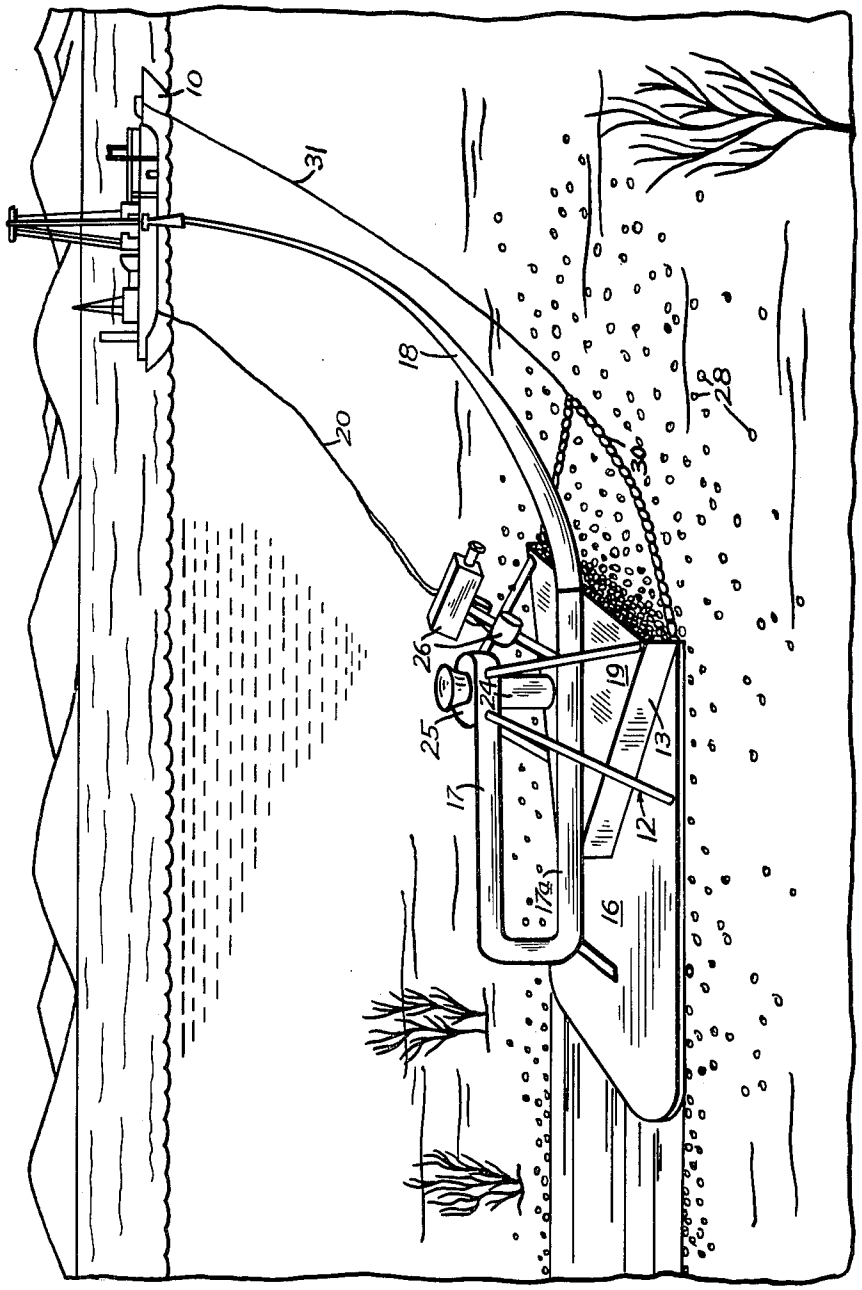
May 3, 1966 P. S. GARDNER, JR 3,248,812

COLLECTOR AND HOIST FOR AGGREGATES

Filed April 22, 1963 4 Sheets-Sheet 1

FIG 1



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COLLECTOR AND HOIST FOR AGGREGATES

