July 18, 1961 C. DAVIS 2,992,497

HYDRAULIC DREDGE

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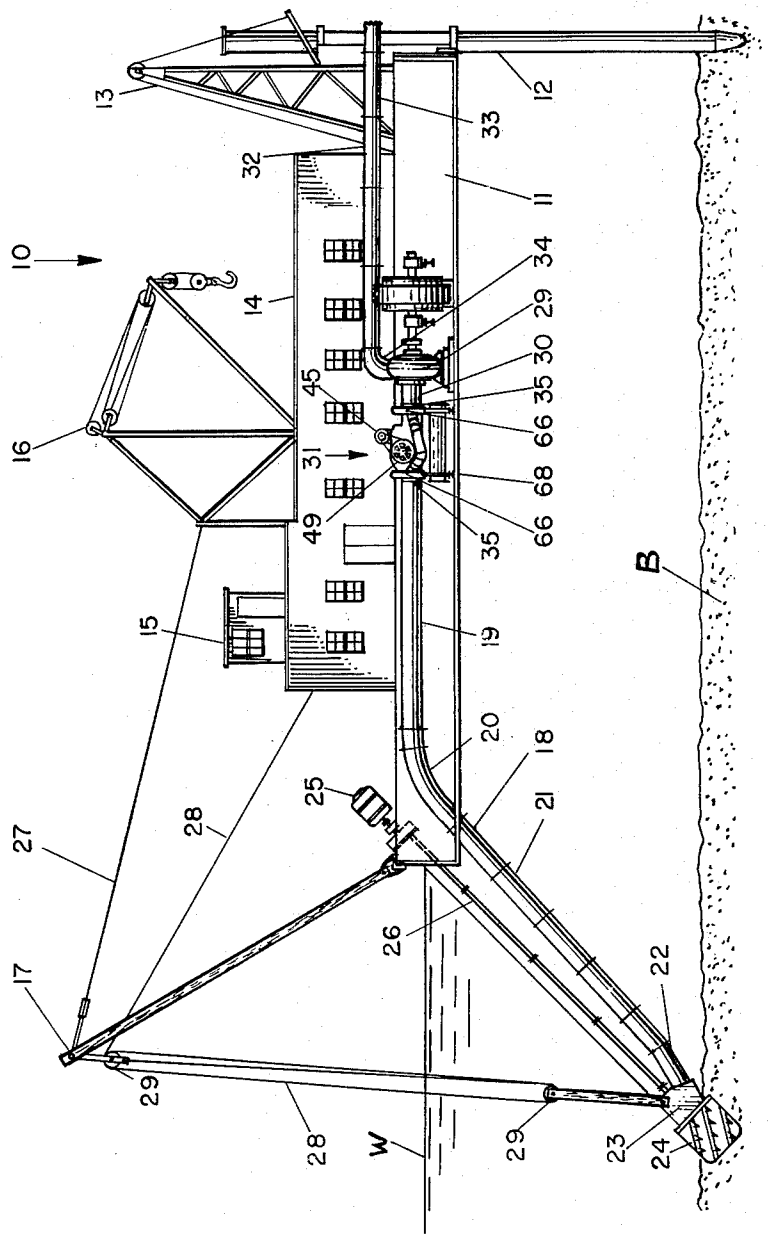


FIG. 1.

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HYDRAULIC DREDGE

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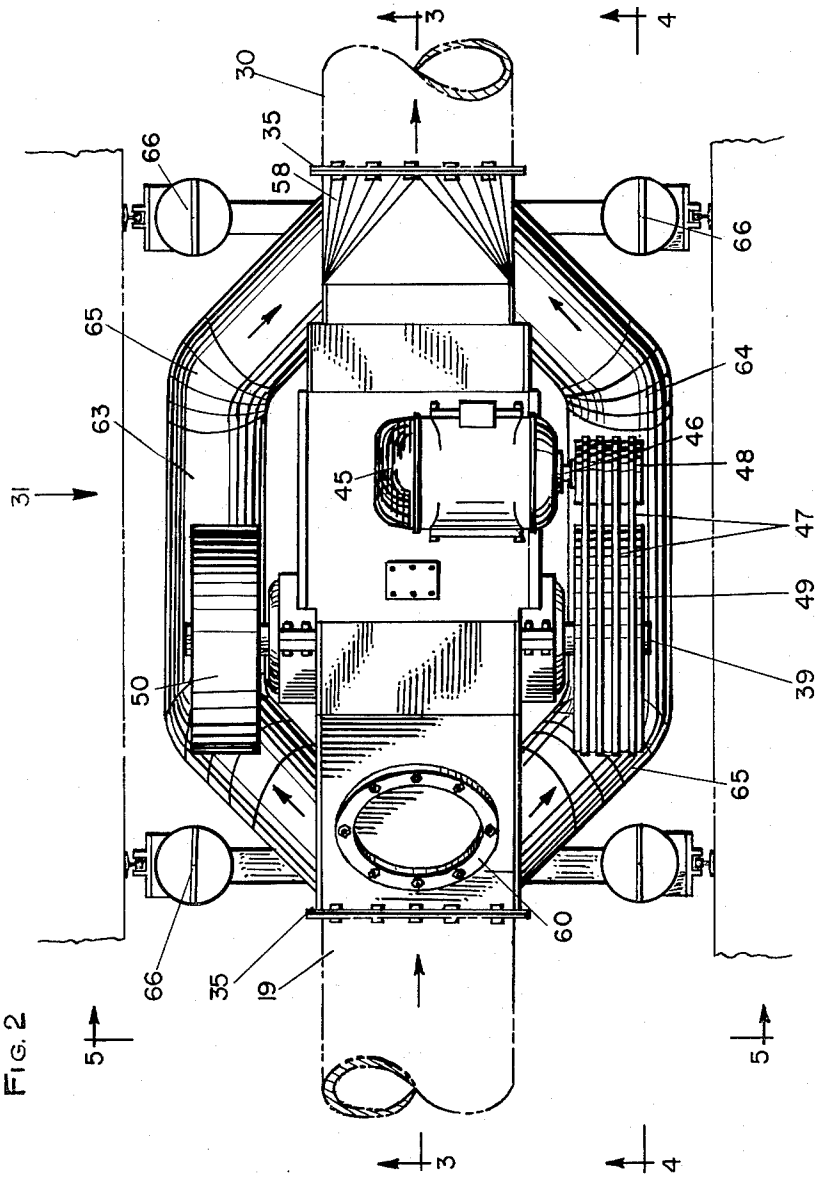


