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DREDGING APPARATUS

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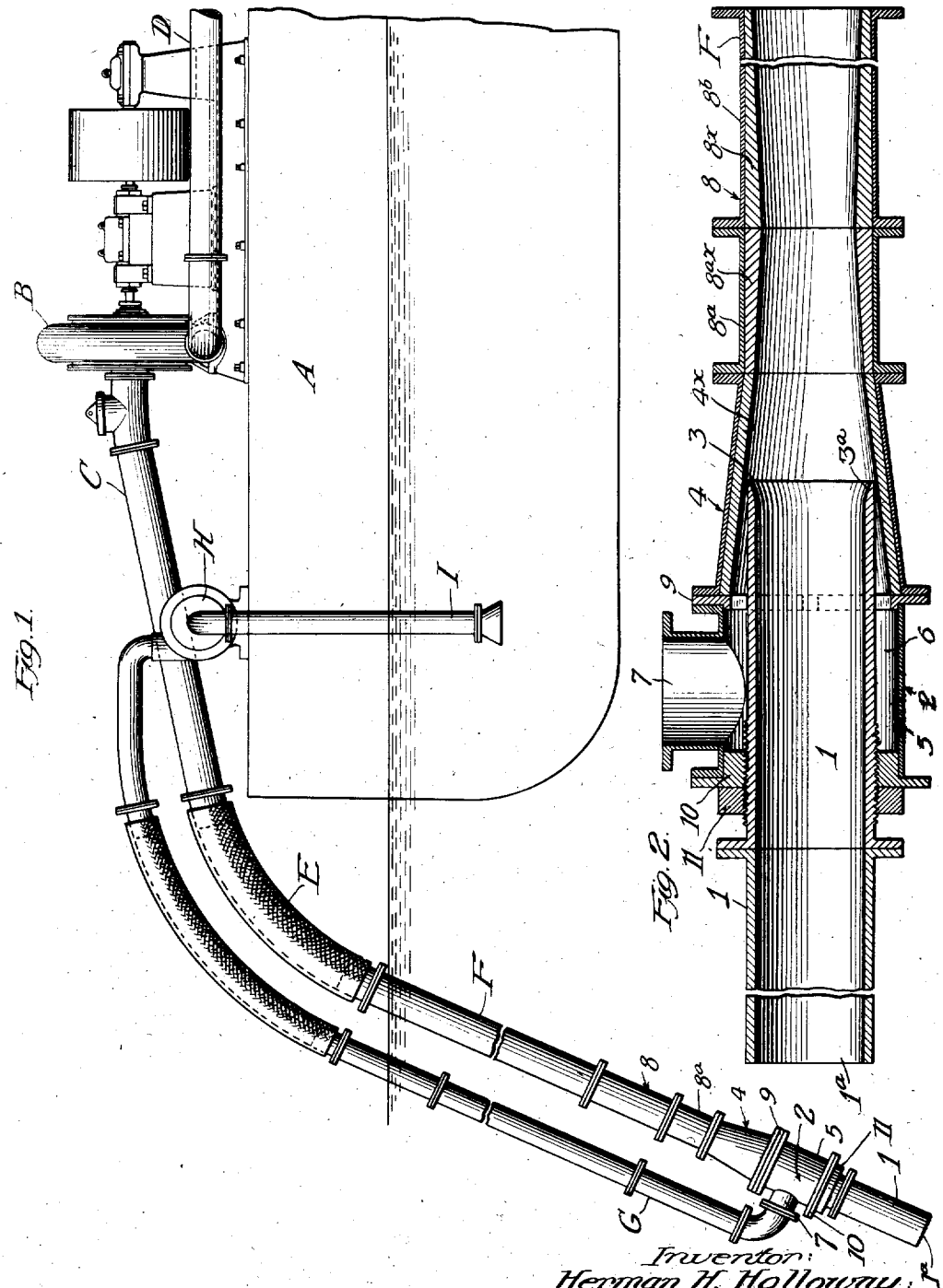

Fig. 1.

