Oct. 10, 1950 W. G. WHITE 2,524,863

MOORED MINE SWEEPING METHOD AND DEVICE

Filed Oct. 1, 1942 2 Sheets-Sheet 1

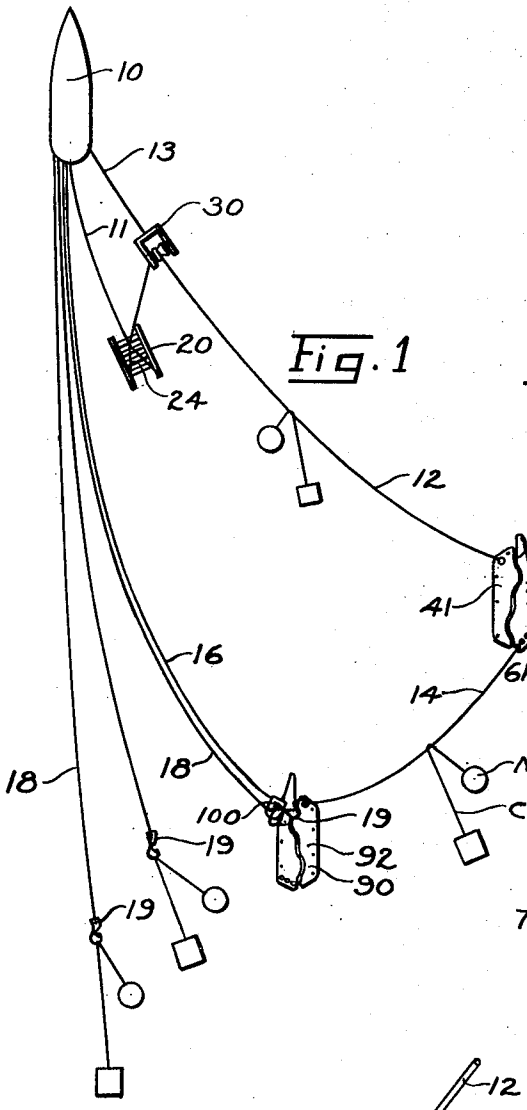

Fig. 1

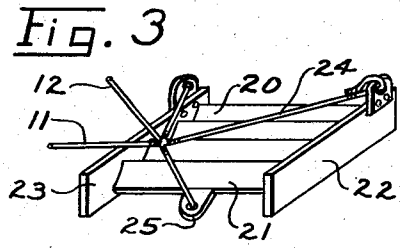

Fig. 3

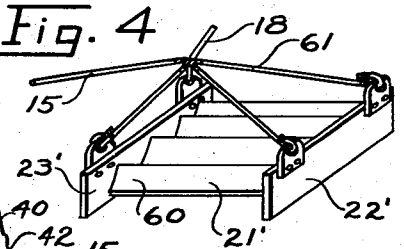

Fig. 4

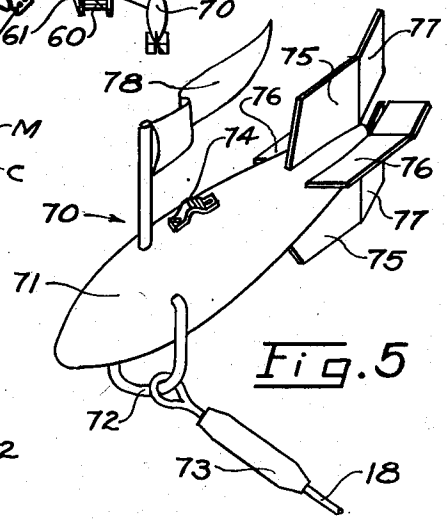

Fig. 5

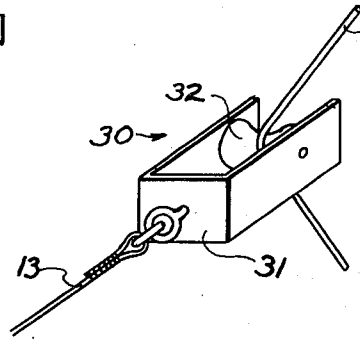

Fig. 6

INVENTOR
BY W. GORDON WHITE
ATTORNEY

Oct. 10, 1950 W. G. WHITE 2,524,863

MOORED MINE SWEEPING METHOD AND DEVICE

Filed Oct. 1, 1942 2 Sheets-Sheet 2

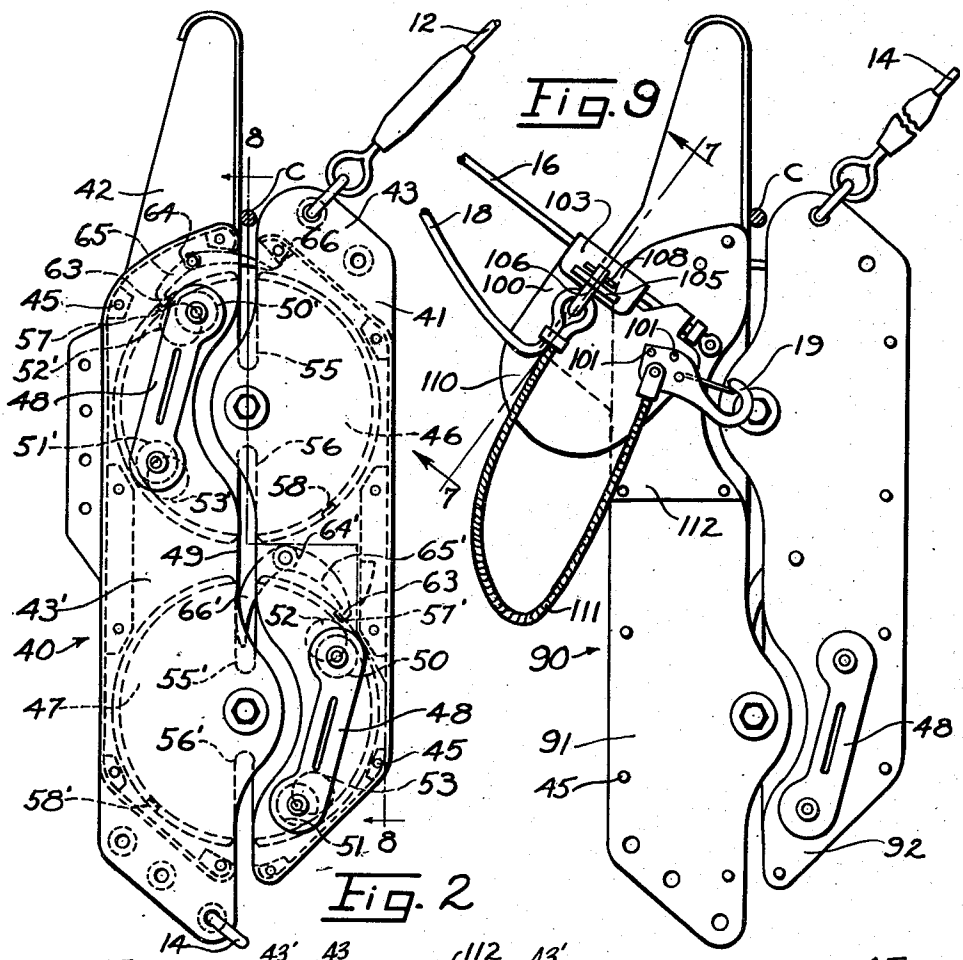

Fig. 9

Fig. 2

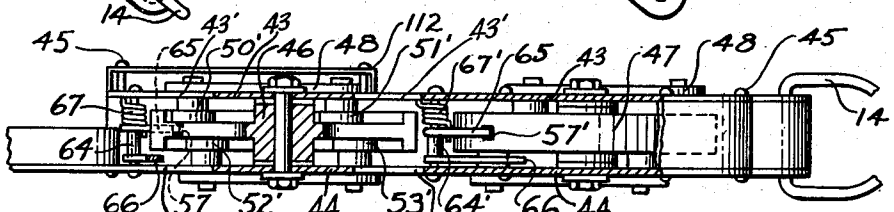

Fig. 8

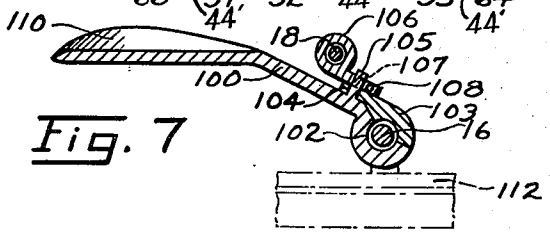

Fig. 7

INVENTOR
W. GORDON WHITE
BY
ATTORNEY

Patented Oct. 10, 1950 2,524,863

UNITED STATES PATENT OFFICE

2,524,863

MOORED MINE SWEEPING METHOD AND DEVICE

Wilfrid Gordon White, United States Navy

Application October 1, 1942, Serial No. 460,465

7 Claims. (Cl. 114—235)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

1

This invention relates to mine sweeping and particularly to an improved method of and apparatus for sweeping moored mines.

Prior art methods of sweeping for moored mines consist of towing through the mined area a sweep wire containing a suitable cutting apparatus for severing from its mooring the anchoring cables of the mines engaged by the said sweep wire, thereby allowing the mine to float clear of its anchoring means and to appear on the surface of the water to afford an opportunity for detonation by means of rifle shot from aboard the towing vessel. The primary disadvantage to the use of these prior art methods is that they can be executed only during hours of daylight.