FIG. 2

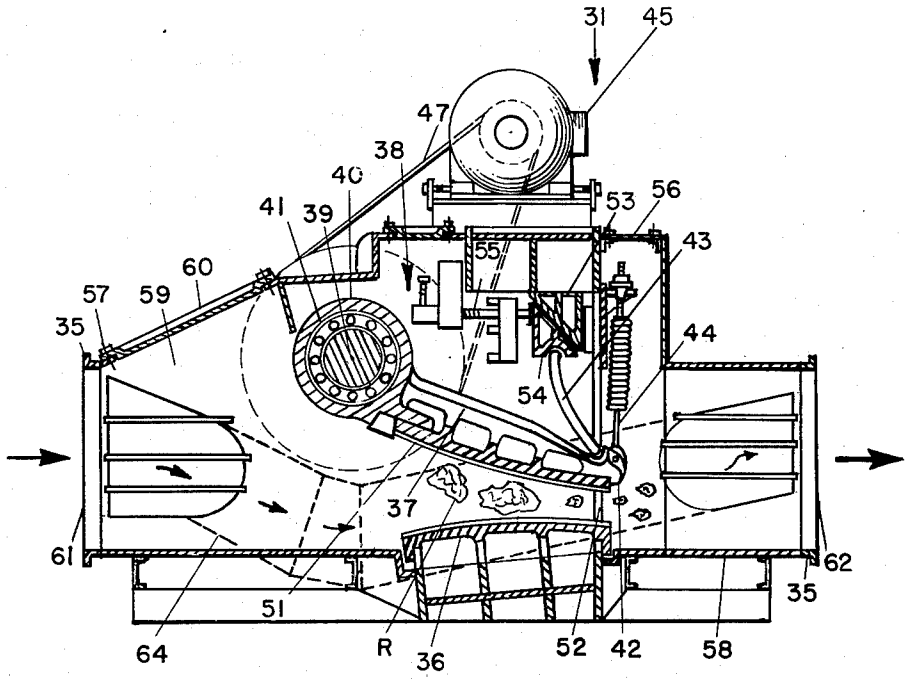
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HYDRAULIC DREDGE

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Fig. 3



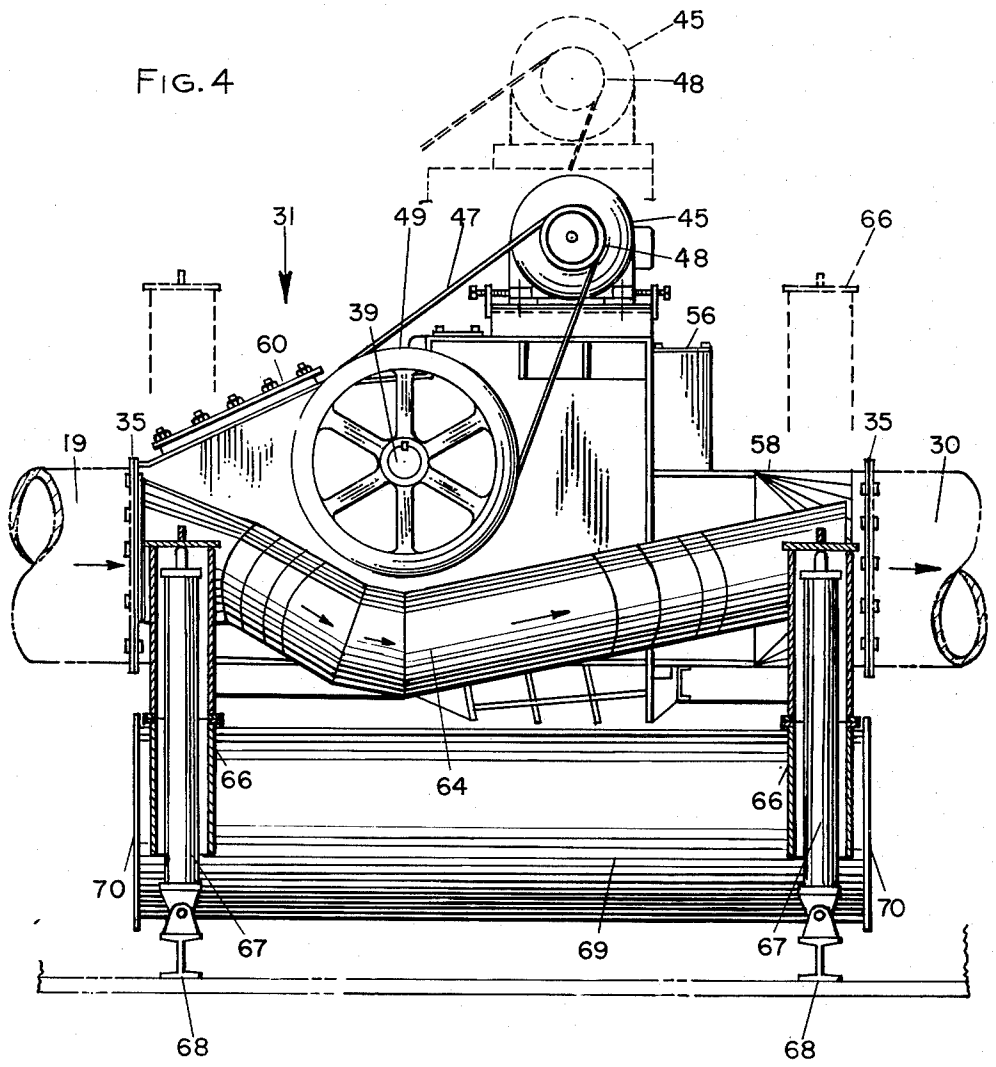
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FIG. 4



