Nov. 11, 1941. J. E. PARKER 2,262,038

APPARATUS FOR RECOVERY OF MAGNETIC SANDS

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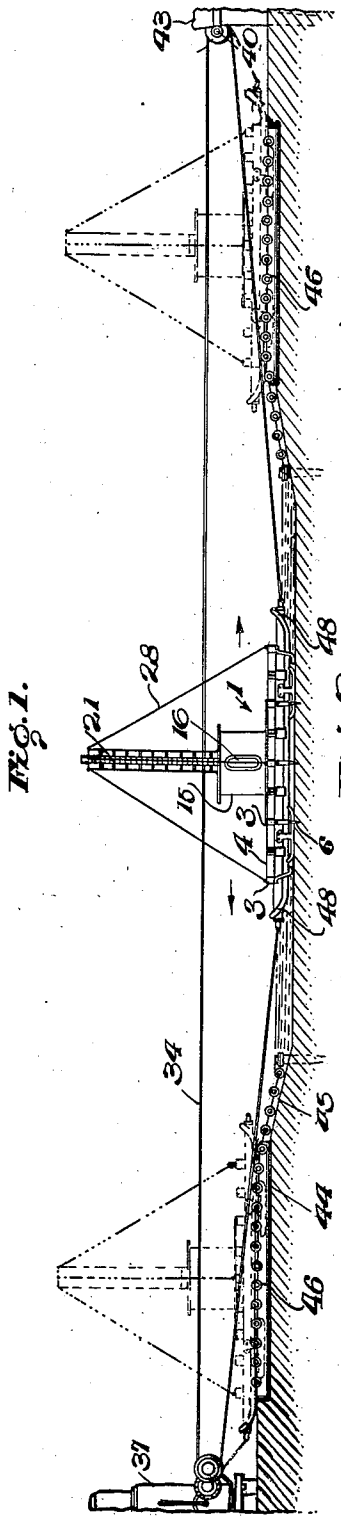


Fig. 1.

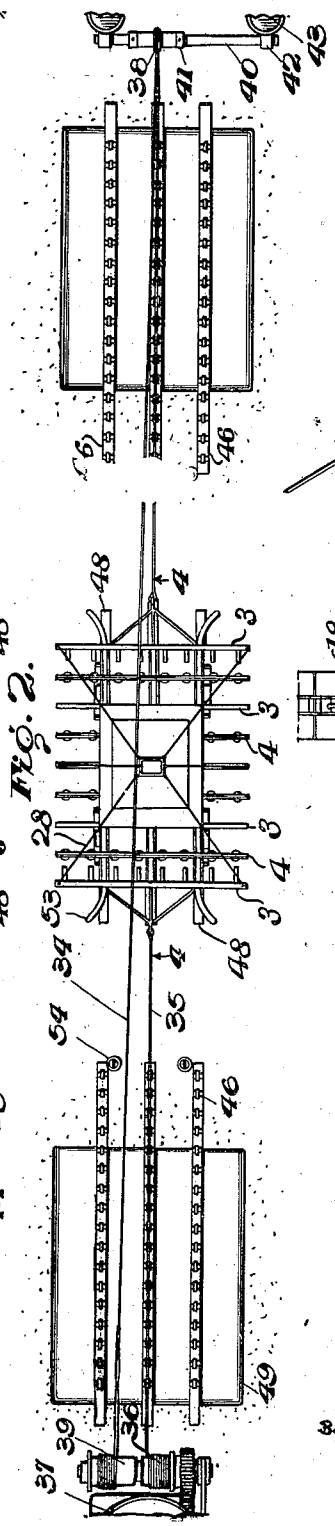


Fig. 2.