It is an object of my invention to provide a new and improved method of mine sweeping which will permit continuous sweeping of a presumptively mined area.

The above object of my invention is obtained through the utilization of a novel apparatus which operates upon collision with an anchoring cable of the mine so as to pass the said anchoring cable through the search wire and into securing engagement with a towing cable streamed from said towing vessel. The engaged mine may be then safely towed at a distance from the mine sweeper or may be transferred to another ship for complete recovery. By utilizing such an apparatus, mine sweeping operations may be executed with increased safety for vessels streaming in formation in tactical sweeping.

It is also an object of this invention to provide apparatus suitable for carrying out the above method.

It is a further object of this invention to provide a device by means of which the anchoring cable of the moored mine may be passed through the sweeping rigging to engage a hook secured to the end of a tow line.

Other objects, uses and advantages of this invention will become more apparent during the course of the following description of a single specific embodiment illustrated in the accompanying drawings in which:

Fig. 1 is a diagrammatic illustration of a single ship sweep embodying the method of my invention;

Fig. 2 is a plan view of the gate mechanism used in Fig. 1;

Fig. 3 is an enlarged perspective view of the depressor utilized in Fig. 1;

Fig. 4 is an enlarged perspective view of the otter utilized in Fig. 1;

2

Fig. 5 is an enlarged perspective view of the float utilized in Fig. 1;

Fig. 6 is an enlarged perspective view of the traveler utilized in Fig. 1;