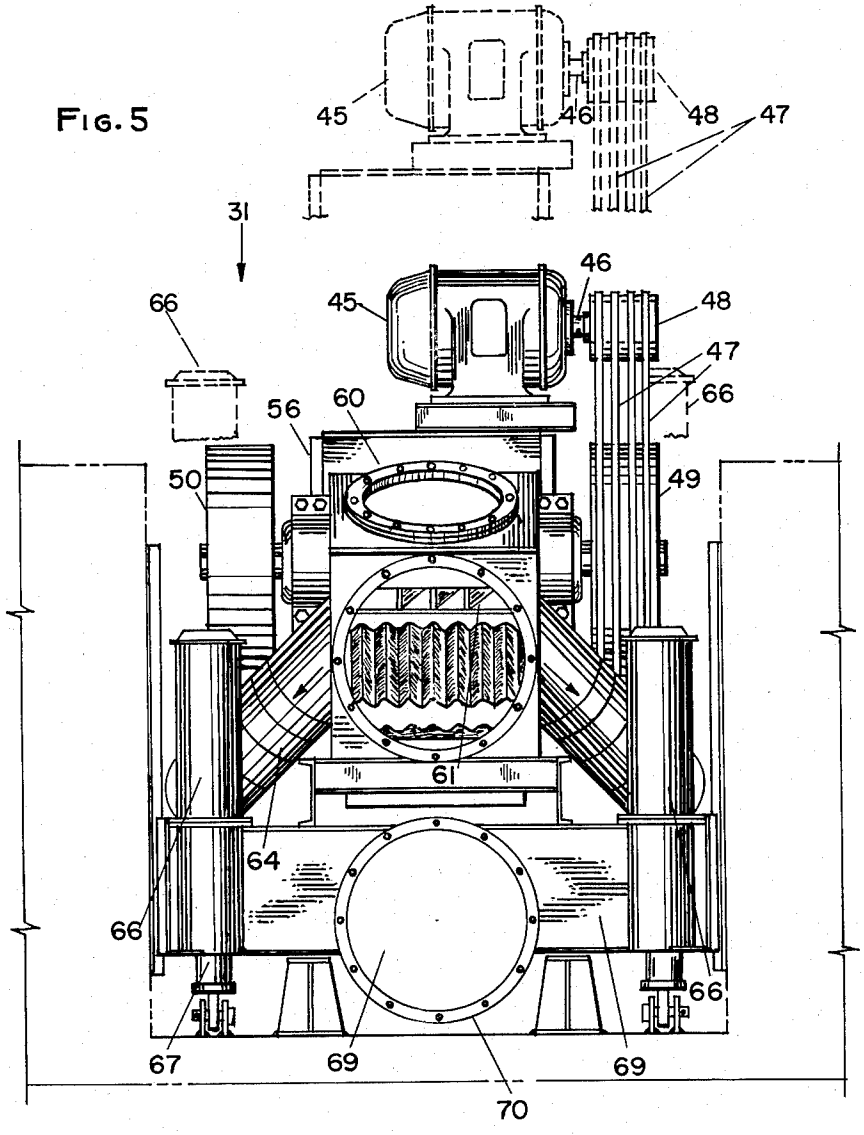
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FIG. 5



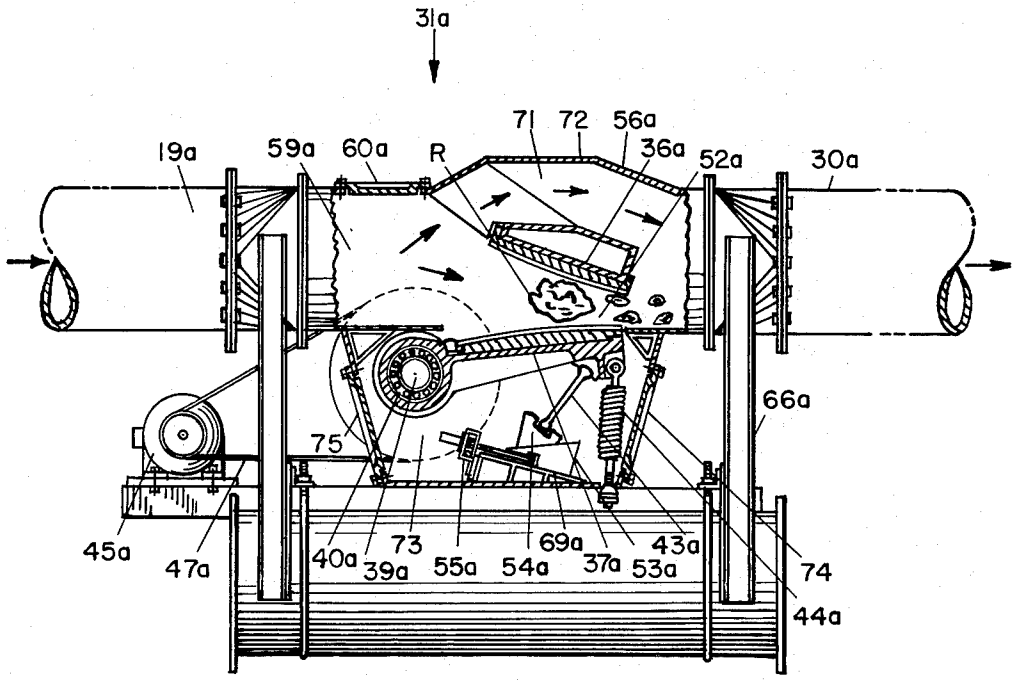
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FIG. 6