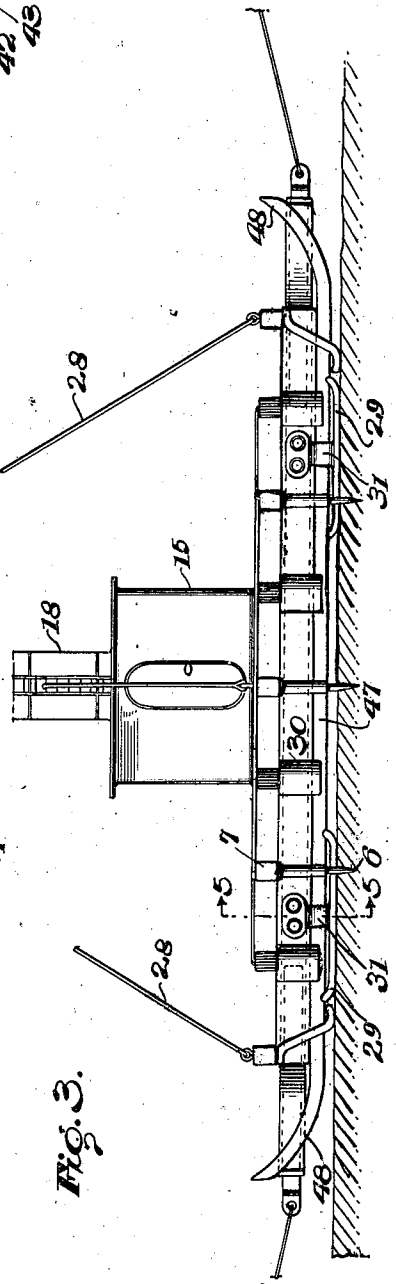


Fig. 3.

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Fig. 4.

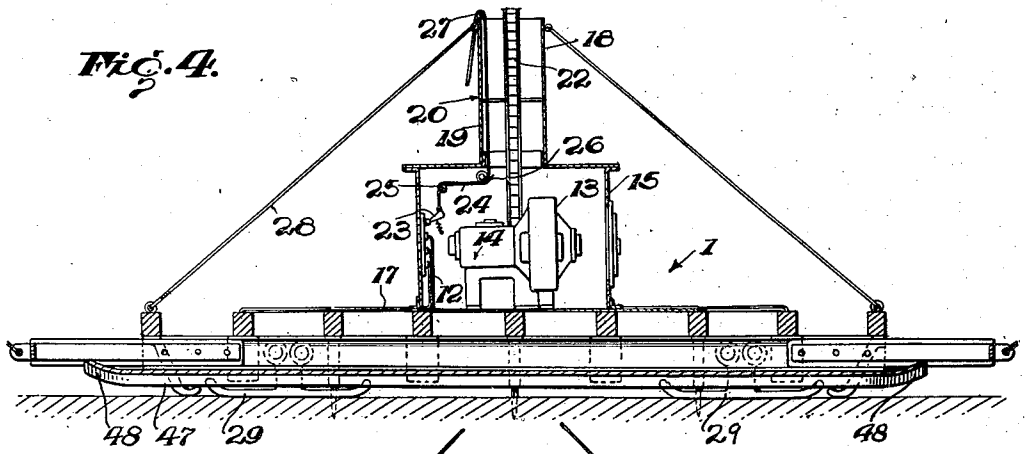



Fig. 6.

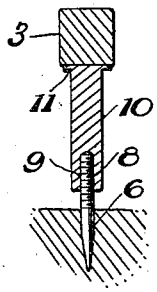



Fig. 5.