Fig. 7 is an enlarged elevational view in cross section of the vaned supporting plate for the hook illustrated in Fig. 9;

Fig. 8 is an elevational view in cross section of the gate mechanism shown in Fig. 2, the section being taken on line 8—8; and

Fig. 9 is a plan view showing the vaned supporting plate in position on the stern gate.

Referring now to the drawings and particularly to Fig. 1 which illustrates the preferred form of my invention, the reference number 10 designates the mine sweeping vessel of a single vessel sweep. Streamed from the stern of the vessel 10 is a depressor tow rope 11 to which is secured the depressor 20. The details of the depressor are shown enlarged in Fig. 3 and as illustrated include a plurality of parallel planing surfaces 21 secured to the side members 22 and 23. The depressor is towed at an angle to the surface of the water by means of a three-legged bridle 24 which is secured to one of each of the side members and to the middle brace 25 so that the pressure of the water acting on the plane surfaces 21 drives the depressor downwardly to hold at a desired depth that portion of the sweep wire 12 which extends between the depressor bridle 24 and the traveler 30. The traveler 30 is shown secured to the vessel 10 by means of the span pendant 13 fixed to the sweep side of the vessel at a point forward of the depressor tow rope 11. The traveler as shown enlarged in Fig. 6 consists of a block 31 and a sheave 32 journaled therein. The sweep cable 12 is threaded through the block 31 and about the sheave to engage the bridle 24 of the depressor 20. The other end of the sweep wire 12 is secured to the inboard segment 41 of the outer gate 40. The outboard segment 42 of this gate is secured to a paravane or otter 60 by means of a pendant 15.