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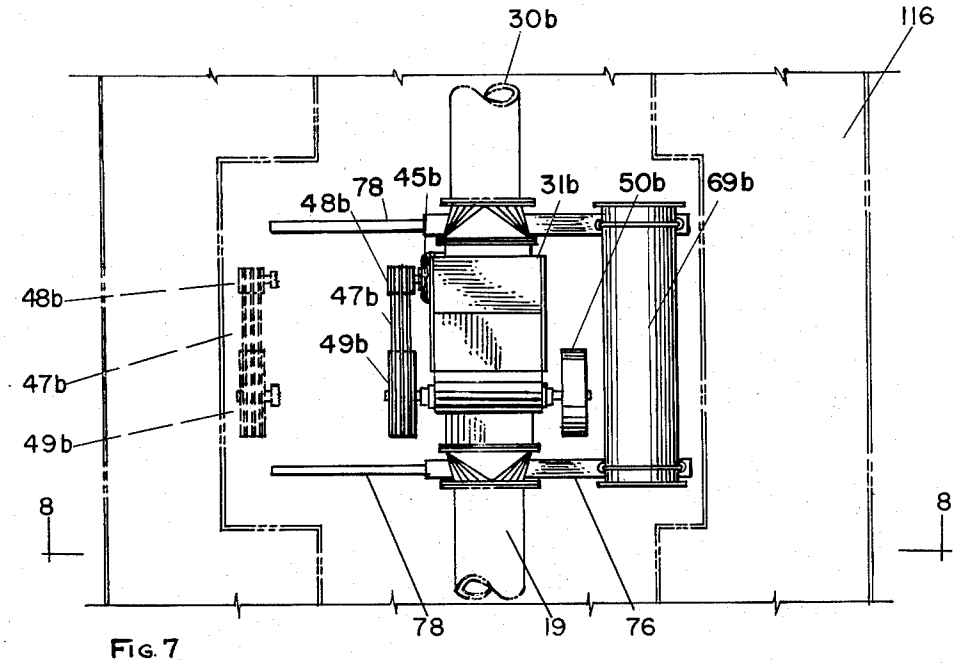


Fig. 7

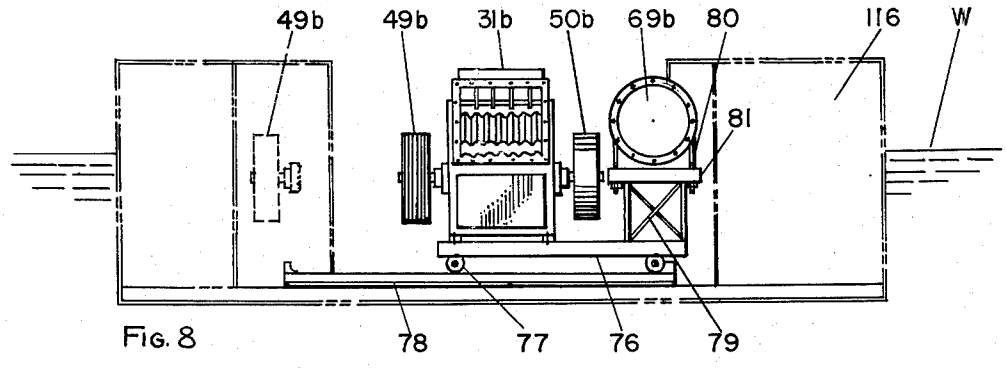


Fig. 8

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2,992,497

HYDRAULIC DREDGE

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Filed Jan. 2, 1959, Ser. No. 784,633
8 Claims. (Cl. 37—58)

This invention relates to improvements in hydraulic dredges of the type used to lower the bottom of bodies of water by dredging up material from the bottom and transporting the same therefrom. Specifically, the invention relates to improvements in such dredges enabling the same to operate economically not only on silt and sand materials, but also on stony, rocky, or coarsely granular materials by incorporating therein means for crushing or reducing the particle size sufficiently to permit their passage through the hydraulic pump without injuring the same, thereby facilitating the passage thereof through the entire material transporting pipe system of the dredge.

Hydraulic or suction dredges have long been used for various construction and mining operations including the deepening of rivers, harbors and similar bodies of water, as well as certain types of mining and stripping operations. The construction of such dredges are well known and usually include a hydraulic suction system comprising a forwardly and downwardly extending suction pipe connected at the rear end thereof to a large suction pump in turn connected to a rearwardly extending discharge pipe. The material operated upon is usually drawn up from the bottom through the suction pipe, passes through the suction pump and is then forced out through the discharge pipe. Heretofore, the type or particle size upon which the dredge was capable of operating was limited due to the necessity of passing the same through the pump. Rocks, boulders, and stones of any appreciable size were unable to pass through the pump without injuring the same (particularly the vanes thereof), thereby necessitating interruption of the work to dismantle the pump for repairs and/or removal of the interfering rocks or boulders. Moreover, these excessively sized particles were so injurious to the pump that the overall life of the equipment was materially and adversely affected.

For the foregoing reasons, numerous attempts have been made to provide screening devices for use in conjunction with the suction head of the suction pipe for the purpose of limiting the particle size capable of being drawn into the suction pipe. Such devices, of course, materially reduced the efficiency of the dredge and at best were effective or useful only where the average particle size of the material was less than that capable of being handled by the equipment. Thus, these devices were feasible where only occasional boulders or rocks occurred. As a matter of fact, the amount of overburden removed was often substantially reduced by the screened out or unadmitted boulders left on the bottom. Thus, essentially, such screening devices offered no basic cure to the limitations heretofore imposed on the utility of hydraulic dredges.