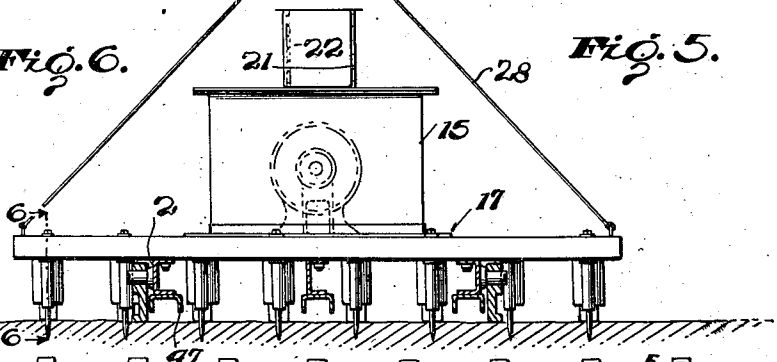
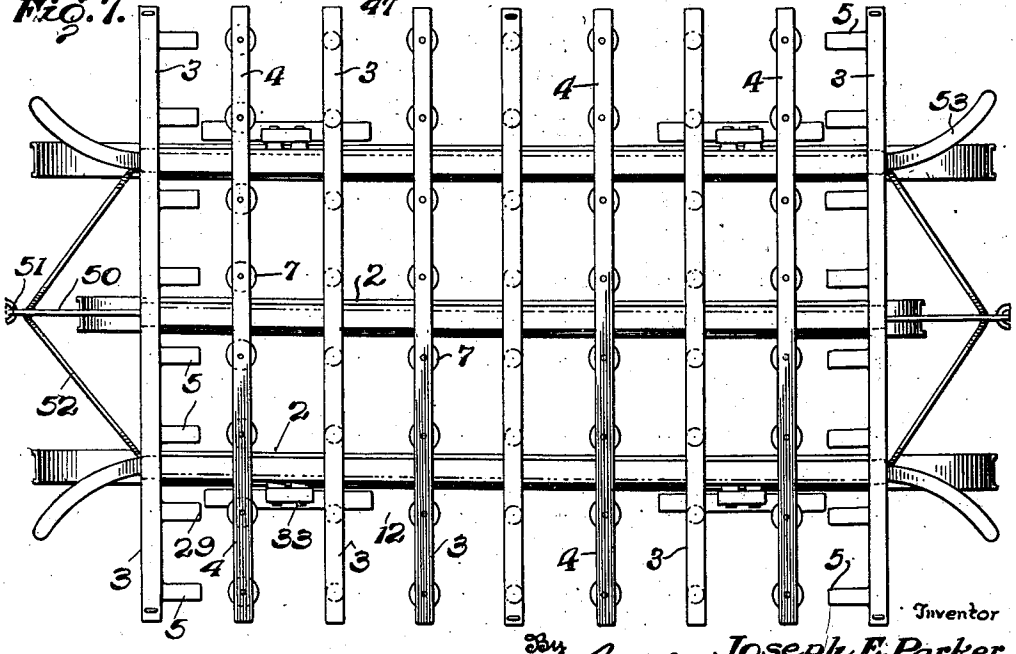



Fig. 7.




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# UNITED STATES PATENT OFFICE

2,262,038

## APPARATUS FOR RECOVERY OF MAGNETIC SANDS

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Application February 16, 1940, Serial No. 319,366

13 Claims. (Cl. 262—2)

The invention relates to an apparatus for the recovery of black or other magnetic sands or silts and free gold from the beds of streams and other bodies of water and for simultaneously effecting the concentration of free gold.

An object of the present invention is to provide an automatically submergible apparatus adapted to rest upon the bed of a stream or other surface operated on and movable over the same to different portions thereof and equipped with means for penetrating said surface and for agitating the material thereof and for also magnetically attracting and recovering black or other magnetic sands or silts and at the same time digging or excavating a submerged channel or trench capable of causing concentration of free gold adapted to be readily removed when a sufficient quantity of the same has accumulated in said channel or trench.

Another object of the invention is to provide an apparatus of this character equipped with means for causing it to traverse the bed of a stream from one side thereof to the other and while passing through such stream in a submerged or partially submerged condition to recover from the bed of the stream black or other magnetic sands or silts and convey the same alternately from one side of the stream to the other and to suitable points beyond the same for depositing the recovered values in pits or other receptacles by demagnetizing the electromagnetic means and thereby freeing the black or other magnetic sands or silts from the same.

Another object of the invention is to provide for the automatically submergible portion or unit of the apparatus ramps or runways for carrying the apparatus to an elevated position above the surface at each side of the stream and to equip such submergible portion of the apparatus and the ramps or runways with antifriction means such as tracks and cooperating wheels arranged to permit said submergible portion of the apparatus to slide up said runways or ramps for the recovery and dumping of the collected material at the expenditure of a minimum amount of power and with friction reduced to a minimum.

A further object of the invention is to equip the automatically submergible unit for operating on the bed of a stream and for collecting black or other magnetic sands or silts with means for guiding the same in proper position with relation to the ramps or runways so that the cooperating rails and wheels will be in proper position for movement of the submergible unit up the ramps or runways.

A further object of the invention is to provide a submergible unit adapted to traverse a predetermined area of the bed of a body of water and equipped with a power plant adapted to supply electric current directly to the magnetizable means of the submergible unit thereby obviating the trouble and expense incident to supplying current to the magnetizable means of the submergible unit from a boat or other craft or from the shore by means of submarine cables which would have to be carefully handled when the submergible unit of the apparatus is moved over the surface operated on.

With these and other objects in view, the invention consists in the construction and novel combination and arrangement of parts hereinafter fully described, illustrated in the accompanying drawings and pointed out in the claims hereto appended, it being understood that various changes in the form, proportion and minor details of construction, within the scope of the claims, may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

In the drawings:

Figure 1 is a side elevation of an apparatus constructed in accordance with this invention and shown applied to the bed of a stream, the submergible unit being shown in full lines at an intermediate point between the banks and in dot and dash lines in dumping position on the ramps.