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FIG 2

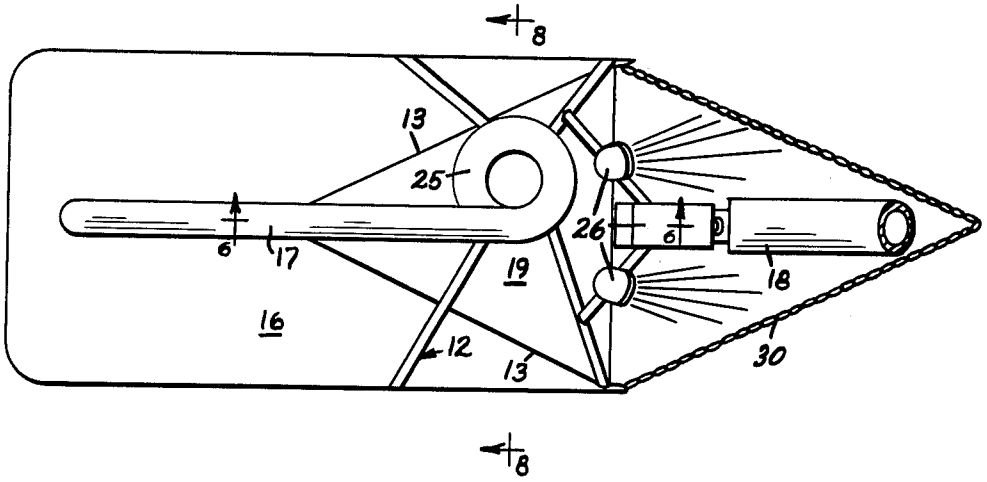
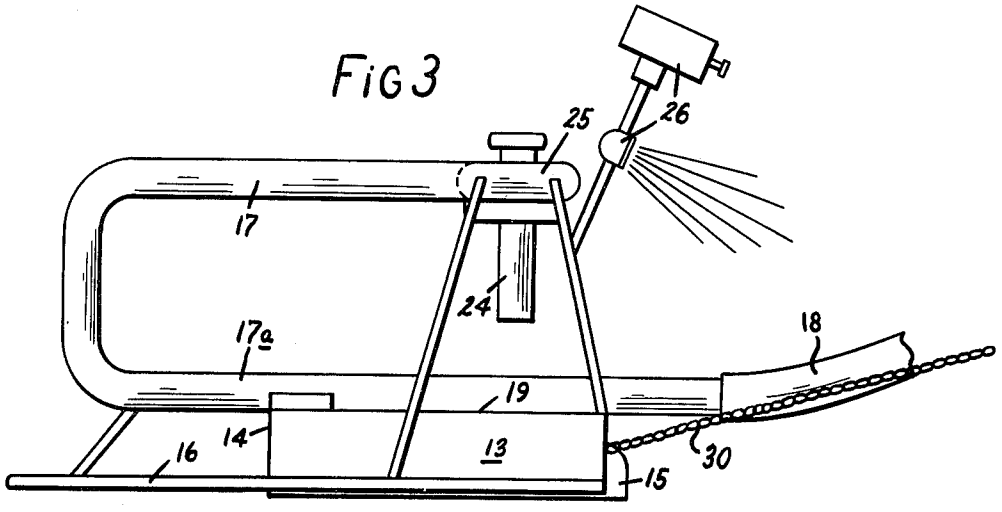


FIG 3



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COLLECTOR AND HOIST FOR AGGREGATES