It is therefore an important object of this invention to provide means for overcoming all of the objections mentioned hereinabove.

Essentially, the invention comprises a hydraulic dredge having incorporated therein a rock crusher capable of reducing excessively sized particles to a size which may be safely passed through the pump without injuring the same or interfering in the operation or function of the hydraulic system. The rock crusher is positioned in the suction line or pipe forward of the pump so that the boulders are reduced before entering the pump.

It is a further important object of this invention to

provide a novel rock crushing apparatus capable of being readily substituted for a section of the suction pipe of a hydraulic dredge. A related object is to provide means for readily inserting or removing the rock crusher from the suction line and further capable of simultaneously replacing or removing the pipe section, thereby readily converting the hydraulic dredge from a conventional-type dredge to one capable of operating on material having more than occasional boulders or rocks therein.

Another object is to afford a hydraulic-dredge rock-crusher apparatus so designed that the use and operation thereof will not adversely affect the rate of flow of material through the hydraulic system. An object relating thereto is to provide bypass means through which may flow the water and smaller sized particles without necessitating the passage thereof through the jaws of the rock crusher.

Still a further object is to afford a hydraulic-dredge rock-crusher apparatus so designed that it will not adversely affect the vacuum of the suction system.

Still another object is to provide a hydraulic-dredge rock-crushing apparatus designed and assembled in such a manner that the controls and operating mechanism of the crusher are in readily accessible position.

Yet, another object is to afford a novel hydraulic lifting mechanism capable of lifting the rock crushing apparatus out of the hydraulic suction line and simultaneously positioning, in the gap left thereby, a pipe section which may be readily joined to the adjacent pipe sections so that the dredge may operate as a conventional dredge.

Yet, a further object is to provide a combined rock crusher device and suction pipe section mounted on mobile means capable of readily moving one or the other of said components into operational position.

Another object is to afford an improved hydraulic dredge capable of operating at substantially greater efficiency and with materially less lost time for repairs.

Finally, a further object is to provide a hydraulic-dredge rock-crushing apparatus of the character described of relatively simple, inexpensive construction, yet sturdy and effective.

With the foregoing and other objects in view which will appear as the description proceeds, the invention consists of certain novel features of construction, arrangement and a combination of parts hereinafter fully described, illustrated in the accompanying drawings, and particularly pointed out in the appended claims, it being understood that various changes in the form, proportion, size and minor details of the structure may be made without departing from the spirit or sacrificing any of the advantages of the invention.

For the purpose of facilitating an understanding of my invention, I have illustrated in the accompanying drawings preferred embodiments thereof, from an inspection of which, when considered in connection with the following description, my invention, its mode of construction, assembly and operation, and many of its advantages should be readily understood and appreciated.

Referring to the drawings in which the same characters of reference are employed to indicate corresponding or similar parts throughout the several figures of the drawings:

FIG. 1 is a side elevational view of a hydraulic dredge incorporating therein the principles of my invention and showing the same in operational position;

FIG. 2 is a top plan view of the rock crushing apparatus portion of the dredge;

FIG. 3 is a longitudinal sectional view taken on the plane of line 3—3 in FIG. 2 of the drawings and viewed in the direction indicated;

FIG. 4 is a side elevational view of the apparatus illustrated in FIG. 2 and showing in dotted outline the posi-

tion to which the apparatus may be moved when not in operational position;

FIG. 5 is an elevational view taken on the plane of line 5—5 in FIG. 2 of the drawings and viewed in the direction indicated;

FIG. 6 is a sectional view in elevation of a modified form of the invention;

FIG. 7 is a top plan view of a further modification; and

FIG. 8 is a sectional view of the modification illustrated in FIG. 7 of the drawings, said section taken on the plane of line 8—8 in FIG. 7 and viewed in the direction indicated.

Referring first to FIG. 1 of the drawings, reference numeral 10 indicates generally a hydraulic dredge floating on a body of water W the bottom of which is designated by reference symbol B. The dredge 10 may comprise a scow or barge 11 upon which is positioned the operative parts of the dredging mechanism. At the rear of said barge may be positioned a plurality of spuds such as 12 and suitable mechanism such as 13 for operating the same. These spuds are usually used as pivots for moving the dredge as well as for anchoring the same in operational position. A housing 14 is positioned on the deck of the barge 11. This housing may have a plurality of functions providing housings for the various motors, equipment and machinery, as well as crew living quarters and the like.

A pilot house 15 may be positioned on the top of a forward portion of the housing 14 as shown in the drawings. A boom or crane such as 16 may be provided for various lifting operations and a large forwardly extending crane 17 is further provided for a purpose which will be revealed as the description proceeds.

The suction or direct dredging portion of the apparatus with which this invention is primarily concerned comprises a forwardly-extending downwardly-inclined suction pipeline indicated generally by reference numeral 18. This pipeline may include a horizontal portion 19 which in turn may be made up of a plurality of pipe sections, one or more elbow sections such as 20, and a plurality of forwardly and downwardly inclined sections such as 21. The latter sections, as well as the elbow sections 20, may if desired, be made of a flexible material such as rubber. The outermost of the inclined sections 21 such as 22 is affixed to a cutter head 23 having a plurality of inclined rotatable blades such as 24 adapted to cut and loosen the material B upon which the dredge may be operating. Cutter head blade 24 may in turn be rotated by means of a motor 25 positioned in the barge 11 and operatively connected to the cutter head by means of a shaft 26. The cutter head 23 may be manipulated and moved by means of the crane 17 as the work progresses. The crane 17 is in turn controlled by the usual apparatus which includes winches, motors and cables such as 27 and 28. The cable 28 may be threaded over suitable pulleys such as 29 in the usual conventional manner for raising and lowering the cutter head.

