(No Model.)

A. B. BOWERS.

HYDRAULIC DREDGING APPARATUS.

No. 388,252. Patented Aug. 21, 1888.

Fig. 1.

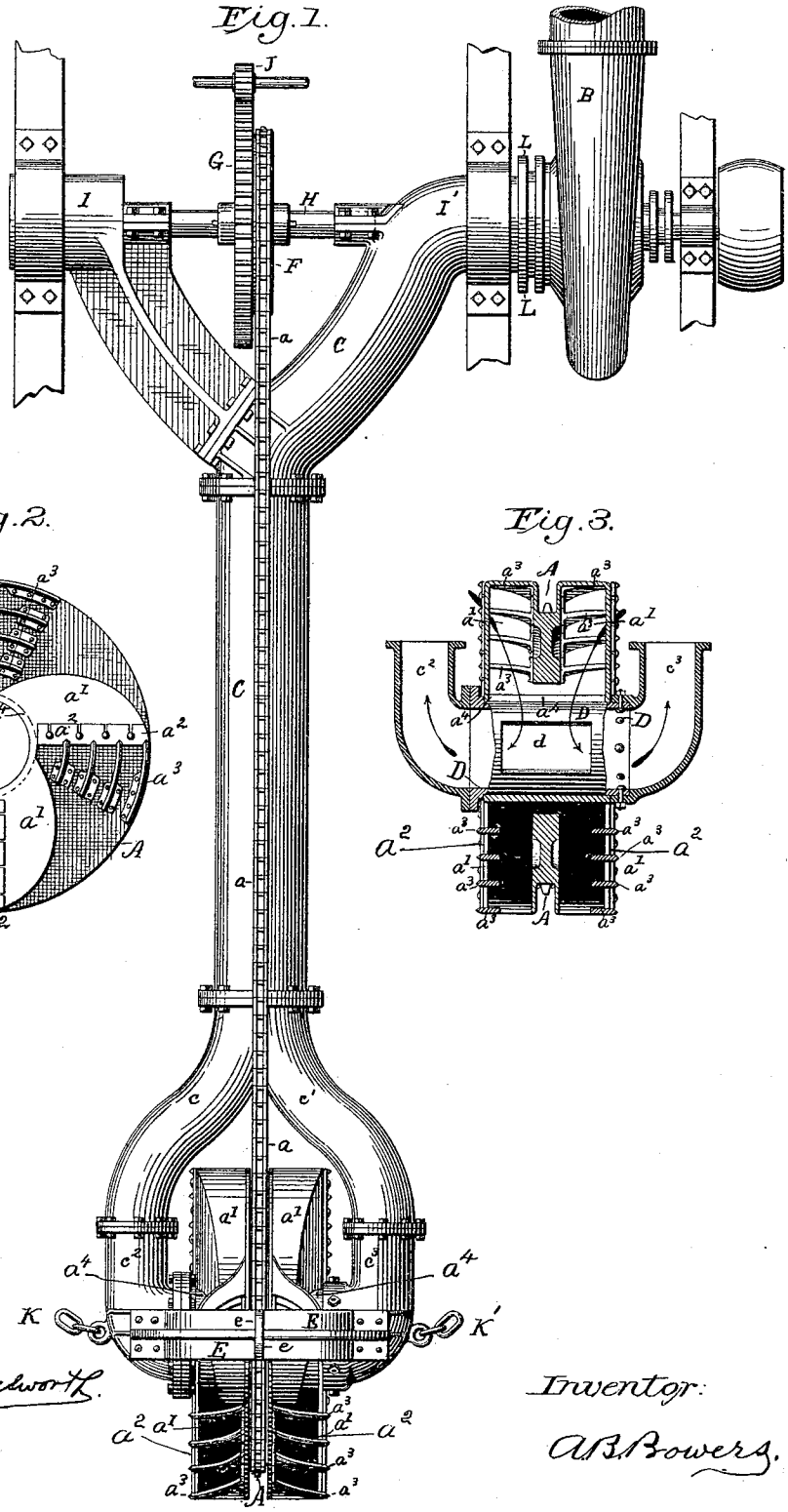


Fig. 2.

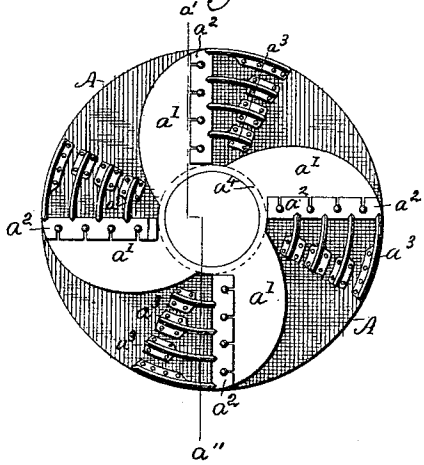


Fig. 3.

Attest.

Sidney P. Mellinghorth.

H. R. Kennedy.

Inventor:

A. B. Bowers.

N. PETERS. Photo-Lithographer, Washington, D. C.

UNITED STATES PATENT OFFICE.