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FIG 4

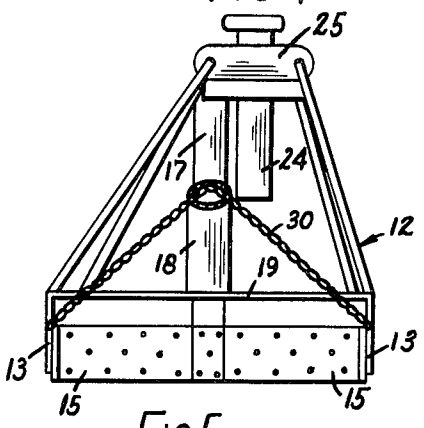


FIG 5

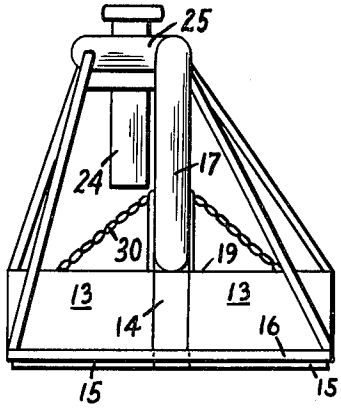
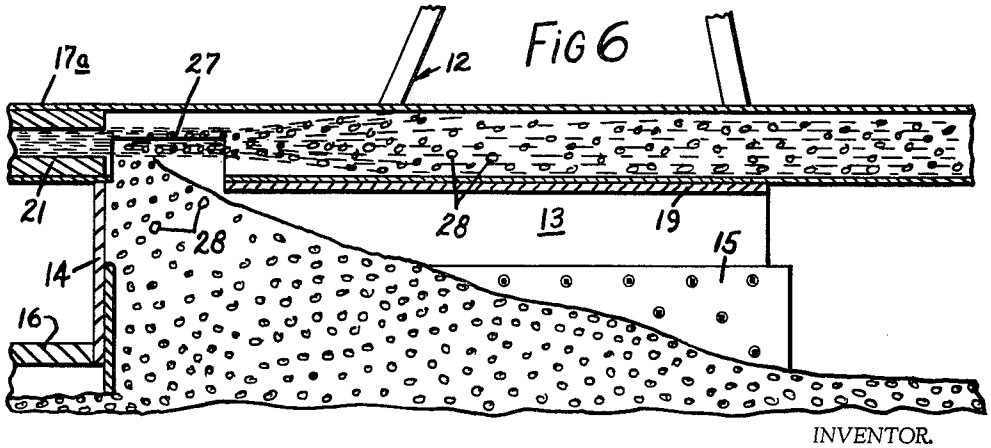


FIG 6



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FIG 7

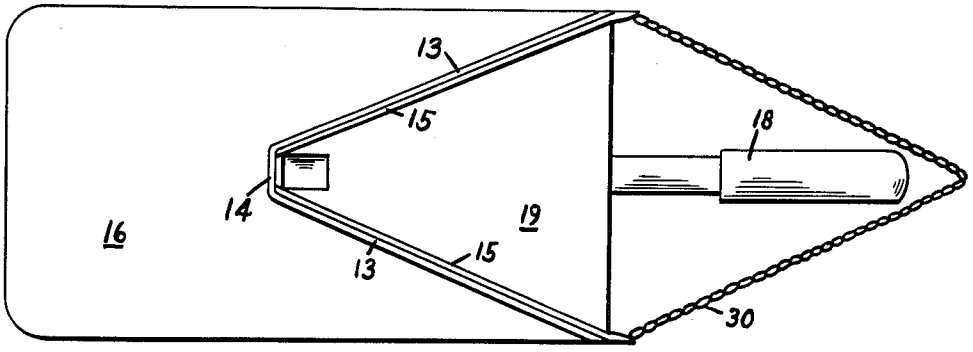


FIG 8

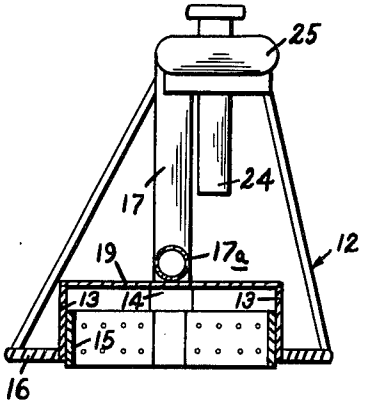
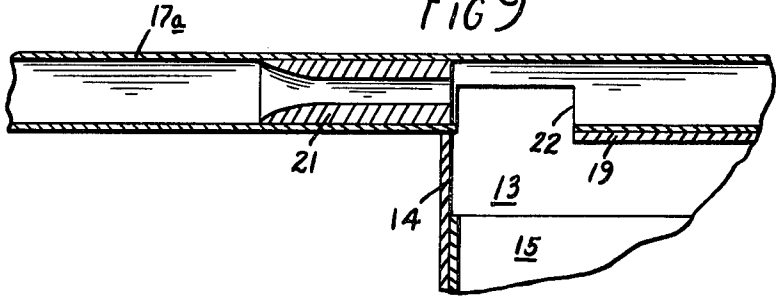


FIG 9



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United States Patent Office

3,248,812

Patented May 3, 1966

3,248,812

COLLECTOR AND HOIST FOR AGGREGATES

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Filed Apr. 22, 1963, Ser. No. 274,418
8 Claims. (Cl. 37—61)

This invention relates to a novel device for collecting and lifting aggregates from a supporting surface, and is particularly adapted for underwater use in cleaning dredging and mining operations.

