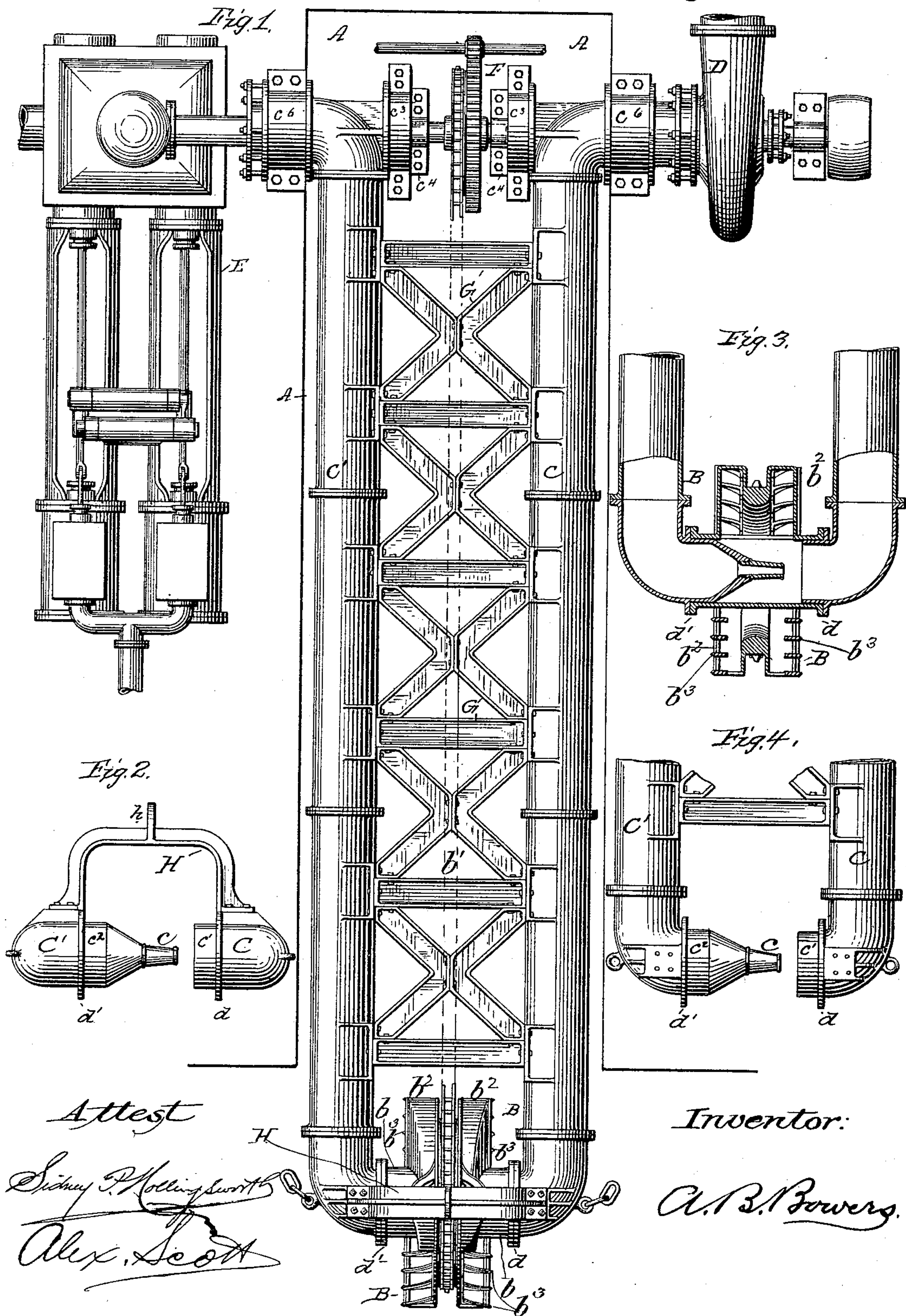


(No Model.)

A. B. BOWERS.
DREDGING APPARATUS.

No. 388,337.

Patented Aug. 21, 1888.



UNITED STATES PATENT OFFICE.

ALPHONZO B. BOWERS, OF SAN FRANCISCO, CALIFORNIA.

DREDGING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 388,337, dated August 21, 1888.

Original application filed December 9, 1876. Renewed April 16, 1879. Divided and this application filed May 1, 1888. Serial No. 272,518. (No model.)

To all whom it may concern:

Be it known that I, ALPHONZO B. BOWERS, of San Francisco, California, civil engineer, have invented an Improvement in Hydraulic
5 Excavating and Dredging Apparatus, of which this is a specification.

It is an eleventh division of the application filed December 9, 1876, and renewed April 16, 1879, (being for portions shown in original
10 Figures 1, 2, 3, 7, 10, 15, described on pages 3, 4, 5, 7, 8, and 12 of the original specification,) with some additional details.

It consists in part of an excavator, of any suitable form, mounted on the outer end of a
15 ladder constructed with tubular sides trussed and bound together to give the necessary stiffness in the usual form of a dredge-ladder, each side having at its inner upper end a bearing in the same axial line with the other, on which
20 bearings the ladder swings in a vertical plane.