Fig. 2.

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DREDGING APPARATUS

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3 Claims. (Cl. 37—62)

This invention relates to apparatus for pumping sand, gravel or other subdivided material from places where sufficient water is available to serve as a vehicle for the material and lend to it sufficient fluidity to enable it to respond to the pump.

In apparatus of this kind, it has long been proposed to tap into the suction pipe, through means of elements coacting therewith after the manner of an injector, a boosting water supply furnished by an independent pump which will largely relieve the back flow load on the material pump and insure an impelling force that will materially increase the output of the apparatus. But in previously suggested arrangements of this kind known to me, the boosting instrumentalities have been irrationally designed, with the result that the increased capacity bestowed has not been economically commensurate with the power expended for the boosting water supply.

The object of the present invention is to provide a highly efficient construction of boosting instrumentality for dredging apparatus of the kind aforesaid, and the invention proceeds upon the principle of having the intake element of the suction pipe designed as a relatively large barrel of substantially uniform diameter through which induced fluid (the material and its vehicular water) to the full capacity of the barrel, will flow as a projectile free from eddy currents, serious torsional disturbance or the like, so that when it meets the boosting water it will be in condition to receive the latter with full and uniform propelling effect throughout its circumference; also in having the intake end of this barrel defined by rationally narrow walls so that material may enter the barrel from points around the intake end without having to travel a substantial distance across a transverse face which, in the older arrangements, materially decreases efficiency; also in having the boosting or impelling column of water associated externally and in the form of an annulus surrounding the intake barrel and induced column of fluid, as distinguished from meeting the latter in the form of an axial jet and with the result of causing the booster column, as it meets the induced column within the diminishing portion of the injector shell, to be brought into effective frictional contact with the induced column and saving the latter from retarding friction against the inner wall of the shell; also in having the delivery of the boosting column of water to the surrounding injector shell arranged through the medium of an elbow or T-connection, the head of which constitutes a chamber completely surrounding the intake barrel at a distance which maintains a water supply materially larger in volume than that which passes the annular injector orifice, so that the boosting water, by maintaining pressure in this large surrounding chamber, develops an injecting annulus of water that is uniform throughout its circumference and has a velocity of flow that is materially greater than obtained in either of the previous arrangements known to me, and especially the arrangement where the impelling water flows in a passage of approximately uniform section composed of an outermost leg extending oppositely to the pumping direction and then abruptly reverses its flow through a constricted bend which largely absorbs its energy as it enters an inner annular leg leading toward the injector; or the previously known construction in which the boosting column meets the injector shell at an obtuse angle, with the result that the boosting water is driven to the far side of the shell where it deflects and develops spiral currents that are much less efficient in their induction effect upon the pumped fluid; also in having a venturi immediately following the jet orifice and having a part of the receiving end of this venturi formed by the converging shell into which the orifice discharges.

In order that the invention may be fully understood, the preferred embodiment thereof is shown, by way of illustration, in the accompanying drawing, in which—

Figure 1 is an elevational view of a portion of a floating vehicle upon which is mounted a conventional dredging pump of rotary type, and an auxiliary boosting water pump, together with the suction pipe of the pump first named, the delivery pipe of the auxiliary pump, and the instrumentalities through which the remote ends of these pipes are connected and associated after the manner of an injector; and

Figure 2 is an axial section on an enlarged scale, of those portions of Figure 1 having to do with the injecting or boosting feature of the invention.

A represents a portion of a vessel or floating vehicle mounting a rotary pump B of any appropriate conventional kind. C represents the axially associated suction pipe of pump B, and D represents its tangential discharge pipe. Pipe C, through conventional intermediate connections which may include a flexible section E and any necessary length of rigid conduit F, leads from an intake barrel I through an interposed injector

2, the impelling fluid of which preferably consists of water supplied through pipe G leading from auxiliary pump H having outboard submerged intake pipe I.