The details of the paravane or otter 60 are clearly shown in Fig. 4. In construction the otter is similar to the depressor except that a four-legged bridle 61 is used and the middle brace member is not provided. A float 70 is secured to the bridle 61 of the otter 60 by means of a line 18 the length of which controls the depth to which this end of the sweep wire is submerged. The float 70 as shown in Fig. 5 consists of a torpedo shape buoyant chamber 71 designed to be towed by line 18 secured to the swivel 73 of the pivoted bale 72 which hangs beneath the

float. The top bridle 74 is provided for lifting the float on an even keel. The float 70 has secured at each side thereof extending therefrom a pair of planing surfaces 76 and also has a pair of vertical fins 75 to each of which a hinge rudder 77 is secured at their after ends. The rudder 77 serves the purpose of assisting the otter 60 to sheer the sweep outward and away from the towing vessel. The float as illustrated is also provided with a suitable flag 78 so that it may perform the dual function of maintaining the search wire 12 at a desired depth and visibly marking the extremity of said sweep.

A rearwardly extending sweep wire 14 is utilized to connect the outboard segment 42 of the outer gate mechanism 40 with the outboard segment 92 of a stern gate 90. The stern gate is towed by means of a trailer wire 16 at a distance astern and inboard the outer gate mechanism 40. A tow wire 18 carrying a snap hook 19 is fastened to a vane supporting plate 100 so as to be passed down the trailer wire 16 into a position of receiving engagement with the anchoring cable of the moored mine which has been encountered by the search cable 12, passed through the outer gate mechanism 40, swept astern and inboard along the sweeper wire 14 to the entrance of the stern gate 90. The anchoring cable *c* of the mine M on engagement with the snap hook 19 shears the pins 101 to free the hook 19 from the supporting plate 100 so that the supporting plate and hook will be dropped clear of the stern gate 90; thus providing space for another supporting plate, hook, and tow line to be passed down the trailer wire 16 into a position of abutting engagement with the inboard segment 91 of the stern gate 90 whereby to engage another anchoring cable of a mine on its passage through the stern gate 90.

Figs. 7 and 9 show in detail the structure of the vaned supporting plate 100 and the means for releasably securing the supporting plate to the trailer wire 16 so that it may be passed down the trailer wire into a position of abutting engagement with the segment 91 of the stern gate 90 and severed from the trailer wire 16 after the anchoring cable has completed its path through the stern gate 90. The hook 19 is removably secured to the supporting plate 100 by the shear pins 101 so as to project into the path of the anchoring cable of the mine M to engage the said anchoring cable as it traverses the circuitous path formed by the profile of the segments 91 and 92 of the stern gate 90. As illustrated in Fig. 7 the forward portion of the vaned supporting plate 100 is configured to provide a recess 102 for the trailer wire 16. A cap 103 covers this recess to completely encompass the wire 16 thus securing the plate 100 to the wire but providing sufficient play between the cap, plate, and wire to permit the plate to move down the wire by that component of the resultant force of the water acting upon the vane 110 as it is towed through the water, which has a direction along the said wire. The cap 103 has an opening 104 formed in its surface to receive the projecting lug 105. The eyebolt 106 through which the tow line 18 is inserted is passed through a drilled opening 107 formed in the lug 105 to hold the cap 103 in position on the plate. The eye bolt 106 is retained in place by the shear pin 108. After the mine anchoring cable has engaged the hook 19 and has sheared the pins 101 to free the hook from its supporting plate the bight 111 of the tow line 18 permits the hook engaged cable

to pass through the stern gate 90 before the tow forces are transmitted to the eyebolt 106 shearing the pin 108 and withdrawing the eyebolt 106 from the opening 107 releasing the cover 103 from securing engagement with the plate 100 so that the plate and cover will fall apart free of the trailer wire 16.