The present invention is concerned with a novel device for the collecting and hoisting of aggregates from a surface on which they are found. The invention is concerned with the collection of loose aggregate which can be scraped from the surface and lifted in a hydraulic hoist. The invention combines the novel collecting apparatus with a hydraulic hoist to provide an efficient and workable lifting device, capable of operating at great depths, as well as operation on dry land.

It is a first object of this invention to provide a device in which a balanced hydraulic hoist can be utilized to lift loose aggregate from a supporting surface on which the aggregate is found. In carrying out this object, use is made of converging blades which scrape along the surface and force the aggregate into an opening wherein it is subjected to hydraulic lifting forces.

Another object of this invention is to provide a device which can be fabricated with no moving parts other than a motor and pump necessary for the hydraulic jet. The pump apparatus may be on the unit or at a remote location.

Another object of this invention is to provide a device which will insure even collection along the surface and which will prevent the device from digging into the surface, so that the device can be safely used at depths where an appreciable amount of time would be lost by undue maintenance or correction. The depth at which aggregate is collected at the surface can be varied to a depth suitable for dredging.

Another object of this invention is to provide a device which is capable of use in a balanced hydrostatic system, so that a minimum of power is required for the lifting operation. This also enchances the value of this device in deep water operation.

These and further objects will be evident from a study of the following disclosure, taken in conjunction with the accompanying drawings, which show a preferred form of the invention. It is to be understood that the drawings and the device shown therein are merely exemplary and that this device is not intended to limit or restrict the scope of this invention.

In the drawings:

FIGURE 1 is a schematic perspective view showing the intended deepsea operation of the device;

FIGURE 2 is a top view of the apparatus seen in FIGURE 1;

FIGURE 3 is a side view of the collecting and hoisting apparatus;

FIGURE 4 is a right hand end view of the apparatus seen in FIGURE 3;

FIGURE 5 is a left hand end view of the apparatus seen in FIGURE 3;

FIGURE 6 is an enlarged fragmentary sectional view taken along line 6—6 in FIGURE 2, showing the operation of the device.

FIGURE 7 is a bottom view of the device;

FIGURE 8 is a sectional view taken along line 8—8 in FIGURE 2; and

FIGURE 9 is a fragmentary sectional view through the nozzle structure.

The present invention is concerned with an apparatus for use in underwater mining and cleaning operations, although the same apparatus might well be adaptable to many dry land operations wherein loose aggregate is to be collected and hoisted to a remote vessel. The description following will be concerned with the underwater application of the apparatus, although the use of the apparatus is obviously adaptable to many different situations. As shown in FIGURE 1, the apparatus might be used for deepsea mining of manganese, or phosphorite deposits, which are commonly available on the ocean floor. These deposits are in the form of varying sizes of aggregate, loosely deposited on the supporting surface. The present invention would utilize the towing surface vessel **10** into which the aggregate would be dumped.

At the floor or supporting surface on which the aggregate is to be collected, there is a framework **12** which is a generally rigid structure for the support of the various elements to be described below. Mounted on the framework **12** are converging blades **13** which are upright and which extend continuously along the supporting surface. The blades **13** are scraper blades and might be provided with removable inside edges **15** so as to readily allow for substitution of the edges **15** when damaged by abrasion. Edges **15** can be vertically shifted by loosening their connecting bolts, so as to allow full adjustment of digging depth. The blades **13** converge toward one another in a V-shaped configuration and are connected to a back stop **14** at their apex. The back stop **14** is merely a vertical plate connecting the two rear edges of the blades **13**. The back stop **14** might be at a different angle than the vertical, so as to either increase the scooplike effect of the blades **13** or to allow the framework **12** to ride more easily over larger obstructions that might be encountered.

The blades **13** converge in a direction opposite to the intended direction of motion of the framwork **12**. Thus, as the framework **12** is moved to the right as seen in FIGURES 2 and 3, the aggregate engaged by the blades **13** would be crowded to the backstop **14** and will work vertically upward between the blades **13**. A top connecting plate **19** is provided to enclose the area between the blades **13** and the backstop **14**, as can be readily seen in FIGURE 2.

Extending outwardly from the lower ends of the permanent blades **13** is a flat shoe **16** designed to ride upon the supporting surface on which the aggregate is found. The purpose of the shoe **16**, which extends both laterally and rearwardly from the blade **13**, is to prevent the framework **12** and the various elements mounted thereon from digging downwardly into the supporting surface by maintaining a constant digging depth.

