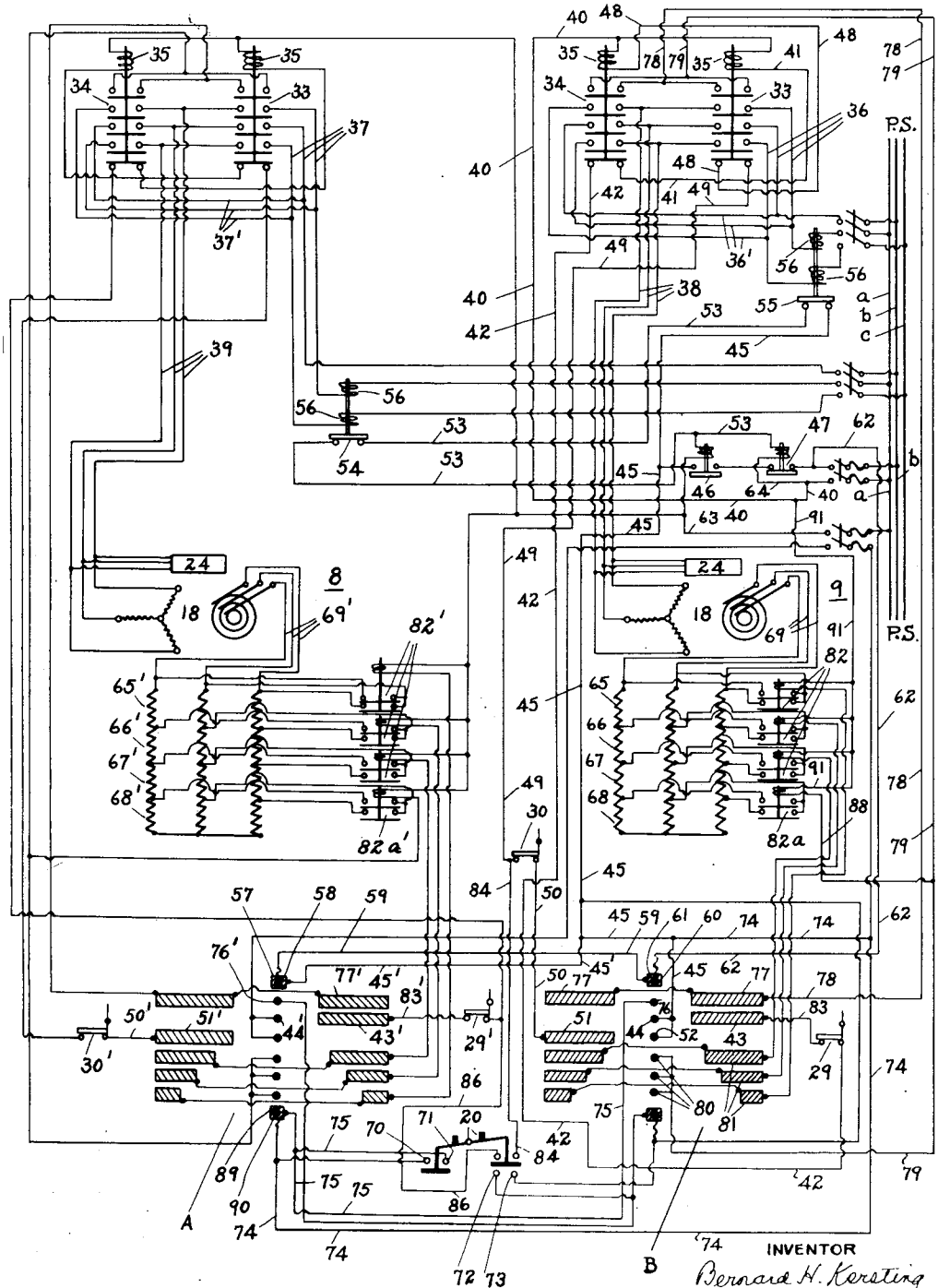


Fig. V

Patented Feb. 16, 1937 2,071,168

UNITED STATES PATENT OFFICE

2,071,168

BARGE SHIFTER

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Application May 25, 1934, Serial No. 727,431

3 Claims. (Cl. 114—230)

This invention concerns the shifting of loads, and finds practical application in shifting a barge along a dock, to the end that one and another of the hatchways that give access to the hold of the barge may be brought to position beneath loading and unloading apparatus—a crane, for instance, equipped with a clam-shell bucket capable of traveling vertically in a fixed path.