As may be noted from Fig. 7 the vane 110 projects downward so that the plate 100 will ride down the wire 16 at an angle with the surface of the water to prevent the edge of the plate from fouling against the edge surface of the inboard segment 91 of the stern gate 90 assuring that the supporting plate will pass down the trailer wire 16 into its proper position of abutting engagement with the lug to which the wire 16 is secured. The pins and bolts which project above the surface of the segment 91 are preferably covered with a smooth surface plate 112. Such a cover plate is illustrated in Fig. 8 although in actual practice this plate would be used only on the stern gate 90.

The outer gate and stern gate are substantially identical in construction and are illustrated in detail in Figs. 2 and 8. In Figs. 2 and 8 the outboard gate 40 is shown as made up of two segments 41 and 42. Each of these segments consist specifically of an upper and lower plate 43—44 and 43'—44', respectively. Each pair of plates are maintained in a spaced apart assembled relation by means of a plurality of through bolts 45 defining a void therebetween. These two segments 41 and 42 form the gate mechanism 40 permitting passage therethrough of the mine cable *c* upon collision therewith. The inner edge or profile of the upper and lower plates of each segment is curved to permit the flange wheels 46 and 47 to be journaled within the space formed by the spaced plates 43, 44 and 43'—44' of the segments 41 and 42, respectively.

To provide the minimum geometrical constraint necessary to maintain the two segments in fixed position relative to each other with their internal edges laterally displaced, a portion of the flanged wheel 46 which is rotatably supported in the top and bottom plate 43 and 44 of the segment 41 projects into the space provided between the spaced apart plates 43' and 44' of the segment 42. Likewise a portion of the flange wheel 47 which is rotatably supported in the top and bottom plates 43' and 44' of the segment 42 projects into the space provided between the space plates 43 and 44 of the segment 41. These flange wheels are retained in the segments into which they protrude by two pair of rollers for each flanged wheel, journaled in the plates into which the wheel projects so as to engage the inner peripheral surface of the rim of each wheel to retain the two segments in a fixed spaced relation, so that the spaced inner edges of each segment forms a circuitous passageway 49 extending longitudinally of said segments. The rollers 50'—52' are secured respectively to the top and bottom plates 43'—44' of the segment 42 to engage the inner surface of the axially and peripherally extending rim of the wheel 46. The pair of rollers 51'—53' are also supported to rotate about a shaft secured respectively in the top and bottom plates 43' and 44'. These rollers also engage the inner surfaces of the axially and peripherally extending rim of the wheel 46.

Similarly the pairs of rollers 50—52 and 50—53 are supported for rotation in the top and bottom plates 43—44 of the segment 41 to engage peripherally spaced points on the inner surfaces of the

flanged wheel 47. Since the center of the flanged wheel 47 and the axes of rollers 50'—52' and 51'—53' are fixed in spaced relation to each other, and since the center of the wheel 46 and the axes of the rollers 50—52 and 51—53 are also fixed and spaced relative to each other the two segments are geometrically constrained since they cannot be forced outwardly because of engagement between the rollers and the inner periphery of the wheels 46—47 and cannot be forced inwardly any substantial distance because of the engagement of wheels 46 and 47 with bolts 45 and their associated structure as shown by Figure 2.

As illustrated, the axes of the rollers 50—52, 51—53, 50'—52' and 51'—53' are respectively offset so that each pair of rollers engage different spaced points on the inner peripheral surfaces of the upper and lower axially extending flanges of their respective wheels. The rollers are offset so that they will not fall into the radial slots 55 and 56 formed in each wheel after the rollers ride over the flange surface of the said wheel. If both rollers were in axial alignment both could fall into the slot 55—56 or 55'—56' of the wheels 46 or 47, respectively, to destroy the geometrical constraint set up by the rollers and wheels. The bracket arms 48 are added to strengthen the plates to which the rollers are rotatably secured to maintain the roller axes in their fixed spaced apart position.