It consists, also, in part in utilizing the hollow sides of this ladder as conduits for conveying water and spoil, and in other details of construction, hereinafter set forth.

25 Figure 1 is a plan of one form of construction. Fig. 2 is a view of the outer end of the ladder shown in Fig. 1 and of a yoke or bail by which said ladder may be suspended and the outer ends of the hollow sides stiffened and
30 bound together. Fig. 3 is a longitudinal section through the outer end of the ladder and excavator shown in Fig. 1, and Fig. 4 is a plan of the lower end of said ladder with the yoke and excavator removed.

35 A represents a longitudinal well in the hull of a dredge-boat, in which the ladder may be mounted.

B represents any suitable excavator, rotary or otherwise, with inward or outward delivery to the pipe by which the spoil is removed.
40 As here shown, it is the hollow rotary excavator with inward delivery described and claimed in the tenth division of the original application, Serial No. 246,339, filed August 6, 1887. It is a chain-wheel mounted on a hollow cylinder or hollow shaft, *b*. It is driven by the endless chain *b'*. It is provided with excavating-buckets *b²* on each side. These buckets are secured to the chain-wheel
45 and to the hollow cylinder or shaft. Beneath these buckets are apertures opening into the

cylinder, through which the spoil passes to the mouth of the suction-pipe inside of said cylinder. These buckets flare outwardly, like the cutting-lips of an auger, and work with an axial
55 or end feed and with a side swing of the ladder in both directions. They are provided with cutting-fenders *b³*, to divide the material and exclude coarse substances, as described and claimed in the aforesaid tenth division. 60

C C' are the hollow sides of the ladder, *C* being utilized as a receiving and, in the present instance, as a suction and *C'* as a force pipe. These pipes are here shown as trussed and tied together to form a rigid structure in the
65 usual form of a dredge-ladder. The outer lower ends of these pipes may be provided with detachable elbows having bearings *c' c²*, forming hollow axles or journals on which the hollow excavator with inward delivery re-
70 volves, these journals being provided with collars *d d'* to hold the excavator in place.

When a different excavator is used, these elbows may be removed, and any suitable device for attaching the excavator to the end of the lad-
75 der, so that it will deliver the spoil to the receiving pipe, may be used instead; or the excavator may be attached to the device here shown. The inner upper ends of the pipes *C C'* may
80 may also be provided with elbows, each in the same axial line with the other, forming hollow trunnions, on which the ladder swings in a vertical plane, though the ladder may be mounted on solid trunnions and connect with the pumps in a different way, as described
85 and claimed in another of my pending applications, Serial No. 187,638, filed January 4, 1886, the same being a division of another pending application filed June 30, 1883, Serial

No. 99,678. When a rotary excavator is used, 90 these elbows may turn outward, as shown, and be provided with interior trunnions and bearings, *c³*, and to these interior trunnions may be attached the bearings *c⁴* of the shaft of the chain-wheel *F*, which carries the endless chain
95 that drives the excavator. This chain-wheel may be actuated by a spur gear and pinion, or in any other suitable manner, as described and claimed in the tenth division, hereinbefore specified. The inner upper elbow of pipe
100 *C* in the construction shown passes through the bearing *c⁶* and a suitable gland to the suc-

tion of the pump D, by which the spoil is withdrawn from the excavator, while the inner upper elbow of C', also passing through a bearing, c', is connected in any suitable manner with the discharge-pipe of the force-pump E, by which water is injected through C' into the pipe C. When the spoil is to be raised just above the water-level and to be transported but a short distance, the pump D is not always used, the force-pipe discharging through the injection-nozzle into the pipe C being sufficient in some cases to dispose of the spoil.

G is any suitable trussing and bracing for binding the sides of the ladder together and giving the necessary stiffness and rigidity.

H is a yoke uniting the lower elbows of the ladder. It may be braced to the ladder to give greater stiffness and strength, and may also be provided with an eye, h, or equivalent device by which the ladder may be suspended from any suitable raising and lowering apparatus.

I do not herein claim the following combinations, the same being claimed in another division of the original application pending concurrently with this, to wit: first, a ladder, suction-pipe, and hollow rotary excavator with inward delivery through itself to said pipe; second, a suction-pipe, ladder, and hollow rotary excavator with inward delivery through itself to said pipe, said excavator being provided with side cutting-edges and devices to effect a side feed; third, a suction-pipe, ladder, and hollow excavator with cutting-edges and devices to effect a side feed.

I do not confine myself to the specific construction here shown, but in this case claim—

1. A ladder for excavating and dredging purposes, consisting of tubular sides suitably trussed and bound together to give the necessary rigidity and mounted on trunnions to swing in a vertical plane, one of these sides being utilized as a suction-pipe and the other as a force-pipe, through which water is injected into the suction-pipe.