This application is in part a continuation of an application for Letters Patent of the United States, filed by me September 6, 1933, Serial No. 688,345.

Essentially the barge-shifting apparatus includes two cables, one secured to each of the opposite ends of the barge, and extending from the boat, fore and aft, to guide pulleys and thence to the drums of winches. The two cables are wound upon separate drums, and winch machinery is provided to effect at will separate rotation or coordinated rotation of the drums. According as the drums are driven together in one or the other direction of rotation, one or the other cable is paid out while the companion cable is drawn in, and in consequence the barge is shifted ahead or astern.

It has been the practice in apparatus of this sort to drive the two drums by means of a single motor, and the apparatus necessarily includes an elaborate system of gearing, clutches, and brakes. While the winch motor may be an electric motor, and, as such, may be easily controlled so far as its own operation is concerned, the clutches for each drum are mechanical things, requiring constant and skillful supervision to maintain them in proper correlation. As a matter of fact, to maintain both cables in the required taut condition during the barge-shifting operation, the drum which is paying out cable is restrained by its brake, while the drum which is taking in cable is clutched for positive rotation to the winch motor. Effective operation requires constant manipulation of the clutches and brakes, and calls for extraordinary skill upon the part of the operator.

Winch machinery of the above-described sort is relatively complicated and costly, and as I have indicated requires skilled attention during operation. The object of my invention is to provide simple apparatus, capable of operation in simpler manner. I provide a mechanically independent winch unit for each of the two cables. Each winch unit is of a simple and standard construction, and comprises a drum, a motor, and a set of interconnecting driving gears. I provide electric means, including a simplified control, for operating the two winches and in the manner best adapted to produce the quick and accurate shifting of a boat.

In the accompanying drawings, I illustrate how the invention is advantageously embodied in a coal-unloading tower, and I show in side elevation in Fig. I a boat dock, upon which a typical unloading tower is erected; Fig. II is a view to larger scale, showing diagrammatically and in plan from above the two winch units, and the means for controlling their operation in accordance with the invention; Fig. III is a fragmentary view to still larger scale of one of the winch drums, and shows in side elevation an electric switch mechanism which automatically limits, within a predetermined range, the rotation of said drum; and Figs. IV and V are wiring diagrams.

Referring to Fig. I of the drawings, a coal barge 1 is shown moored to the dock 2. An unloading tower 3 of approved and well-known construction is built upon the dock, and in accordance with usual practice is adapted to operate a clam-shell bucket 4. In the engine-house 5 of the tower, bucket-operating machinery is arranged, and, manifestly, the tower structure may be used either in loading or unloading the barge 1. Let it be supposed that the barge is loaded and that the tower is operating for removal of its cargo. In such operation the clam-shell bucket is lowered through one of the hatchways 6 and into the hold of the barge, and there the opened bucket is closed upon the material to be removed; the closed bucket then is raised to the position shown in Fig. I, and shifted by known means in the direction of the line of sight of Fig. I from a position directly above the barge to the position in which emptying is to be effected—a position, for example, directly above a freight car (not shown). The bucket then is opened and its load discharged. Subject to the control of an operator stationed in cab 7, the machinery in the engine-house 5 effects repeated operations of the bucket, and so the barge is unloaded. From time to time it is necessary to shift the barge along the dock, so that, as unloading progresses, the hatchways 6 of the barge one after another may be brought to position beneath the bucket. As already mentioned, my invention is found in means to this end.