Figure 2 is a plan view of the same, the dotted positions being omitted.

Figure 3 is an enlarged side elevation of the automatically submergible unit of the apparatus.

Figure 4 is a longitudinal sectional view taken on the line 4—4 of Figure 2.

Figure 5 is a transverse sectional view taken on the line 5—5 of Figure 3.

Figure 6 is a detail sectional view taken on the line 6—6 of Figure 5.

Figure 7 is an enlarged plan view of the frame of the submergible unit.

In the accompanying dawings in which is illustrated the preferred embodiment of the invention the apparatus comprises in its construction an automatically submergible unit 1 comprising in its construction a horizontal frame composed of spaced longitudinal beams 2 and transverse connecting members 3 and 4. The longitudinal beams and the transverse connecting members

3 are preferably constructed of channel steel but any other metal or other suitable material may be employed in the construction of the frame. The horizontal frame may be constructed of any desired dimensions and while the longitudinal beams are shown located at the center and opposite sides of the frame they may be of any desired number.

The transverse frame members 3 and 4 are arranged at regular intervals and are spaced apart, as clearly illustrated in Figure 7 of the drawings, and they are secured to the longitudinal beams at their points of intersection by any suitable means. The transverse members 3 are located at the end portions of the frame and at intermediate points and are constructed of metal. The end transverse members have mounted upon them depending fenders 5 constructed of suitable metal or other material and preferably curved rearwardly at their lower portions as shown. The fenders 5 will preferably be spaced apart a distance slightly less than three feet in order to enable them to serve as guards and prevent submerged rocks and other obstructions having a minimum dimension of three feet from coming in contact with either teeth 6 carried by the other transverse frame members 3 or electromagnets 7 mounted on and depending from the transverse frame members 4 and breaking or otherwise injuring either the teeth or the electromagnets.

The fenders 5 which are designed to be located at each end of the frame operate to agitate the material composing the beds of streams or other bodies of water on which the apparatus may operate and it is preferable to arrange one of the transverse frame members 4 between the end transverse member 3 and the next adjacent transverse end member 3 in order that the electromagnets carried by the transverse member 3 may magnetically attract and recover black or other magnetic sands or silts displaced or agitated by the said fenders and contained in the water through which the frame may be passing. The transverse frame members 4 are preferably constructed of wood and serve to insulate the electromagnets from the metal of the frame. It is preferred to arrange the fenders at each end of the frame, then a row of electromagnets and then alternate rows of teeth and electromagnets but any other preferred arrangement may be employed as will be readily understood.

The teeth 6 which are adapted to penetrate the bed of a stream or other body of water or similar surface operated on by the apparatus agitates the sand and other material which is caused to mix with the water so that the electromagnets will attract and recover black or other magnetic sands or silts while the ordinary sand and other material will be carried away by the current. In practice the submergible unit will be moved back and forth by the means hereinafter described and thereby caused to traverse a predetermined area of the surface operated on and will loosen the sand and other material and enable the black or other magnetic sand or silt to be recovered by the electromagnets and at the same time excavate or cut a channel or trench in the bed or bottom of a stream or other body of water. The cutting of the trench or channel in the bed or bottom will cause free gold to concentrate in the channel or trench while the sand and other lighter material will be swept away by the current. When a sufficient quantity of free gold has accumulated in the trench it may be removed by any suitable means.

The teeth 6 which may be constructed of steel or any other suitable material are designed to be removable and replaceable when worn, broken or otherwise damaged. Each tooth 6 which is preferably provided with a tapered, pointed lower portion has a threaded upper portion 8 which is screwed into an interiorly threaded socket 9 of a shank 10 flanged at its upper end at 11 and secured by electric welding or other suitable means to the lower face of the transverse frame member 3, as clearly illustrated in Figure 6 of the drawings. In case of breakage of a tooth 6 the broken tooth may be readily unscrewed from the socket 9 by a wrench or other tool and may be quickly replaced by a new tooth.