These radially extending and diametrically disposed slots 55 and 56 of the wheel 46 and the radially extending and diametrically disposed slots 55'—56' of the wheel 47 are cut radially inwardly of their respective wheels a distance sufficient to enable the cable c of an engaged mine to traverse the passageway 49. For example, a cable entering the slot 55 will traverse substantially half the circuitous passageway 49 by producing a counterclockwise rotation of the wheel 46 through substantially 180°. The cable is then free to leave the slot 55 of the wheel 46 and enter the slot 55' of the wheel 47 where the passageway 49 curves in an opposite direction thus producing rotation of the wheel 47 in a clockwise direction of substantially 180° to permit the cable to traverse the remaining portion of the circuitous passageway 49. After each wheel completes the 180° rotation the slots 56 and 56' are each brought into a position of alignment with the passageway 49 to receive the next cable to be passed by the gate mechanism.

To prevent the flanged wheels 46 and 47 from taking any position other than the positions illustrated wherein the slots 55—56 or 55'—56' remain in alignment with the straight entrance portion to each half of the circuitous passageway 49, two notched recesses 57 and 58 are provided at diametrically opposed points on the outer rim surface of the wheel 46, and two notched recesses 57' and 58' are likewise provided at diametrically opposed points on the outer rim surface of the wheel 47. The notched recesses 47 and 58 of the wheel 46 are adapted to be successively engaged by a detent 63 formed integrally with the arm 65 for the bell crank lever 64. The arms 65 and 66 of the bell crank lever 64 are axially offset so that the arm 65 to which the detent 63 is secured extends along the peripheral surface of the rim of the wheel 46 whereas the other arm 66 is positioned to extend between the rim of the wheel and the plates 44—44' and to project across the passagway 49. A spring 67 is provided to bias the bell crank lever 64 into a position maintaining

the detent 63 firmly pressed against the flanged surface of the wheel 46 so that the said detent will engage the recess formed therein to thereby stop the wheel in a position wherein the slot 55 or 56 will be in alignment with the passageway 49. When the cable c begins to traverse the passageway 49 between segments 41 and 42 it will strike the end 66 of the bell crank lever 64 to cause the bell crank lever to rotate on its axes thereby lifting the detent 63 out of its position of engagement with the notched recess 57 formed in the flanged wheel 46. The wheel will thus be free to rotate and the detent will be retained in the elevated position free from contact with the surface of the wheel 46 until the slot 55 has cleared the detent 63 thus assuring rotation of the wheel to a position displaced by 180°, to bring the other notched recess 58 into engagement with the detent 63 to stop further rotation of the wheel 46 at a position wherein the passageway 49 and the slot 56 are in alignment.

The wheel 47 is similarly provided with a bell crank lever 64' which has axially offset arms 65' and 66'. The arm 66' extends into the passageway 49 so as to be engaged by the cable c to lift the other arm 65' to which a detent 63' is secured to a position free from engagement with the surface of the wheel 47. The bell crank lever 64' is also provided with a spring 67' which maintains the arm 65 of the lever into a depressed position of engagement with the outer surface rim of the wheel 47, so as to stop the wheel after each 180° rotation by forcing the detent 63' into either of the notched recesses 57'—58'.

In the invention as disclosed, a single vessel sweep is provided, however, it should be apparent to those skilled in the art that the invention may also be readily applied to a two vessel sweep. It should also be understood that the invention in its broadest aspects is not limited to the specific mechanism shown and described but departures may be made therefrom within the scope of the subjoined claims without departure from the principles of the invention.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

I claim:

1. The method of sweeping for moored mines which includes the steps of searching a presumptively mined area by towing a submerged sweep through said area to engage the anchoring cables of moored mines contained therein, passing the engaged anchoring cable of said mine through said sweep, and securing a tow line to said anchoring cable after said anchoring cable has passed through said sweep.