In the engine-house 5, I install two power winches 8 and 9. The two cables are severally anchored to and wound upon the drums 21 of the two winches. From the drums of winches 8 and 9 the cables 10 and 11, trained upon suit-

ably placed sheaves 12, 13, and 14, extend downward, forward, outward, and inward again and are made fast at 15 and 16 to the bow and stern of the barge. Subject to the control of the operator the drums of winches 8 and 9 may be jointly rotated clockwise, paying out the cable 11 and winding in the cable 10, and thus effect the right-to-left movement of the barge 1 (Fig. I). Alternately, the drums may be simultaneously rotated counter-clockwise, and the barge shifted astern—from left to right, Fig. I. In this manner any one of the hatchways may be brought to position beneath the bucket. A brake is organized with each winch, and, save when the winches are in motion, the brakes remain applied, to hold the cables 10, 11 taut and to hold the barge in that position to which it has been brought. In order to make accommodation to boats of various lengths, it is necessary that the winches shall be severally operable, so that one or the other cable may be taken up or paid out independently. To meet this requirement, I have provided an electric control which at the will of the attendant is adapted to effect either joint or several operation of the winches 8, 9.

Referring to Fig. II, each winch unit includes a three-phase electric motor 18, and the connection of the motor to drum 21 is through reduction gear units 22, 23. An electrically-released brake 24 is organized with the shaft of the motor, and normally (that is, when the winch is at rest) the brake is in applied position. When, however, the motor is energized, the brake is electrically released and remains in release so long as the motor is turning. Brakes of this nature are well known, and a detailed structural description of them is unnecessary to further an understanding of the invention. A master controller is provided for the control of each winch—a controller A for which winch 8, and a controller B for winch 9. The electric control circuits for the motors include a selector switch 20 having two operative positions: In one position of the switch both motors 18 respond to operation of either controller A, B (Fig. II); and in the alternate position of the switch, the two winches are severally responsive, one to each of the controllers A, B.

In each winch unit I provide means for automatically limiting the number of revolutions that the drum 21 may make in either direction of rotation, and thus I insure against the complete unwinding of the cable from the drum, and insure against winding in the cable so far as to withdraw it from the sheaves 14, or to cause damage of any sort due to overwinding. The means for providing this safeguard comprise a threaded shaft 25 (Fig. III) geared to rotate in accord with rotation of the drum 21. Upon shaft 25 is a nut 26, having finger 27 projecting from its side; a guide 28, preventing rotation of the nut, permits it to move longitudinally of the shaft; rotation of the drum in clockwise direction effects the rise of nut 26, and counter-clockwise rotation effects the downward travel of the nut upon the shaft. In the path of finger 27, I provide two limit switches 29 and 30; the limit switches are pivotally supported at spaced-apart points, and normally they stand in the circuit-closing positions in which they are illustrated. It is essential that the limit switches be closed for the motor to receive energy. Rotation of the drum may progress in one direction until the finger 27 in moving upward engages and swings the switch 29 to open position, and rotation of the drum may continue in the opposite direction until the finger, in moving downward, strikes and swings the switch 30 to open position. Upon the swinging of either switch to open position, the motor is deenergized and rotation of the drum ceases. Thus, it will be perceived that it is merely a matter of adjusting the relative positions of the switches 29, 30, to determine the range of rotation of the drum 21.

Manifestly the winches might be installed on the dock 2, at the opposite ends of the berth for the barges to be unloaded; that is to say, at the points where the sheaves 14 are shown in Fig. I. In such case the cables would be shorter and they would extend in direct course to the points of their attachment to the bow and stern of the barge. However, in the installation illustrated, it has been deemed advantageous to arrange the winches in the engine-house 5 of the tower, where together with the other machinery they are subject to the supervision of the engineer. By the positioning of the sheaves 14 the winches are made effective in spaced relation along the dock.

Turning to the wiring diagram, Fig. IV, the motors 18 and the electrically-released brakes 24 of the two winches 8 and 9 are indicated diagrammatically, as also are the drum-type controllers A, B. The control circuits include a pair of master switches 33, 34 for each of the motors 18; each master switch has five pairs of contacts, together with five contact arms adapted electrically to unite the contacts of each pair; the contact arms of each master switch are movable between alternate positions—in one of their alternate positions (the position in which they are shown in Fig. IV) the four upper arms lie free of the contacts and the lower contact arm is closed upon the lower pair of contacts, while in their alternate positions, into which positions the contact arms are moved in response to the energizing of magnet coils 35, the four upper pairs of contacts are closed and those of the lower pair are not.