In the conventional hydraulic dredges, the opposite end of the horizontal portion 19 was heretofore directly connected to a large suction pump such as 29. In the present modification it will be noted that an end section 30 of the pipeline 18 is likewise connected to the pump 29. However, it will be further noted that adjacent said end portion 30 there is interposed a novel rock crushing mechanism indicated generally by reference numeral 31. This mechanism 31 is of primary importance to the present invention and a detailed description of its construction and function will be subsequently disclosed.

The output end of the pump 29 is connected to a discharge pipeline 32 which may be made up of a plurality of pipe sections such as 33 connected to the pump discharge end by means of an elbow such as 34. Thus, in the conventional dredge, the bottom material B is first loosened and cut by the cutter head 23 and then drawn up as a slurry through the suction pipe 18 into the pump 29, passed therethrough, and then discharged through the discharge pipeline 32. The pipeline 32 may of course be extended to deposit the material directly on the banks of the body of water or it may be discharged onto barges or scows and transported thereby to a suitable dumping site.

Directing attention first to FIGS, 1, 2 and 3 of the drawings, the novel rock crushing apparatus 31 will now be described in greater detail. As noted in FIGS. 1 and 2 of the drawings, the rock crushing apparatus is shown mounted in operational position, connected by suitable connecting flanges such as 35 to the adjacent ends of the pipe sections 19 and 30 respectively. The crusher may be of the eccentric jaw type in which a stationary jaw 36 is provided against which rocks and boulders such as R may be crushed by a movable jaw 37 of a pitman mechanism indicated generally by reference numeral 38. It will be noted in FIG. 3 of the drawings that the movable jaw 37 is mounted at one end on a large eccentric shaft 39 by means of a cylindrical casting 40 and a suitable roller bearing assembly 41. The movement of the free end 42 of the jaw may be controlled by a return yoke 43 and a spring-urged tie rod 44.

The eccentric shaft 39 may be powered by a motor 45 having a drive shaft 46 which is operatively connected by means of suitable drive belts 47 mounted over and around a motor drive sheave or pulley 48 and a driven sheave 49 in turn mounted on the eccentric shaft 39. A fly wheel 50 may be mounted on the other end of the shaft 39 as shown in the several figures of the drawings.

From the foregoing it will be noted that the movable jaw 37 is provided with a toggle action by the eccentric shaft and return yoke. Thus with each revolution of the eccentric shaft two distinct crushing blows are directed against the material being operated upon. There is a primary blow at the trailing end of the jaws (left side, as viewed in FIG. 3) and then a secondary blow at the other end. The eccentric and toggle action provides a forward-crowding motion with the primary blow thereby producing a forced feed for passage of the material through the crusher. It will be noted in FIG. 3 of the drawings that the jaws 36 and 37 may both be provided with cheek plates such as 51. These cheek plates may be made of tough wear-resistant material such as cast manganese steel and may be made replaceable.

The discharge opening 52 of the jaws may be adjusted to regulate the finished product particle size by means of a pair of wedges 53 and 54. Wedge 53 is permanently positioned but wedge 54 may be moved to a plurality of positions along the face of the wedge 53 thereby in turn changing the angular disposition of the return yoke 43 which in turn changes the position of the free end 42 of the movable jaw 37 with respect to the fixed jaw 36. The adjustment of the movable wedge 54 may be controlled by a suitable screw adjustment mechanism such as 55.

The crusher portion of the apparatus may be contained in a housing 56 of suitable configuration for enclosing the same but having end portions such as 57 and 58 of a size and configuration identical with the adjacent pipe sections 19 and 30 so that the entire dredging apparatus may be readily positioned in the suction pipeline. A clean-out box 59 may be provided closed by a door 60 affording convenient access to the rock crusher mechanism for various purposes.

The importance of maintaining the vacuum in the dredge suction system was previously pointed out. Hence in order to maintain the dseired suction in the entire pipeline, it will be noted that the construction of the housing 56 is such as to afford an airtight chamber. Thus, also it will be noted that the flanges 35 are designed to cooperate with the adjacent pipe sections 19 and 30 so that the airtight integrity of the entire pipeline is maintained. In this regard, if necessary, suitable

gaskets or other sealants may be used in conjunction with the flanges **35**.

As shown in FIG. 3 of the drawings the rocks pass through the pipeline **19** and enter the rock crusher **31** through the upstream opening **61**. They then flow along the path indicated by arrows through the jaws of the rock crusher and pass out through the downstream opening **62**. It will thus be noted that the material flows in a substantially straight path through the crusher. This is of prime importance and is conducive to maintaining a steady flow of material without adversely affecting the vacuum on the suction side of the pipeline.

It should, of course, be apparent that as the jaws of the crusher operate, flow of the material therethrough is to some extent slowed up or dammed. It should also be apparent that there is no need for the water and small conventional size particles to pass through the crusher. Thus, if proper bypass means is provided, the water and smaller size particles may be made to bypass the jaws of the crusher so that the proper rate of flow of material through the entire system may be maintained. Accordingly, it will be noted in FIG. 2 of the drawings that such bypass means has been provided in the form of two bypass pipelines **63** and **64**. Each of these bypass pipelines may be made up of a plurality of sections such as **65**. The general configuration of the pipelines may be that illustrated in FIG. 2 and the diameters of the same may be less than the diameter of the suction pipeline proper. This, then, permits at least a considerable portion of the smaller particle slurry to flow around the rock crusher through the bypass lines in the path illustrated by arrows in FIGS. 2 and 4. Thus, the proper rate of flow is maintained without any slowing up of the same by the rock crusher operation.