Mounted on the framework **12** is a U-shaped pipe **17** which is the receiving conduit of the hydraulic hoist. The pipe **17** has a lower horizontal section **17***a* which extends parallel to the supporting surface and the bottom edge of each blade **13** in close proximity with the supporting surface. Pipe **17** is connected at its lowermost end to a flexible conduit **18** which extends upwardly to the receiving vessel.

Mounted rearwardly of the backstop **14** and within the lower portion **17***a* of the pipe **17** is a hydraulic nozzle **21** having a restricted interior diameter relative to the interior diameter of the pipe **17**. The length of the restricted opening in nozzle **21** is preferably at least two or three times the inside diameter of the nozzle **21**. The nozzle **21** is designed particularly to supply a stream of liquid having a constant cross section area across the side opening **22** cut through the pipe **17**, as seen in FIGURES 6 and 9. The length of the portion **17***a* of pipe **17** rearwardly of the side opening **22** is preferably such that the liquid being forced through the nozzle **21** will have no cross currents and will therefore remain entirely within

the pipe 17. Liquid is forced through the pipe 17 by a motor 24 and pump 25 mounted at the opened end of the pipe 17 on the framework 12. The submersible motor and pump 24–25 utilize surrounding sea water as the hydraulic medium in the hoist. The present invention is concerned primarily with the manner in which the aggregate is collected, but is usable very effectively with a hydraulic hoist having a hydrostatic balance between the stream of water 27 (see FIGURE 6) which issues past the window or side opening 22 and the surrounding water directly outside the opening 22. Full static balance can be obtained by the following adjustments: (1) position of nozzle with respect to opening; (2) diameter of nozzle with respect to pipe 17; (3) rate of flow through a given nozzle size or position, with the final result that solid particles only will enter the pipe opening 22 into the moving stream of water. The manner by which such a hydrostatic balance can be accomplished is fully described in detail in my Patent No. 3,003,820, issued Oct. 10, 1961. The various adjustable mechanisms described in that patent can be provided in the instant device so as to insure the hydrostatic balance between the interior stream and the outer water.

Also mounted on the framework 12 might be lamps and television cameras 26 utilized to remotely monitor the operation of the device and to inspect the condition of the surface on which the apparatus is operating. These are shown only in FIGURES 1–3.

The apparatus is intended to be towed by means of chain bridle 30 connected to the framework 12 at the front end thereof and a towing cable 31 which leads to the vessel 10. There should also be a power cable 20 leading from the framework 12 to the towing vessel 10 to provide the necessary circuitry for the television equipment 26 and for the motor 24.

In operation the towing of the framework 12 will cause the blades 13 to scrape along the supporting surface and to loosen solid particles or aggregate 28 found thereon. These particles 28 will be urged toward the center line of the framework 12 and will be crowded upwardly due to engagement by the backstop 14. Thus the apparatus will effectively crowd the particles 28 up into the downwardly facing side opening 22 of pipe 17. The crowding motion of the blades 13 makes this apparatus particularly adaptable to use with a hydrostatic balance system wherein no suction pressure is available at the opening 22 which would aid in the lifting of particles 28. Should a solid obstruction be encountered, the entire apparatus can be readily lifted by means of the cable 31, although this might sometimes involve repositioning of the vessel 10.

It is to be emphasized that the present apparatus can be used either in shallow or deep operations and may be used also on dry land, using the scraper mechanism in conjunction with the hydraulic hoist to either raise the aggregate in the stream of water or to carry it a considerable distance as a conveyor.

Various refinements of this structure and modifications within the scope of this invention might well occur to one skilled in the art. For this reason the above description is not intended to limit or restrict the invention which is set out in the claims which follow.

Having thus described my invention, I claim:

1. In a collector and hoist for aggregates:
a supporting framework adapted to rest upon a surface containing loose and unconsolidated solid deposits;
conduit means mounted on said framework and extending outwardly therefrom to a receiving vessel, said conduit means being provided with a downwardly directed side opening intermediate the ends thereof, said opening being located adjacent said framework in proximity to the solid deposits on said surface;
hydraulic means operatively connected to said conduit means for directing a jet of liquid within said conduit means past said opening, the liquid velocity being sufficient to propel solid deposits outwardly from said framework through the full length of said conduit means;
rearwardly converging upright blade means on said framework having a lower edge contacting said surface and leading toward the opening of said conduit means for collecting and directing loose and unconsolidated solid deposits contacted thereby into said opening responsive to forward motion of said blade means relative to said surface;
and means operatively connected to said blade means for effecting forward motion of said blade means relative to said surface.