ALPHONZO B. BOWERS, OF SAN FRANCISCO, CALIFORNIA.

HYDRAULIC DREDGING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 388,252, dated August 21, 1888.

Original application filed December 9, 1876. Renewed April 16, 1879. Divided and this application filed August 6, 1887. Serial No. 246,339. (No model.)

To all whom it may concern:

Be it known that I, ALPHONZO B. BOWERS, of San Francisco, California, civil engineer, have invented certain Improvements in Hydraulic Dredging Apparatus, of which this is a description.

It is a tenth division of the application filed December 9, 1876, and renewed April 16, 1879, consisting, mainly, of a rotary excavator, in combination with and mounted transversely to a suction-pipe, said excavator being provided with devices whereby it is enabled to work with an axial feed or swing in both directions; also with peripheral devices that enable it to cut in a plane perpendicular to its axis of rotation, and with fenders to prevent its cutting-edges from catching against obstructions, being for portions of the original application shown in original Figures 7, 10, 15, 17 to 23, inclusive, and described on pages 3, 4, 5, and 7 of the original specification.

Figure 1 is a plan of the excavating, actuating, raising, and discharging apparatus. Fig. 2 is a view of one end of the excavator. Fig. 3 is a cross section of the excavator, (in the line a' a'', Fig. 2,) a longitudinal section of the elbows of the lower end of the suction-pipe, and a view of one form of axle or journal on which said excavator may be mounted.

A is a chain-wheel driven by an endless chain, a, and having axial excavating devices on each side constructed to work with an axial feed or swing in both directions. These devices may be of any suitable form or construction to deliver their spoil either inwardly or outwardly to a suction-pipe. As here shown they consist of bottomless buckets with inward delivery, a' being the bucket, a^2 the "serrated, chisel-toothed, or straight-edged detachable knife," and a^3 the "fender." This chain-wheel, with its excavating devices, as here shown, constitutes a hollow rotary excavator with axial or end excavating edges and inward delivery. It consists of a hollow cylinder, a^4, having peripheral opening, over which are secured the buckets a', which are also secured to the chain-wheel in such manner that the whole rotates together, being in these respects substantially like the excavator described and claimed in Letters Patent No. 364,158, issued to me May 31, 1887, for the sixth division of the original application, except the non-spiral arrangement and shape of its buckets, which in this case are made with an outward flare to give an axial lead forming axial excavating devices that, like the cutting-edges of an auger or drill, work with an axial or end feed of the excavator as the pipe swings from side to side. The fenders a^3 are made with beveled cutting-edges and serve not only as fenders and to subdivide the spoil, but also as a screen to exclude coarse hard substances. They are secured to the disks of the chain-wheel and to the buckets by bolts and screws, thus making them detachable, or in any other suitable manner. As this excavator works wholly with an axial or end feed and side swing of the suction-pipe, except when being lowered for a new swing, the fenders are arranged to run parallel with the circumference, except the outside ones, which may have a slight outward flare.

B is a pump for raising and discharging spoil.

C is a suction-pipe connecting the pump with the excavator. It may be mounted on a ladder or otherwise stiffened and strengthened, as described and claimed in other divisions of the original case, and swings in a vertical plane on the trunnions I I′ or equivalent joints. The outer end of this pipe is constructed and arranged to support the excavator, and is suspended from a suitable derrick or frame. It may be fitted to the periphery of an excavator with outward delivery, as described in the eighth divisional application, Serial No. 238,513, filed May 17, 1887, or it may be constructed to take its spoil from the interior of an excavator having an inward delivery, the latter being the form of construction here shown. For this purpose, in the present instance, it is provided with branches c c', which are bolted to elbows c^2 c^3, and these, in their turn, to the open ends of a hollow cylinder, D, forming an axle or journal for the excavator, and having an opening, d, for the reception of spoil. The ends of the cylinder a^4 may, and it is preferred that they should, project beyond the buckets sufficiently to form bearings outside thereof, this being shown in original Figs. 15, 16, and 17. This will re-

quire slightly longer inner and outer cylinders than shown in Figs. 1 and 3, and to the same extent increase the spread of branches *c c'*, but will give additional strength and stability to the excavator.

E is a yoke passing over the excavator and connecting the elbows c^2 c^3. It is provided with an eye, *e*, to which is secured the raising and lowering tackle (not shown) by which it is suspended from a derrick or crane.

F, as here shown, is a chain-wheel bolted to the arms of the gear G, mounted on a shaft, H, in line with the axes of the trunnions I I', on which the excavator and suction-pipe swing.

J is a pinion on the crank-shaft of the engine that actuates the excavator.

K K' are portions of chains by which the excavator is fed to its work and the suction-pipe swung from side to side.

L is a gland, making an air-tight connection between the suction pipe and pump. The suction-pipe is usually mounted in the same manner, and the best mode of operation is the same as that described in my patent, No. 318,859, issued May 26, 1885, for the first division of the original application.