2. In combination, a ladder for excavating and dredging purposes, consisting of tubular sides suitably trussed and bound together to give the necessary rigidity and mounted on trunnions to swing in a vertical plane, one of these sides being utilized as a suction-pipe and the other as a force-pipe, through which water is injected into the suction-pipe, and an excavator constructed and arranged to deliver its spoil to said suction-pipe.

3. In combination, a ladder for excavating and dredging purposes, consisting of tubular sides suitably trussed and bound together to give the necessary rigidity and mounted on trunnions to swing in a vertical plane, one of these sides being utilized as a suction-pipe and the other as a force-pipe, through which water is injected into the suction-pipe, and a rotary excavator constructed and arranged to deliver its spoil to said suction-pipe.

4. In combination, a ladder for excavating and dredging purposes, consisting of tubular

sides suitably trussed and bound together to give the necessary rigidity and mounted on trunnions to swing in a vertical plane, one of these sides being utilized as a suction-pipe and the other as a force-pipe, through which water is injected into the suction-pipe, and a hollow rotary excavator with inward delivery through itself to said suction-pipe.

5. A ladder for excavating and dredging purposes, consisting of tubular sides suitably trussed and bound together to give the necessary rigidity and mounted on trunnions to swing in a vertical plane, one of these sides being utilized as a receiving and discharging pipe and the other as a force-pipe, through which water is injected into said discharge-pipe.

6. In combination, a ladder for excavating and dredging purposes, consisting of tubular sides suitably trussed and bound together to give the necessary rigidity, one of these sides being utilized to form a receiving and discharging pipe and the other as a force-pipe, through which water is injected into the discharge-pipe; and an excavator constructed and arranged to deliver its spoil to said receiving and discharging pipe.

7. In combination, a ladder for dredging purposes, consisting of tubular sides suitably trussed and bound together to give the necessary rigidity, one of these sides being utilized as a receiving and discharging pipe and the other as a force-pipe, through which water is injected into the discharge-pipe, and a rotary excavator constructed and arranged to deliver its spoil to said discharge-pipe.

8. In combination, a ladder for excavating and dredging purposes, consisting of tubular sides suitably trussed and bound together to give the necessary rigidity, one of these sides being utilized as a receiving and discharging pipe and the other as a force-pipe, through which water is injected into the discharge-pipe, and a rotary excavator with inward delivery through itself to said discharge-pipe.

9. A swinging ladder for dredging purposes, consisting of hollow or tubular sides suitably trussed and bound together to form a rigid structure and mounted on hollow trunnions, on which it swings in a vertical plane, one of these sides being utilized as a suction-pipe and communicating through its hollow trunnion, and a suitable connection with a suction-pump capable of raising and discharging spoil, the other side communicating through its hollow trunnion with the discharge of a force-pump and serving as a conduit through which water may be injected into the suction-pipe.

10. A swinging ladder for dredging purposes, consisting of hollow or tubular sides suitably trussed and bound together to form a rigid structure and mounted on hollow trunnions, on which it swings in a vertical plane, one of these sides being utilized as a suction-pipe and communicating through its hollow trunnion and a suitable connection with a suction-pump capable of raising and discharging

spoil, the other side communicating through its hollow trunnion with the discharge of a force-pump through which water may be injected into the suction-pipe, in combination
 5 with elbows on the lower ends of said hollow sides, forming continuations of said pipes, the force-pipe being provided with an injection-nozzle through which water is forced into the mouth of the suction-pipe.

10 11. A swinging ladder for dredging purposes, consisting of tubular sides suitably trussed and bound together to form a rigid structure and mounted on hollow trunnions, on which it swings in a vertical plane, one of
 15 these sides being utilized as a suction-pipe and communicating through its hollow trunnion and a suitable connection with a suction-pump capable of raising and discharging spoil, the other side communicating through its hollow
 20 trunnion with the discharge of a force-pump through which water may be injected into the suction-pipe, in combination with elbows on the lower ends of said hollow sides, forming continuations of said pipes, these elbows be-
 25 ing provided with bearings forming journals for the support of a hollow rotary excavator with inward delivery through itself to the suction-pipe.

12. The combination, in a device for raising

spoil, of a rotary excavator provided with cut- 30
 ting edges or blades, a suction pipe and pump, and an injection-pipe through which water may be forced into said suction-pipe.

13. The combination, in a device for raising spoil, of a suction pipe and pump, an exca- 35
 vator having a cutting-edge or cutting-edges constructed and arranged to work with a side feed or swing of the ladder in lateral planes from side to side across the longitudinal axis of the excavation and deliver its spoil to this 40
 pipe, and an injection-pipe through which water may be forced into said suction-pipe.

14. The combination, in a device for raising spoil, of a suction pipe and pump, a rotary ex- 45
 cavator provided with axial excavating-blades that deliver its spoil to this pipe, and an in-
 50 jection-pipe through which water may be forced into said suction-pipe.

15. The combination, in a device for raising spoil, of a suction pipe and pump, a rotary ex- 50
 cavator with inward delivery through itself to this pipe, and an injection-pipe through which water may be forced into said suction-pipe.

A. B. BOWERS.

In presence of—

W. E. EVANS,

J. C. STODDARD.