The conductors of a three-phase power supply P. S. are electrically connected by the three wires 36 to the three middle pairs of contacts in the master switches (33, 34) for the control of winch 9, and by the three wires 37 to the three middle pairs of contacts in the master switches for the control of winch 8. Conductors 38 lead from one set of master switches 33, 34, to the motor 18 of winch 9, and conductors 39 lead from the other set of master switches to the motor 18 of winch 8. As may be perceived in the drawings, the three central pairs of contacts in each master switch 34 are, by wires 36', 37', wired electrically opposite to those of the companion switch 33. Accordingly, when either master switch 33 is energized, the motor 18 controlled by it is energized and rotates clockwise, and when either master switch 34 is energized, the corresponding motor is energized for counter-clockwise rotation. Simultaneously with the energizing of either motor 18 for rotation in either direction, the brake 24 which is organized with the motor is released. As mentioned above, the brakes 24 are normally held mechanically in applied position, and are shifted into release position when energized by electric current. The supply lines 38, 39 of each motor are severally connected to each brake 24, and, accordingly, it will be understood that the brakes are released when the supply lines 38, 39 are energized to run the motors in either direc-

tion, and are restored to braking position upon the deenergizing of such motor supply lines.

It will suffice to describe particularly the circuits and controls of one of the winches, and I shall describe those of the winch 9. The master switches 33, 34 are electrically interlocked; that is, they include electric interlocking means which prevent one switch from being closed so long as the other is in closed position. The electric interlocking means comprise the lowest pair of contacts in each of switches 33, 34. The lowest pair of contacts in switch 34 is included in the energizing circuit for the magnet coil 35 of switch 33, and the lowest pair of contacts in switch 33 is included in the circuit for energizing the magnet coil 35 of switch 34. Inasmuch as the lowest pair of contacts in each master switch are electrically closed only when the switch is in motor-deenergizing position (the illustrated position), it will be understood that neither master switch can be operated to run the motor 18 until the other switch has been placed in "off" position, i. e. motor-deenergizing position.

The energizing circuit for the master switch 33 includes the wire 40, running from one terminal of its magnet coil 35 to line *a* of the power supply, and the wire 41, running from the other terminal of coil 35 to one of the two lower contacts of switch 34. From the other of such contacts the wire 42 extends to limit switch 29, thence connection is made, by wire 83, to the contact plate 43 on the controller B. From contact finger 44 of the controller the wire 45 extends to two under-voltage relays 46 and 47, and the circuit passes through the contacts of these relays in series to the line *b* of the power supply P. S. Similarly, the energizing circuit for the magnet coil of master switch 34 includes the wire 40 running to power line *a*, the wire 48 running to the lower pair of contacts of switch 33, the wire 49 running to limit switch 30, the wire 50 running from the limit switch to controller contact plate 51, and from finger 52 the circuit runs to the power supply line *b*, through the wire 45 and the relays 46, 47.

These under-voltage relays must be closed before the master switches 33, 34 (subject, as will presently appear, to the control of controllers A, B) can be operated to run the motors. The closing of the under-voltage relays is effected by means of an auxiliary circuit comprising a wire 53 running from the upper terminals of the magnet coils of the relays, through the contacts of two overload relays 54 and 55, whose contact poles are connected in series by wire 53, and whose energizing coils 56 are located respectively in the lines 36 and 37, running from the power supply lines P. S. to the master switches 33, 34 for the winches 8, 9. From the overload relay 55 the energizing circuit for relays 46, 47 continues through wires 45 and 45' to the contact plate 57 of controller A; from contact finger 58 of such controller, a line 59 runs to the contact plate 60 of the controller B, and from contact finger 61 of controller B a line 62 runs to the line *b* of the three-phase power supply P. S. The lower terminals of the magnet coils of the relays 46, 47 are connected respectively, by means of leads 63 and 64, to the line *a* of the power supply lines. Thus, when both controllers A, B are in their illustrated "off" positions, the relays 46, 47 are energized, assuming of course that there is no overload in either motor to open one or the other of relays 54, 55.