I do not confine myself to the special devices here shown; but in this tenth division claim—

1. In combination, a suction-pipe and a rotary excavator having its axis transverse to said pipe, said excavator being provided with axial excavating devices constructed to work with an axial or end feed, and means for giving to said excavator an axial swing.

2. In combination, a suction-pipe and a rotary excavator having its axis transverse to said pipe, said excavator being provided with axial excavating devices and detachable cutting-edges.

3. In combination, a suction-pipe and a rotary excavator having its axis transverse to said pipe, said excavator being provided with axial excavating devices, and fenders to protect said devices.

4. In combination, a suction-pipe and a rotary excavator having its axis transverse to said pipe, said excavator being provided with axial excavating devices, and a device for excluding substances too hard and coarse to pass through the raising and discharging apparatus.

5. In combination, a suction-pipe, a rotary excavator having its axis transverse to said pipe, said excavator being provided with axial excavating devices, detachable cutting-edges, and fenders to protect said edges.

6. In combination, a suction-pipe, a rotary excavator having its axis transverse to said pipe, said excavator being provided with axial excavating devices and detachable cutting-edges, and a device for excluding coarse hard substances from the suction-pipe.

7. In combination, a suction-pipe and a rotary excavator having its axis transverse to said pipe, said excavator being provided with axial excavating devices having an inward delivery through themselves to said pipe.

8. In combination, a suction-pipe and a rotary excavator having its axis transverse to said pipe, said excavator being provided with axial excavating devices armed with detachable cutting-edges and having an inward delivery through themselves to said pipe.

9. In combination, a suction-pipe and a rotary excavator having its axis transverse to said pipe, said excavator being provided with axial excavating devices having an inward delivery to said pipe, and fenders to protect said devices.

10. In combination, a suction-pipe and a rotary excavator having its axis transverse to said pipe, said excavator being provided with axial excavating devices having an inward delivery, and a device for excluding coarse hard substances from said pipe.

11. In combination, a suction-pipe and a rotary excavator having its axis transverse to said pipe, said excavator being provided with axial excavating devices having an inward delivery, detachable cutting-edges, and fenders to protect said edges.

12. In combination, a suction-pipe, a rotary excavator having its axis transverse to said pipe, said excavator being provided with axial excavating devices having an inward delivery and detachable cutting-edges, and a device for excluding coarse hard substances from said pipe.

13. In combination, a suction-pipe and rotary excavator having its axis transverse to said pipe, said excavator being provided with bottomless buckets having axial excavating-edges.

14. In combination, a suction-pipe and a rotary excavator having its axis transverse to said pipe, said excavator being provided with bottomless buckets having detachable side or axial cutting-edges.

15. In combination, a suction-pipe and a rotary excavator having its axis transverse to said pipe, said excavator being provided with bottomless buckets having side or axial cutting-edges, and fenders to protect said edges.

16. In combination, a suction-pipe and a rotary excavator having its axis transverse to said pipe, said excavator being provided with bottomless buckets having side or axial cutting-edges, and a device to exclude coarse hard substances.

17. In combination, a suction-pipe and a rotary excavator having its axis transverse to said pipe, said excavator being provided with bottomless buckets having detachable side or axial cutting-edges, and fenders to protect said edges.

18. In combination, a suction-pipe, a rotary excavator having its axis transverse to said pipe, said excavator being provided with bottomless buckets having detachable side or axial cutting-edges, and a device for excluding coarse hard substances from the suction-pipe.

19. In combination, a suction-pipe, a rotary

excavator having its axis transverse to said pipe, said excavator being provided with axial excavating devices, a chain-wheel, and an endless chain actuated by a chain-wheel in the axis or center of oscillation of said suction-pipe.

20. In combination, a suction-pipe and rotary excavator, consisting of a chain-wheel provided with axial excavating devices constructed to work with an axial or end feed, and means for giving to said excavator an axial swing.

21. In combination, a suction-pipe and a rotary excavator consisting of a chain-wheel provided with axial excavating devices and detachable cutting-edges.

22. In combination, a suction-pipe and a rotary excavator consisting of a chain-wheel provided with axial excavating devices, and fenders for the protection of said devices.

23. In combination, a suction-pipe and a rotary excavator consisting of a chain-wheel provided with axial excavating devices, and a device for excluding coarse substances from said pipe.

24. In combination, a suction-pipe and a rotary excavator consisting of a chain-wheel provided with detachable axial excavating-edges, and fenders to protect said edges.

25. In combination, a suction-pipe and a rotary excavator consisting of a chain-wheel provided with axial excavating devices, detachable cutting-edges, and a device for excluding coarse substances from the suction-pipe.

26. A rotary excavator consisting of a chain-wheel provided with axial excavating devices, and fenders for the protection of said devices.

27. A rotary excavator provided with axial excavating devices on each end to excavate in each direction and deliver the spoil inward between said devices.

28. A rotary excavator provided with axial excavating devices, and with detachable fenders for the protection of said devices and to prevent them from catching against obstructions, and with means for giving to said excavator an axial swing.

ALPHONZO B. BOWERS.

In presence of—

E. W. B. PHILLIPS,

A. C. RAWLINGS.