The electromagnets are arranged in a circuit 12 which is supplied with electric current by a generator 13 carried by the submergible unit and operated by an internal combustion engine 14 or other suitable motor but the electromagnets may be supplied with electric current from any other suitable or convenient source. It is preferable, however, to have the power plant for supplying electric current to the electromagnets carried by the automatically submergible unit as it eliminates the expense and labor or handling relatively long lines of submarine cable and similar conductors, which operation is more or less difficult with an apparatus similar to that of the present invention where the submergible unit is practically constantly in motion traveling either in one direction or the other across a predetermined area of the surface subjected to the operations of the apparatus.

The power plant comprising the generator 13 and the engine or motor is preferably arranged within a housing 15 constructed of sheet metal or other suitable material and mounted upon the frame centrally thereof. The housing 15 which is shown of rectangular formation may be of any desired form and it is provided with a manhole or door 16 of any suitable construction forming a water-tight closure and designed to be of sufficient size when open to permit the generator and the engine or motor to be passed through the manhole or door opening individually should the same become necessary or desirable.

The frame is preferably provided adjacent the housing with a platform 17 of any preferred dimensions and the housing is equipped at the top with a vertical stack 18 consisting of a tubular member and composed of a plurality of detachable sections 19 having suitable water-tight joints 20 and adapted to permit the stack to be increased or diminished in length to adapt the submergible unit to the character of the water in which the apparatus is designed to operate. Shallow streams may require only a short stack or no stack at all and the entire stack may be removed when desirable. Larger bodies of water will vary in depth and a stack of any desired length may be provided to permit the apparatus to operate on the beds of rivers and other natural streams, and on the beaches of lakes, gulfs, and other large bodies of water and on the bottom of reservoirs and on deposits and other surfaces.

The stack is provided with exteriorly and interiorly arranged ladders 21 and 22 to afford access to the interior of the housing while the submergible unit is submerged. The stack furnishes

ventilation as well as access to the housing. The circuit 12 which connects the generator with the electromagnets is provided with an automatically closable switch 23 of any suitable construction which is operated from the exterior of the stack by means of an operating rope 24 or other suitable flexible connection arranged on guide pulleys 25, 26 and 27 and having its outer portion arranged exteriorly of the stack and of a sufficient length to be operated from the platform 17 when the submergible unit is carried by the means hereinafter described out of the water and to a dumping position on the shore or side of a river or other body of water. The opening of the switch 23 demagnetizes the electromagnets and deposits the recovered black or other magnetic sand or silt after which the submergible unit is returned to the water and is moved to the opposite side of the stream in which the apparatus operates. Each time the submergible unit traverses the area operated on the material composing the bed of the stream or other body of water is penetrated by the teeth and black or other magnetic sands or silt and other material are loosened and caused to mingle with the water and to be placed in a condition in which the magnetic sand or silt may be recovered by the electromagnets.

The weight of the submergible unit 1 is sufficient to maintain the same in an upright condition in both shallow streams and deeper bodies of water. The shallow streams which are generally more rapid than deeper bodies of water are often insufficient in depth to entirely submerge the frame and the housing of the unit and frequently the apparatus may be operated without a stack. In larger bodies of water the current or flow generally does not exert sufficient leverage on the stack to disturb the upright position of the submergible unit. Should, however, it be desired to operate the apparatus in deep bodies of water having swift currents any suitable means may be provided for maintaining the submergible unit in an upright position.

The stack is preferably braced by inclined guys 28 consisting of cables, rods or any other suitable means and preferably located at the corners of the frame and at the centers of the sides thereof, three guy rods or cables 28 being arranged at each side of the submergible unit.

The submergible unit may be supported upon the bottom or bed of a stream or body of water by runners, wheels or any equivalent means and in the accompanying drawings the frame is shown equipped at opposite sides with front and rear runners 29 having upturned terminal portions 30 and provided with central posts or standards 31 which support heads 32 through which pass horizontal laterally extending pins or studs 33 secured to and extending outwardly from the side beams 2 of the frame. The heads of the posts are keyed or otherwise detachably secured to the laterally projecting pins or studs 33 but the runners may be secured to the sides of the frame in any other desired manner. The spaced runners with their upturned terminals permit the submergible unit to be moved freely longitudinally in either direction for causing the submergible unit to traverse a predetermined area.