As was indicated previously, the use of the rock crusher apparatus **31** is indicated only where the material operated upon is characterized by the presence of boulders, rocks, and coarse material which, if permitted to enter the pump **29**, would be injurious thereto or might cause excessive work stoppages for removing such excessively sized particles from said pump. Where the material consists of uniform, small-sized particles there is no need for the use or operation of the rock crusher. It is obvious therefore that from a practical standpoint it is desirable to provide means for readily converting the above-described rock-crusher hydraulic dredge to a conventional dredge. This, of course, may be accomplished by removing the rock crusher apparatus **31** from the pipeline and substituting therefor a conventional pipeline section. Although this may be accomplished manually, it is obvious that the shutdown time necessary to manually effect such a reconversion might be excessive to the point of rendering the use of the rock crusher itself economically non-feasible. To alleviate this situation, a novel reconversion apparatus has been provided which will now be described in detail.

Attention is directed to FIGS. 2, 4 and 5 of the drawings. An examination thereof will disclose that the rock crusher **31** is supported by four hydraulic cylinders such as **66**, one positioned at each corner. Positioned within each cylinder **66** may be a hydraulic lifting piston or mechanism such as **67** in turn supported on suitable structural steel members or rails such as **68**. Thus, when the pistons **67** are actuated the entire rock crushing apparatus **31** may be lifted out of the pipeline to the position indicated in dotted outlines in FIGS. 4 and 5 of the drawings.

Likewise supported below the rock crushing apparatus **31** by said hydraulic cylinders **66**, may be a conventional suction pipeline section **69**. Thus, as the rock crushing apparatus **31** is lifted out of the pipeline by the hydraulic cylinders **66** the conventional pipeline section **69** is simultaneously lifted up into aligned position between the adjacent pipeline sections **19** and **30**. The section **69** may then be readily connected into the suction pipeline thereby permitting the entire dredge to operate in a conventional manner. For this purpose the pipeline section **69** is provided with proper connecting flanges **70** capable of cooperating with the flanges **35** of the suction pipeline sections **19** and **30** for achieving a rapid and effective reconversion to a conventional pipeline. The flanges **70** may be identical with the flanges **35**, so that when the reconversion is effected, the previously described airtight integrity will once again be maintained. Actually, the reconversion may be effected in a matter of minutes so that the shutdown time for operation of the dredge is kept to an absolute minimum.

In FIG. 6 of the drawings there is illustrated a modified form of the rock crushing mechanism **31*a*** in which the bypass means for the smaller size particles and water is incorporated directly into the mechanism itself. In this embodiment, similar parts are indicated by like reference numerals with the added suffix "*a*."

In this embodiment it will be noted that the rock crusher is reversed in position so that the stationary jaw **36*a*** is positioned above the movable jaw **37*a***. There is thereby left above the stationary jaw **36*a*** a passage **71**, the size of which may be increased somewhat by a protuberance **72** formed at this point in the housing **56*a***. This passage **71** provides bypass means through which smaller size particles and water may flow in the direction indicated by arrows. Larger particles such as rock R being somewhat heavier than the smaller size particles tend to drop to the bottom of the stream of material passing through the suction line **19*a***. Thus, these larger particles naturally tend to enter between the lower-positioned rock crusher jaws **36*a*** and **37*a*** as again indicated by arrows in the drawings.

The operation and function of the rock crushing apparatus of this embodiment is in all other respects identical to the operation and function of the initially described embodiment so that further description of the same would be superfluous. It should, however, be noted that due to the positioning of the movable jaw **37*a*** on the bottom, a small amount of material may seep down into the lower portion **73** of the housing **56*a***. As this material builds up it may become necessary to remove the same, and for this purpose additional clean-out openings, closed by doors, such as **74** and **75**, may be provided.

In the previously described embodiments the replaceable pipe sections **69** or **69*a*** were positioned below the rock crushing apparatus proper **31** supported by the hydraulic cylinders **66**. Thus, the rock crushing apparatus was lifted upwardly when removing the same from the pipeline and simultaneously the replaceable pipe section was lifted into operational position. It is of course apparent that the lifting of heavy apparatus such as a rock crusher is somewhat inefficient requiring a rather sturdy, heavy, lifting mechanism. However, such a construction is often dictated by the lack of sufficient space on the dredge barge **11** for permitting the use of reconversion apparatus in which no lifting is required. Nevertheless, in those instances where space permits, a lateral moving apparatus may be utilized. Accordingly, still another modification has been provided as illustrated in FIGS. 7 and 8 of the drawings. Again, similar parts are designated by like reference numerals, but this time with the added suffix "*b*."

In this embodiment, the entire apparatus, both the rock crusher **31*b*** and the reconversion pipe section **69*b***, are mounted side by side on a movable truck **76**. The truck **76** is provided with wheels **77** in turn mounted on a set of rails **78**. Thus, when it is desired to reconvert the rock crusher type dredge to the conventional dredge, the truck **76** is rolled on the track **78** to the position shown in dotted outlines in FIGS. 7 and 8 of the drawings, thereby aligning the reconversion pipeline section **69*b*** in the pipeline between sections **19*b*** and **30*b***. In order to achieve such alignment, pipe section **69*b*** may be supported on an elevated structural support member **79** so that the pipe section is in the proper plane of elevation.

Fastening means such as tie rods **80** may be used to secure the pipe section **69***b* on the platform **81** of the support member **79**.

It will, of course, be understood that either described form of reconversion apparatus may be used with either form of rock crusher shown, depending upon the limitations of barge space, and the like. Thus, for example, the truck and rail apparatus last described may be employed with the rock crusher of FIG. 6 by merely properly positioning the reconversion pipe section **69***a* to the side of the crusher, as indicated in FIGS. 7 and 8.

From the above description and drawings it should be apparent that I have provided a novel hydraulic dredge having incorporated therein a rock crushing mechanism in the suction pipeline of the dredge. The position of the rock crushing mechanism precedes the pump **29** so that any excessively sized particles are crushed and reduced to a size which may be conveniently handled by the pump **29** without injuring the same. The provision of such a rock crushing mechanism materially reduces the shutdown time which heretofore was necessary to repair the pump or to remove large rocks and stones which often became lodged between the vanes of the pump. The efficiency of the dredge is thereby substantially increased and the limitation of its utility, heretofore imposed by the type of material upon which the dredge was operating, is substantially removed.