It will be noted that, when the two relays 46, 47 have been energized (by placing the two controllers A, B in "off" positions), the contact poles of the relays are connected in series to the power supply line *b*, whereby the energizing circuit for the relays is shunted from the wire 45, through the relay contacts to the power line *b*, instead of running through wire 45' and the contacts 57, 58 of controller A. Accordingly, when the relays 46, 47 have once been energized, the controllers A, B may be moved from "off" positions, without disturbing the relays. Now let it be supposed that in service the winch 9 is required to pay out cable. The controller B for the winch is so shifted that its contact plate 43 engages the contact finger 44. The energizing circuit for the master switch 33 is closed; the master switch 33 is energized; the wires 38 are charged; the brake 24 is released; the motor 18 rotates clockwise; and the cable 11 (Fig. I) is paid out. The operation continues until the controller is restored to neutral or "off" position, or until rotation of the winch drum has reached the predetermined limit of its clockwise rotation, whereupon the limit switch 29 is swung open, the energizing circuit of the master switch 33 is opened, and all parts are restored to their initial positions. Similarly, by turning the drum controller B in the opposite direction, the contact plate 51 and contact finger 52 are brought into engagement, and the energizing circuit for the master switch 34 is completed. In consequence the master switch (34) is energized; the brake 24 is released; the motor is operated in counter-clockwise direction; and the winch reels in the cable. The limit switch 30 is included in the last-named circuit, and thus overwinding of the cable is prevented. If, during the operation of the winch, the line voltage falls to a value where the operation of the winch motor becomes uncertain and the motor lacks sufficient power to move the cables as required, the relays 46, 47 automatically open, and break the energizing circuit to the master switch (which at the time is in position to effect motor rotation), thus causing the master switch to swing into release position, and to deenergize the motor supply lines 38, whereupon the brake 24 is set. Accordingly, the cables 10, 11 are always under control, and the barge 1 is always restrained, even though the winch-operating power suddenly fails. It is further noteworthy that the overload relays 54, 55, normally closed, open when excessive or dangerous current flows through either winch motor; and by opening they interrupt the energizing circuit of the relays 46, 47. Thus, by means of relays 46, 47, 54, 55 the apparatus is safeguarded against under-voltage and overload current conditions.

In accordance with general practice each winch motor is provided with a series of resistance units in its rotor circuit (69, 69'), and means are provided to short out such resistance units in delayed succession, to the end that the motor may be gradually accelerated to operating speed. In the motor circuit 69 of winch 9, the resistance units 65, 66, 67, 68 are controlled each by a resistor relay 82, subject to the control of controller B, and the motor for winch 8 includes in its circuit 69' resistance units 65', 66', 67', 68' under the control of resistor relays 82' which are controlled by controller A.

As mentioned above, the winches 8, 9 may be operated jointly or separately, and I shall consider first how the equipment functions, to effect the independent operation of winch 9. When, as explained, the controller B has been operated to

energize, say, the master switch 33, the brake 24 is released and the motor operates at slow speed, with the upper three units of the accelerating resistances (65, 66, 67, 68) included in the rotor circuit 69 of the motor. For individual operation of the winches, the selector switch 20 is in the alternate position from that in which it is shown in the wiring diagram; that is, the switch 20 is in position to unite contact 70 with 71 and contact 72 with 73. The electric circuits for controlling the relays 82 and resistance units 65–68 (to regulate acceleration of the motor) are as follows: The wire 45 (connected, as explained, through relays 46, 47 to line *b* of the power supply P. S.) is connected by wire 74 to selector switch contact 70; from selector switch contact 71 wire 75 extends to contact finger 76 of the controller B; the plate 77 which, upon rotation of the controller is engaged by finger 76, is connected by wire 78 (through the upper pairs of contacts in switches 33, 34) to wire 79 which is connected to the three accelerating fingers 80 in the controller B. The fingers 80 severally cooperate with contact plates 81 in such manner that the accelerating relays 82 are energized to cut out, one after another, the resistor units (67, 66, 65) in the rotor circuit 69 of the motor. That is to say, as the drum controller B is rotated by the operator, the resistor relays 82 are successively closed, and in consequence the resistance in the rotor circuit of the motor is decreased step-by-step, so that the rotation of the motor is gradually accelerated to operating speed. It will be seen that the contact plates 77 and 81 are paired or duplicated on opposite sides of the contact fingers 76 and 80, so that in individual operation of the winch 9, the rotation of the controller drum to one side of its "off" position will effect and regulate clockwise rotation of the motor 18, while rotation of the controller drum in the opposite direction will effect and regulate counter-clockwise rotation. What has been said above with respect to the controller B and motor 18 for winch 9, applies to the controller A and to the motor 18 of winch 8—i. e., for individual operation of the winch.