The submergible unit is actuated by cables 34 and 35. The cable 35 extends directly from one end of the frame of the submergible unit to a drum 36 of a donkey engine 37 located at one side of a river or stream, as clearly illustrated in Figures 1 and 2 of the drawings. The other cable which is connected to the other end of the frame of the submergible unit extends to the other side of the river and passes around a pulley or sheave 38 and thence across the river or stream to a drum 39 of the donkey engine. The drums of the donkey engine are controlled in the usual manner for winding one of the cables on one of the drums while permitting the other cable to unwind simultaneously from the other drum and vice versa. When the cable 35 is wound upon the drum 36 the submergible unit will be moved in the direction of the donkey engine and when the clutch mechanism of the donkey engine is operated to wind the cable 34 on the drum 39 the submergible unit will be moved away from the donkey engine.

The pulley or sheave 38 is adjustably mounted on a horizontal shaft 40 by means of set collars 41. The shaft is mounted in suitable bearings 42 secured to posts 43 or other suitable supports. The arrangement of the cables in Figures 1 and 2 is adapted to move the submergible unit from one side of a stream to the other and to carry the submergible unit up ramps 44 located at opposite sides of the stream.

The ramps which may be of any desired construction are preferably provided with front inclined portions 45 extending downwardly into the stream and provided with sets of wheels 46 preferably arranged at the sides and center of the ramps and adapted to receive channel rails 47 of the submergible unit. The channel rails which are constructed of metal or other suitable material are secured to and extend longitudinally of the beams 2 at the bottom thereof, as clearly illustrated in Figure 5 of the drawings. The rails 47 extend outwardly beyond the end transverse members and have upwardly curved terminal portions 48 which ride on the wheels 46 and lift the frame and the teeth thereof clear of the ground and prevent the teeth and the electromagnets from coming in contact with the surface of the ground when the submergible unit is withdrawn from the water for the purpose of discharging the recovered magnetic sand or silt.

The rails 47 serve as slides and also as guides for the frame of the submergible unit but the rails of the submergible unit and the wheels of the ramp may be reversed or arranged in any other desired manner for enabling the submergible unit to be drawn upwardly and outwardly on the ramp at either side of the stream with a minimum amount of friction. Each ramp is designed to be provided with a suitable receptacle 49 which may be in the form of a pit and which is adapted to receive the black or other magnetic sand or silt which is released from the electromagnets when the current is broken by operating the switch 23 of the circuit 12.

After the magnetic sand or silt is discharged at the end of a trip the switch is permitted to close and the submergible unit is caused to travel across the bed of the stream to the other side thereof and to discharge the recovered values in the pit at that side of a river or stream. The action of the teeth 6 in digging into the material of the bed of the stream and the agitation of such material frees the same from the bed of the stream and causes the magnetic material to be magnetically attracted by the electromagnets while the nonmagnetic sand and other material will be conveyed away by the current. The repeated movements of the submergible unit from one side of the stream to

the other will dig or excavate a trench or channel in the bed of a stream and will cause concentration of free gold which when a suitable quantity of the same has accumulated may be conveniently removed by an ordinary bucket (not shown) attached to one of the cables.

The frame of the submergible unit is provided at each end with a central longitudinal draft bar **50** extending outwardly from the center beam of the frame and electrically welded or otherwise secured to the same and provided at its outer end with a clevis or eye **51** or other means for enabling one of the cables to be readily connected with the draft bar **50**. The draft bar is preferably held against lateral movement by braces **52** extending from the side beams to the outer portion of the draw bar. The braces **52** may consist of a cable or cables or any other suitable means.

Each end of the frame of the submergible unit is provided with curved laterally extending guides **53** which diverge outwardly and which are adapted to engage fixed abutments **54**. The abutments **54** which may consist of spaced posts located at opposite sides of the front end of the ramp cooperate with the laterally extending guides **53** in guiding the end of the frame to a central position where the channel rails will be in proper position to ride on the wheels of the ramps. The channels of the rails open downwardly and the rails straddle the wheels and guide the submergible unit in its movement up the ramp. The terminal portions of the transverse members of the frame of the submergible unit extend beyond the side beams and the pits or receptacles **49** which are located beneath the ramps have sufficient width to receive all of the material recovered by the submergible unit when such material is dumped or deposited by deenergizing the electromagnets. Instead of arranging the cables as illustrated in Figure 1 of the drawings for moving the submergible unit from one side of a stream to the other they may be arranged in any other desired manner to cause the submergible unit to traverse a predetermined portion of the bottom of any other body of water.