2. The method of sweeping for moored mines comprising the steps of searching a presumptively mined area by towing a submerged sweep through said area to engage the anchoring cables of the moored mines contained within said area, passing the engaged anchoring cable of said mine through said sweep, and securing said anchoring cable to a tow line upon passing said anchoring cable through said sweep.

3. In a device adapted to be used in a system for continuously sweeping moored mines, the combination which includes, a first pair of plates, means securing said first pair of plates together to define a space therebetween, a circular member having an axially flanged rim journaled for rotation within the space defined by said plates, so

that a portion thereof projects exteriorly of said plates, a second pair of plates, means securing said second pair of plates together to define a space therebetween, a second circular member having an axially flanged rim journaled for rotation within said space, so that a portion thereof projects exteriorly of said plates, a plurality of rollers journaled in each of said pairs of plates for engaging at peripherally spaced points the inner surface of the axially and peripherally extending rim of the exteriorly projecting portions of said circular members when said portions are each inserted into the space enclosed by said other pair of plates to retain said pairs of plates in rigid spaced position with their surface edges defining a passageway therethrough, and means comprising radial slots in the circular members cooperable with the passageway adapted to produce rotation of the said circular members as an anchoring cable of a moored mine travels freely through said device along the passageway defined by the spaced edges of said pairs of plates.

4. The invention defined in claim 3 characterized further by the fact that the axes of the rollers journaled in one plate of one of said pairs of plates are out of alignment with the axis of the rollers journaled in the other plate of said one pair of plates, whereby to engage the periphery of the flanged rim at different points.

5. In a mine sweeping device, comprising a towing vessel, a search line fixedly connected to said vessel for engaging the anchoring cable of moored mines when towed through a mined area, means maintaining said search line in an outwardly extending direction transverse to the course of said vessel, a first and second gate means each having separate inboard and outboard segments, rotatable means maintaining the segments of each of said gate means in assembled relation without preventing passage between said segments of the anchoring cable of a mine engaged by said search line, means securing the inboard segment of said first gate to said search line, means securing the outboard segment of said first gate to said first named means, a sweep line securing said outboard segment of said first gate to the outboard segment of said second gate, a trailer wire connecting the inboard segment of said second gate to said towing vessel so that said second gate will be towed inboard and astern of said first gate and in a position to engage the anchoring cable of said mine after it has passed through said first gate traveling inboard and astern along said sweep line to said second gate, and means for passing down said trailer wire a separate towing means adapted to engage an anchoring cable of each mine as it passes said second gate.

6. In a minesweeping apparatus the combination of a search line adapted to engage the anchoring cable of a moored mine, means for maintaining said search line in an outstretched position laterally of the forward direction of sweep, gate means positioned within said search line secured to said first named means and adapted to pass an engaged anchoring cable of a mine rearwardly of said search line, a second gate means secured to the first means positioned rearwardly thereof and adapted to pass an engaged anchoring cable of a mine previously passed by the first gate means, and a towing means secured to said second gate means adapted to engage said anchoring cable upon the passage of said cable through said second gate means whereby to provide a continuous sweeping of a mined area by securing to each mine encountered therein a separate towing means.

7. In a device adapted to be used in a system for continuously sweeping moored mines, the combination which includes a first member having a curved inner edge, a second member having a curved inner edge, rotatable means securing said members together and having a radially extending slot therein for initially receiving the anchoring cable of a moored mine in a radial direction of the rotatable means, said inner edges cooperatively defining a curved passageway for guiding said cable during said initial movement in a direction to impart rotation to said rotatable means, and detent means normally retaining the rotatable means against rotation, said detent means being releasable upon engagement therewith by the cable as it enters said slot.

WILFRID GORDON WHITE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
219,153	Frazee	Sept. 2, 1879
1,582,388	Elia	Apr. 27, 1926

FOREIGN PATENTS

Number	Country	Date
104,037	Great Britain	Feb. 22, 1917