2. A collector and hoist for aggregates as defined in claim 1 wherein said hydraulic means maintains a hydrostatic balance at said opening between the jet of liquid within said conduit means and the material and surrounding medium directly outside of said opening.

3. In a collector and hoist for aggregates:
a supporting framework adapted to rest upon a surface area;
upright blade means mounted on said framework with the lower edges thereof engaging the surface supporting the framework, said blade means having a rearwardly converging configuration;
a conveying conduit mounted on said framework provided with a side opening formed thereon and located adjacent said blade means at a position wherein materials engaged by said blade means will be crowded into said opening in response to motion of said framework relative to said surface;
and hydraulic means operatively connected to said conduit adapted to supply a jet of liquid within said conduit past said opening, the velocity of said liquid being sufficient to propel solid materials in the stream of liquid from said opening through the full length of said conduit.

4. In a collector and hoist for aggregates:
a supporting framework;
means operatively connected to said framework for moving said framework relative to a supporting surface;
upright blade means mounted on said framework, the lower edges of said blade means being adapted to contact said supporting surface in a continuous rearwardly converging configuration;
conduit means mounted on said framework and extending outwardly therefrom, said conduit means including a side opening therein located forwardly adjacent to the convergence of said blade means, whereby solid materials on said supporting surface engaged by said blade means will be urged into said opening in response to forward motion of said framework relative to said surface;
and hydraulic means operatively connected to said conduit means adapted to direct a jet of liquid within said conduit means past said opening, the liquid velocity being sufficient to propel solid materials outwardly from said framework within the full length of said conduit means.

5. In a collector and hoist for aggregates for underwater usage in the recovery of loose and unconsolidated solid materials from a supporting surface;
a vessel within which recovered solid material is to be collected;
a supporting framework adapted to rest upon the supporting surface;
conduit means mounted on said framework and extending outwardly therefrom to said vessel, said conduit means being provided with a side opening adjacent said framework in proximity with said surface;
hydraulic means operatively connected to said conduit means directing a jet of liquid within said conduit means past said opening, the liquid velocity

being sufficient to propel solid materials within said conduit means to said vessel;

rearwardly converging upright blade means on said framework having a lower edge contacting said surface, said blade means being located on said framework so as to direct solid deposits contacted thereby into said opening responsive to forward motion of said blade means relative to said surface;

and means operatively connected to said blade means to effect forward motion of said blade means relative to said surface.

6. A collector and hoist as defined in claim 5 wherein the jet of liquid provided by said hydraulic means within said conduit means past said opening is in hydrostatic balance with the surrounding water directly outside said opening.

7. In a mining apparatus for underwater usage in the recovery of loose and unconsolidated solid materials from a supporting surface;

a supporting framework adapted to rest upon the surface area;

means operatively connected to said framework to effect movement of said framework relative to said surface;

a vessel within which recovered solid material is to be collected;

upright blade means mounted on said framework with the lower edges thereof engaging said surface, said blade means having a rearwardly converging configuration;

conduit means mounted on said framework and extending outwardly therefrom to a discharge point in communication with said vessel, said conduit means including a side opening therein located adjacent the convergence of said blade means, whereby solid materials on said surface engaged by said blade means are urged into said opening in response to motion of said framework relative to said surface;

and hydraulic means operatively connected to said conduit means directing a jet of liquid within said conduit means past said opening, the liquid velocity being sufficient to propel solid materials outward-

ly from said framework within said conduit means to said discharge point and into said vessel.

8. In a collector and hoist for aggregates:

a pair of rearwardly converging upright blades fixed relative to one another;

a plane sled extending rearwardly from said blades and adapted to rest upon a surface containing loose and unconsolidated solid deposits, the bottom surface of said sled being elevated above the lower edges of said blades;

a plate fixed across the top edges of said blades, said plate being provided with an opening formed therethrough directly above the rear ends of said blades and bounded by said blades at each side thereof;

a tube mounted on said plate and extending along the upper surface thereof, said tube being provided with a downwardly directed opening in communication with the opening formed through said plate;

and hydraulic means operatively connected to said tube for directing a jet of liquid within said tube past said opening.

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