What is claimed is:

1. An apparatus of the character described including a submergible unit, means for actuating the unit for moving the same over the surface to be operated on and for also moving the unit beyond the portion of the surface operated on, said unit including means for penetrating the surface and for agitating sand and other material and electromagnetic means for attracting and recovering magnetic material, and a ramp arranged to receive the unit and having an inclined portion arranged to elevate said unit to a dumping position above the surface of the ground, said ramp being also provided with a substantially horizontal portion forming a continuation of the inclined portion and arranged to support said unit in an elevated position for discharging recovered values.

2. An apparatus of the character described including a submergible unit, means for actuating the unit for moving the same over the surface to be operated on and for also moving the unit beyond the portion of the surface operated on, said unit including means for penetrating the surface and for agitating sand and other material of said surface and electromagnetic means for attracting and recovering magnetic material, and a ramp arranged to receive the unit and having an inclined portion adapted to elevate said unit to a dumping position above the ground, said unit and ramp having cooperating channel rails and wheels arranged to guide the unit up the ramp and reduce friction incident to such movement of the unit.

3. An apparatus of the character described including a submergible unit, means for actuating the unit for moving the same over the surface to be operated on and for also carrying the unit beyond the portion of the surface operated on, said unit including means for penetrating said surface and for agitating sand and other material of said surface and electromagnetic means for attracting and recovering magnetic material, a ramp arranged to receive the unit and having an inclined portion adapted to elevate said unit to a dumping position, spaced abutments located at the front end of the ramp, and laterally extending longitudinally diverging guiding elements carried by said unit and arranged to engage said abutments for positioning the unit properly for movement up the ramp.

4. An apparatus of the character described including a submergible unit comprising a frame having spaced transverse members and provided with supporting means arranged to rest upon the surface operated on, shanks depending from and carried by the transverse members, teeth detachably secured to the shanks and extending below the plane of said supporting means and adapted to penetrate the surface operated on and agitate sand and other material thereof, electromagnetic means carried by the frame and arranged for attracting and recovering magnetic material, and means for moving the unit over the surface operated on.

5. An apparatus of the character described including a submergible unit comprising a frame, transverse groups of fenders located at the end of the frame for protecting the unit from obstructions, transverse rows of teeth also carried by the frame, said rows of teeth being spaced from one another and also from the groups of fenders and the teeth projecting downwardly sufficiently to penetrate the surface operated on and agitate sand and other material thereof, and electromagnets located between the rows of teeth and also between the same and the fenders for attracting and recovering magnetic material.

6. An apparatus of the character described including a submergible unit comprising a frame provided with means for penetrating the surface operated on and for agitating sand and other material of said surface, electromagnetic means adapted to attract and recover magnetic material, a water-tight housing mounted on said frame, and means contained within the housing and carried by the unit for supplying electric current to said electromagnetic means.

7. An apparatus of the character described including a submergible unit comprising a frame, means carried by the frame for penetrating the surface operated on and for agitating sand and other material of said surface, electromagnetic means also carried by said frame and arranged to attract and recover magnetic material from said agitated material, a housing mounted on the frame and provided with an upwardly extending stack adapted to ventilate the casing and of a size to form an entrance to and an exit from said housing when the unit is submerged, and means contained within the housing for supplying electric current to said magnetic means.

8. An apparatus of the character described including a submergible unit comprising a frame

provided with means for penetrating the surface operated on and for agitating sand and other material of said surface, electromagnetic means also carried by the frame and arranged to attract and recover magnetic material, a housing mounted on the frame and provided with a stack adapted to ventilate the housing and of a size to form an entrance to and an exit from said housing when the unit is submerged, a power plant arranged within the housing for supplying electric current to said electromagnetic means and including a circuit having a switch, and operating mechanism connected with the switch and arranged to permit the circuit of said electromagnetic means to be opened and closed from a point exteriorly of the housing.

9. An apparatus of the character described including a submergible unit comprising a frame provided with means for penetrating the surface operated on and for agitating sand and other material of said surface, electromagnetic means also carried by the frame and arranged to attract and recover magnetic material, a housing mounted on the frame and provided with a stack extending upwardly from the housing for ventilating the same and for affording an entrance to and an exit from the housing when the unit is submerged, said stack being composed of a plurality of separate detachable sections adapted to permit the stack to be buried in height to suit the depth of the water in which said unit may be submerged, and means contained within the housing and carried by the unit for supplying electric current to said electromagnetic means.