I have further provided means for readily converting a standard dredge to a rock crusher dredge and as readily reconverting back to the conventional type. Said conversion means is likewise useful during such times as it may be necessary to repair the crusher. In this interim period the dredge may operate in a conventional manner. Further, during this period, if necessary, the openings of the cutter head **23** may be closed to some extent to prevent the admission of large rocks and boulders during said period when the rock crusher itself is not in operation.

It should also be noted that I have provided bypass means enabling the major portion of conventional size particles to bypass the crusher, leaving the larger size material requiring crushing to be operated upon by the crusher jaws.

It is believed that my invention, its mode of construction and assembly, and many of its advantages should be readily understood from the foregoing without further description, and it should also be manifest that while preferred embodiments of the invention have been shown and described for illustrative purposes, the structural details are nevertheless capable of wide variation within the purview of my invention as defined in the appended claims.

What I claim and desire to secure by Letters Patent of the United States is:

1. In a hydraulic dredge comprising a barge, a suction pipeline, a suction pump and a discharge pipeline all mounted on said barge; a rock crusher interposed in said suction pipeline in spaced relationship with said suction pump, said suction pipeline comprising a plurality of pipe sections, said rock crusher comprising a housing having end sections sized and shaped to cooperate with adjacent pipe sections to connect said housing in watertight relationship therebetween, and an eccentric jaw crushing mechanism positioned in said housing, said crushing mechanism comprising a stationary jaw, a movable jaw, an eccentric shaft having one end of said movable jaw mounted thereon, powered means for driving said eccentric shaft, means for controlling the movement of the free end of said movable jaw, means for adjusting the spacing between said jaws, bypass means for the passage therethrough of relatively small size particle slurry not requiring crushing, an auxiliary suction pipeline section connected to said rock crusher, and means connected to said auxiliary suction pipeline section and rock crusher for removing said rock crusher from said suction pipeline and moving said auxiliary suction pipeline section into alignment with adjacent suction pipeline sections whereby to close the gap left by the removal of said rock crusher.

2. The rock crusher of claim 1 in which said stationary jaw is positioned in spaced relationship below said movable jaw and said bypass means comprises a pair of pipelines positioned one on either side of said crushing mechanisms, said pipelines connecting the end sections of said housing.

3. The rock crusher of claim 1 in which said stationary jaw is positioned in spaced relationship above said movable jaw, said housing including a portion depending below said suction pipeline, all of said crusher mechanism excepting said stationary jaw positioned in said latter-mentioned housing portion, and said bypass means comprising a top portion of said housing and the top portion of said stationary jaw cooperating to define the passageway of said bypass means.

4. In a hydraulic dredge comprising a barge, a suction pipeline, a suction pump and a discharge pipeline all mounted on said barge; a rock crusher interposed in said suction pipeline in spaced relationship with said suction pump, said suction pipeline comprising a plurality of pipe sections, said rock crusher replacing one of said pipe sections, said rock crusher comprising a housing having end sections sized and shaped to cooperate with adjacent pipe sections to connect said housing in watertight relationship therebetween, an eccentric jaw crushing mechanism positioned in said housing, and an apparatus for removing said rock crusher from said suction pipeline, said apparatus including a suction pipeline section, said apparatus further adapted to move said last-mentioned pipeline section into alignment with adjacent suction pipeline sections whereby to close the gap left by the removal of said rock crusher, said apparatus comprising a plurality of hydraulic cylinders and cooperating pistons adapted to raise said rock crusher out of said pipeline, and a pipe section supported by said cylinders and adapted to be raised up into alignment with said adjacent suction pipeline sections by said hydraulic cylinders and cooperating pistons.

5. A convertible hydraulic dredge including in combination; a suction pipeline, a suction pump, a discharge pipeline, a rock crusher positioned in said suction pipeline ahead of said suction pump, an auxiliary suction pipeline section connected to said rock crusher, and means connected to said auxiliary suction pipeline section and rock crusher for removing said rock crusher from said suction pipeline and moving said auxiliary suction pipeline section into alignment with adjacent suction pipeline sections whereby to close and seal the gap in said suction pipeline left by the removal of said rock crusher.

6. The hydraulic dredge of claim 5 in which said rock crusher comprises a housing, an eccentric jaw-type mechanism including a stationary jaw and a pitman mechanism positioned in said housing, and bypass means in said housing for passage of smaller-size particle slurry not requiring crushing, said bypass means comprising a top portion of said housing formed with a protuberance to afford a passage above said eccentric jaw-type mechanism through which said slurry may flow thereby bypassing said latter-mentioned mechanism.

7. The hydraulic dredge of claim 5 in which said means comprises a plurality of hydraulic cylinders and cooperating pistons adapted to raise said rock crusher out of said pipeline, said auxiliary suction pipeline section being supported by said cylinders and adapted to be raised up into alignment with said adjacent suction pipeline sections.

8. The hydraulic dredge of claim 5 in which said means comprises a truck mounted on tracks, said rock crusher mounted on said truck, said auxiliary suction pipeline section being mounted on said truck adjacent said rock crusher.

(References on following page)

References Cited in the file of this patent

UNITED STATES PATENTS

966,651	Cochran	Aug. 9, 1910
1,024,664	Baltz	Apr. 30, 1912
1,027,095	Baltz	May 21, 1912
1,633,161	Cavenagh	June 21, 1927
2,214,194	Franicley	Sept. 10, 1940
2,318,039	Wood	May 4, 1943
2,500,109	Young	Mar. 7, 1950
2,605,051	Bogie	July 29, 1952
2,815,771	Gibbs	Dec. 10, 1957