Intake barrel 1 is of such substantial length, say, for instance, five or six times its diameter, as will cause it to develop, in response to suction, a projectile or body of pumped fluid (dredged material with its vehicular complement of water) filling its bore and largely free from vortical disturbances, eddy currents or the like, so that upon reaching the injector orifice 3 in the choke shell 4 it will have substantial momentum and impelling force stored in it. Shell 4 is forwardly tapering and in rear of orifice 3 unites with the cylindrical shell of the injector 2, which is in the form of a T-member, the head 5 of which is of such materially greater diameter than the external diameter of the barrel 1 which it surrounds, as to develop a substantial provisional water chamber 6 into which boosting water pipe G delivers through the stem 7 of the T in a direction perpendicular to the flow of the material pumped, with the result that the provisional body of water in the chamber 6, maintained by pump H, will cause an annulus of water to be delivered at the orifice 3 which is substantially uniform in density over its entire circumference, as well as at constant volume and speed. This annular water jet has a relatively high velocity in response to pressure maintained in provisional reservoir 6, being free from flow obstructions other than jet opening 3 and enters the converging shell 4 in full contact with the inner surface of the shell and with lubricating effect or elimination of frictional resistance upon the projectile of water flowing from barrel 1, and thus produces altogether superior impelling effect upon the fluid coming from the barrel. 8 represents a Venturi section in the pipe F that is conventional as to design and function, except that in the present instance its converging leg 8*a* is materially shorter than its diverging leg 8*b*, and the former is made up in part of the converging injector shell 4. Shell 4 and converging Venturi leg 8*a* are not necessarily of the same angle of convergence; in fact, the angle of shell 4 is preferably greater than that of leg 8*a* but the two merge together with a minor change in angle and the shell thus serves as a portion of the venturi.

8*x*, 8*ax*, and 4*x* represent bushings or liners for the elements 8, 8*a* and 4, which are readily replaceable when worn away by erosion from the material pumped; the liners being preferably in abutment with the several flange couplings or held in column by an intervening ring 9, as may be desired.

10 represents a separately formed header for the head 5 of the T, and this header is threaded upon the barrel 1 as shown and has associated with it a jamb nut 11 in order that barrel 1 may be adjusted axially relatively to converging shell 4 in regulating the orifice 3.

A feature in the most approved design of the apparatus is the flare 3*a* at the discharge end of the intake barrel 1 through which the induced fluid projectile is enabled to meet the injecting annulus from the orifice 3 without eddy-forming offset that would result from an abrupt barrel section at this point.

The several elements of the injector, its associated parts, and the pipes which it connects are all made of readily assembled and easily replaceable parts, and the construction and assembly is such that a high efficiency of injector and propelling effect is obtained.

What is claimed is:

1. In dredging apparatus, an injector shell comprising a straight wall tubular section terminating with flanged ends and having a laterally offset intake opening intermediate said flanged ends, a choke shell co-axially joined to the injector shell and having walls converging in a direction forward of the injector shell, a Venturi shell co-axially joined to the restricted end of the choke shell and extending from and in advance thereof for a distance exceeding the length of the choke shell, an intake barrel comprising a straight pipe section entering the injector shell through one end thereof and extending co-axially through the same with its discharge end terminating within the choke shell in co-operating relation with the converging walls thereof, thereby providing an annular orifice through which water is injected into the choke shell from the injector shell, and means for axially adjusting the position of the intake barrel relatively to the converging walls of the choke shell for changing the effective port area of said orifice.

2. The combination as set forth in claim 1 and in which the joint between the injector shell and the choke holds a spider which embraces the intake barrel and serves to support the forward end of the same.

3. The combination as set forth in claim 1 and in which the length of the intake barrel is not less than three times its diameter.

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