10. An apparatus of the character described including a submergible unit adapted to be moved back and forth over a predetermined area of the bed of a body of water or other surface and comprising a frame having supporting means arranged to rest upon said surface, means carried by the frame and projecting below said supporting means and adapted to penetrate the surface operated on and agitate sand and other material thereof, electromagnetic means also carried by the frame and arranged to attract and recover magnetic material, a housing mounted on the frame and provided with a stack extending upwardly therefrom for ventilating the stack and provided with means for affording entrance to the housing and exit therefrom when the unit is submerged, means located within the housing and carried by the unit for supplying electric current to said electromagnetic means, cables extending in opposite directions from the frame and connected therewith and adapted to be operated for moving the submergible unit back and forth over a predetermined area, and means for actuating and guiding the cables.

11. An apparatus of the character described including a submergible unit adapted to be moved back and forth over a predetermined area of the bed of a body of water or other surface and comprising a frame having supporting means arranged to rest upon said surface, means carried by the frame and projecting below said supporting means and adapted to penetrate the surface operated on and agitate sand and other materials thereof, electromagnetic means also carried by the frame and arranged to attract and recover magnetic material, a housing mounted on the frame and provided with a stack extending upwardly therefrom for ventilating the stack and provided with means for affording entrance to the housing and exit therefrom when the unit is submerged, means located within the housing and carried by the unit for supplying electric current to said electromagnetic means, cables extending in opposite directions from the frame and connected therewith and adapted to be operated for moving the submergible unit back and forth over a predetermined area, means for actuating and guiding the cables, ramps located at opposite sides of the body of water in which the unit may be submerged and having inclined portions for lifting the unit to an elevated dumping position, spaced abutments located at the front ends of the ramps, and longitudinally diverging laterally extending guides located at the ends of the frame and arranged to engage the said abutments for positioning the unit properly for movement up the ramps.

12. An apparatus of the character described including a submergible unit adapted to be moved back and forth over a predetermined area of the bed of a body of water or other surface and comprising a frame having supporting means arranged to rest upon said surface, means carried by the frame and projecting below said supporting means and adapted to penetrate the surface operated on and agitate sand and other material thereof, electromagnetic means also carried by the frame and arranged to attract and recover magnetic material, a housing mounted on the frame and provided with a stack extending upwardly therefrom for ventilating the stack and provided with means for affording entrance to the housing and exit therefrom when the unit is submerged, means located within the housing and carried by the unit for supplying electric current to said electromagnetic means, cables extending in opposite directions from the frame and connected therewith and adapted to be operated for moving the submergible unit back and forth over a predetermined area, means for actuating and guiding the cables, ramps located at opposite sides of the body of water in which the unit may be submerged and having inclined portions for lifting the unit to an elevated dumping position, spaced abutments located at the front ends of the ramps, longitudinally diverging laterally extending guides located at the ends of the frame and arranged to engage the said abutments for positioning the unit properly for movement up the ramps, and means for guiding the submergible unit up the ramps including wheels and channel rails adapted to receive the wheels in their channels and prevent lateral movement of the unit while the same is traveling up and down the ramps.

13. An apparatus of the character described including a submergible unit adapted to be moved back and forth over a predetermined area of the bed of a body of water or other surface and comprising a frame having supporting means arranged to rest upon said surface, means carried by the frame and projecting below said supporting means and adapted to penetrate the surface operated on and agitate sand and other material thereof, electromagnetic means also carried by the frame and arranged to attract and recover magnetic material, a housing mounted on the frame and provided with a stack extending upwardly therefrom for ventilating the stack and provided with means for affording entrance to the housing and exit therefrom when the unit is submerged, means located within the housing and carried by the unit for supplying electric current to said electromagnetic means,

cables extending in opposite directions from the frame and connected therewith and adapted to be operated for moving the submergible unit back and forth over a predetermined area, means for actuating and guiding the cables, ramps located at opposite sides of the body of water in which the unit may be submerged and having inclined portions for lifting the unit to an elevated dumping position, spaced abutments located at the front ends of the ramps, longitudinally diverging laterally extending guides located at the ends of the frame and arranged to engage the said abutments for positioning the unit properly for movement up the ramps, wheels mounted on the ramps, and inverted channel rails secured to the frame and having upwardly curved terminal portions and arranged to receive and straddle the wheels of the ramps for guiding the unit in its movement up and down the ramps.

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