Individual operation of the winches is requisite, to admit of the independent adjustment of the cables, and, when by such individual operation the cables have been brought to proper adjustment, the selector switch 20 is thrown to "group" position, the position (shown in the wiring diagram) in which the two controllers operate in conjunction, to effect the simultaneous operation of the winches in one direction of turning or the other. When the selector switch 20 is positioned for such joint operation of the motors, the contact plate 51 of controller B is, by wire 50, limit switch 30, wire 84, selector switch 20, wire 87, wire 50', connected to contact plate 51' of controller A; and contact plate 43 of controller B is, by wire 83, wire 85, selector switch 20, limit switch 29', and wire 83', connected to plate 43' of the other controller. Thus, the two controllers A, B are so interconnected that both winches respond to the operation of the controller A, to effect the shifting of the barge 1 from right to left (Fig. I), and to the operation of the controller B, to effect the shifting of the barge from left to right.

Next, I shall consider the joint operation of the winches, to shift the barge, say from left to right, Fig. I. The selector switch 20 is first shifted from "individual" to the "group" position in which it is illustrated in the wiring diagram, and then the controller B is rotated in such direction as to move the contact plates 51 and 77 severally into engagement with the contact fingers 52 and 76. The controller A stands in "off" position, and its contact plate 51' is connected through the selector switch with plate 51 of controller B. It will be perceived, therefore, that the rotation of the controller B effects the energizing of the master switches 34 of both winches 8, 9, whereupon the brakes of both winches are released, both motors 18 are energized and begin slowly turning counter-clockwise, cable 10 is paid out and cable 11 drawn in, and the barge begins to move from left to right. Upon shifting controller B and moving plate 77 into contact with contact finger 76, a circuit is closed through the energizing coil of resistor relay 82*a*, and consequently the resistance unit 68 is shorted out of the rotor circuit in the motor of winch 9. The circuit which energizes the relay 82*a* runs from one terminal of the relay-energizing coil through wire 88, wire 79, the upper contact poles of master switches 33, 34, wire 78, contact plate 77, finger 76, wire 75, contact plate 89 and finger 90 of controller A, wire 74, wire 45, and under-voltage relays 46, 47 to power line *b*; and from the other terminal of the relay 82*a* the circuit runs through lines 91 and 40 to the power line *a*. Thus, it will be understood that, when the controller B is shifted to energize the master switches 34, it simultaneously energizes the resistor relay 82*a*, and shorts out resistance unit 68 in the motor circuit of winch 9. Inasmuch as controller A stands in "off" position, none of the resistor relay 82' is energized, so that all four resistance units 65'–68' are effective in the motor circuit of winch 8, while, as noted above, only three resistance units (65, 66, 67) are effective in the motor circuit of winch 9. Accordingly, the motor of winch 9—the winch which is winding in cable—receives more electric energy than that of winch 8; winch 9 tends to rotate faster than the winch 8, which is the paying-out winch in this case. Thus, the motor of winch 8, in tending as it manifestly does to lag behind the motor of winch 9, provides a drag upon the joint operation of the winches, and serves to maintain the paid-out cable 10 under tension. As the controller B is further rotated to accelerate the barge-shifting operation, the resistor units (67, 66, 65) of winch 9 are successively shorted out of the motor circuit 69, while all resistor units (65', 66', 67', 68') of the motor of winch 8 remain in circuit. Thus, during the operation, the motor of winch 8 produces a drag on the cooperating winch 9, and (regardless of the speed or acceleration of winch 9) winch 8 is effective to maintain the cables 10, 11 taut.

In case the barge is to be shifted in the opposite direction (right to left, Fig. I) the controller A is operated in such direction as to bring contact plates 43' and 77' into engagement with the contact fingers 44' and 76', respectively. Thereupon, an energizing circuit is closed through each of the magnet coils 35 of master switches 33. The master switches 33 close, energize the motor lead lines 38, 39, and in consequence effect the release of brakes 24 and the clockwise rotation of the motors 18. Thus, winch 9 pays out cable 11, winch 8 reels in cable 10, and the barge is shifted. It will be understood that, as the contact plates 43' and 77' of controller A are shifted into engagement with contact fingers 44' and 76', an energizing circuit is closed through the resistor relay 82*a*', and resistance unit 68' is shorted out of the motor in winch 8, in the same manner

that the resistance 68 was shorted out of the circuit of the motor of winch 9 in the first-described joint operation of the winches. Accordingly, while effecting the right-to-left shifting of the barge, winch 8 has less resistance in its motor circuit than winch 9, and, consequently, winch 8 tends to operate faster than winch 9, so that the cables are maintained taut in the manner and for the purpose already described. It will be understood, therefore, that in the joint operation of the winches 8, 9 the motor 18 of the winch which is paying-out cable always has more resistance in its rotor circuit than the other motor which is effecting the reeling in of cable. The motors are unequally energized, so that the motor of the paying-out winch tends to rotate at a slower speed than the reeling-in winch, in consequence of which the paid-out cable is always under sufficient tension to hold the barge in place against the dock.

I have found it best to cause the two winches, when in simultaneous operation, to receive rotative impulses in the same direction; but, in consequence of inequality in the resistance interposed in the circuits of their motors, to rotate in response to impulses of different magnitudes. The effect of this is that the winch responsive to the major impulse exerts upon the companion winch a tendency to turn faster than its motor would drive it, and the barge is held snug to the dock while being shifted. In Fig. V the wiring shown is such that the motors for the two winches when simultaneously energized tend to rotate the two winches in opposite directions; but, because of the inequality in the effective value of the two impulses, one overcomes the other and the two winches actually turn in uniform direction, and the barge is held snug to the dock in shifting. Either arrangement is permissible; I prefer that shown in Fig. IV and first described.

Referring to details shown in Fig. V, the circuit derived from the source of power flows from plate 51 in controller B, through wire 80, to limit switch 30; there it divides. One branch flows through wire 49, wire 48, and coil 35 of switch 34, motor B, to wire 40, and thence to the source of power again. The other branch flows from limit switch 30, through wire 84, selector switch 26, wire 87, wire 86, and coil 35 of switch 33 of motor A, and thence through wire 83 to the source of power. The two rotative impulses thus imparted to the two winches are opposite in direction; not uniform, as in the case illustrated in Fig. IV.

When the controller B is moved so that plate 51 makes contact with finger 52, then as previously described the resistances 66, 67, and 68 are included in the rotor circuit of motor B and simultaneously resistances 65', 66', 67', and 68' are included in the rotor circuit of motor A. The additional resistance 65' reduces the torque produced by motor A, and allows motor B to overcome the tendency of motor A to rotate in the opposite direction.

In similar manner, when controller A is moved so that plate 43' makes contact with finger 44', the two motors are energized in a similar manner as before, except that the torques are in relative magnitude inverted, and the torque upon motor A exceeds that upon motor B.

The alternate coils 35 are arranged for individual operation of the two winches, as described in connection with the diagram, Fig. IV.

I claim as my invention:

1. In apparatus for shifting a movable container, the combination of two winches including each an electric motor and drum, two cables anchored severally to and wound upon the two said drums and adapted to be secured to the movable container at opposite ends thereof, a power supply line, a controller for each motor, a selector switch, and interconnecting leads, whereby (the switch being in one position) the motors are severally responsive to the controllers for rotation in either direction, and (the switch being in alternate position) the motors are responsive to the controllers for joint operation in either direction of rotation, and means responsive to said controllers for effecting the unequal energizing of said motors during their joint operation.

2. In apparatus for shifting a movable container, the combination of two winches including each an electric motor, a drum, and an electrically-operated brake, two cables anchored severally to and wound upon the two said drums and adapted to be secured to the movable container at opposite ends thereof, a power supply line, a controller for each motor, a selector switch, and interconnecting leads, whereby (the selector switch being in one position) the motors and brakes are severally responsive to the controllers, and (the switch being in alternate position) the motors and brakes are jointly responsive to either controller.

3. The structure of claim 2, together with means for effecting unequal energizing of the motors during their joint operation.

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