

(No Model.)

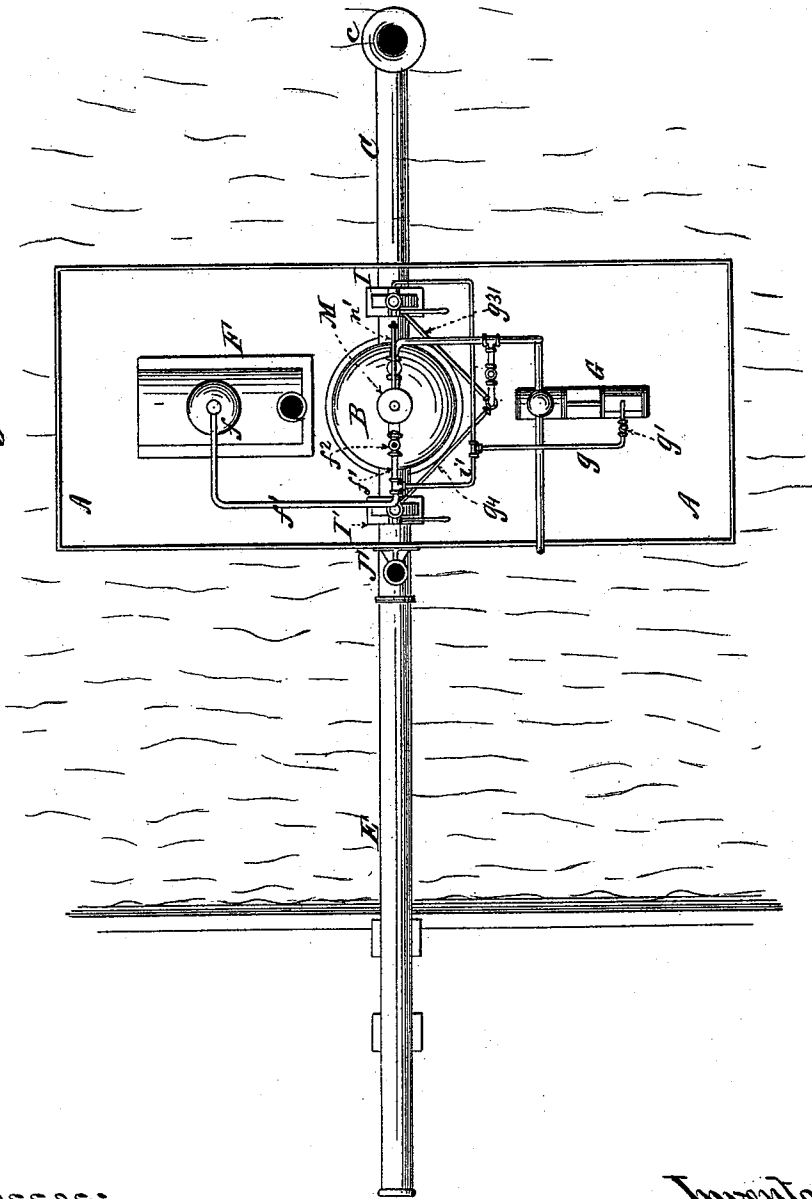
4 Sheets—Sheet 1.

C. G. COLLINS.
DREDGING APPARATUS.

No. 496,344.

Patented Apr. 25, 1893.

Fig. 1.



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Inventor:

Caleb G. Collins

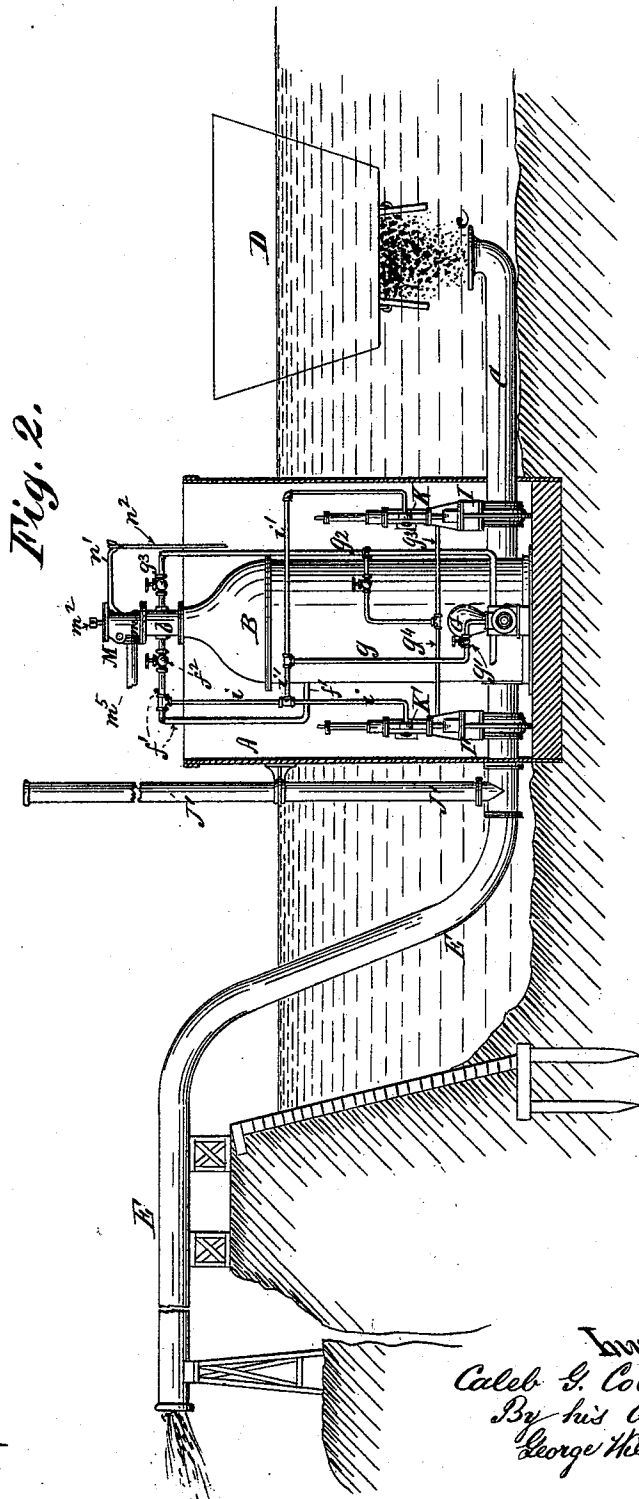
By his Attorney

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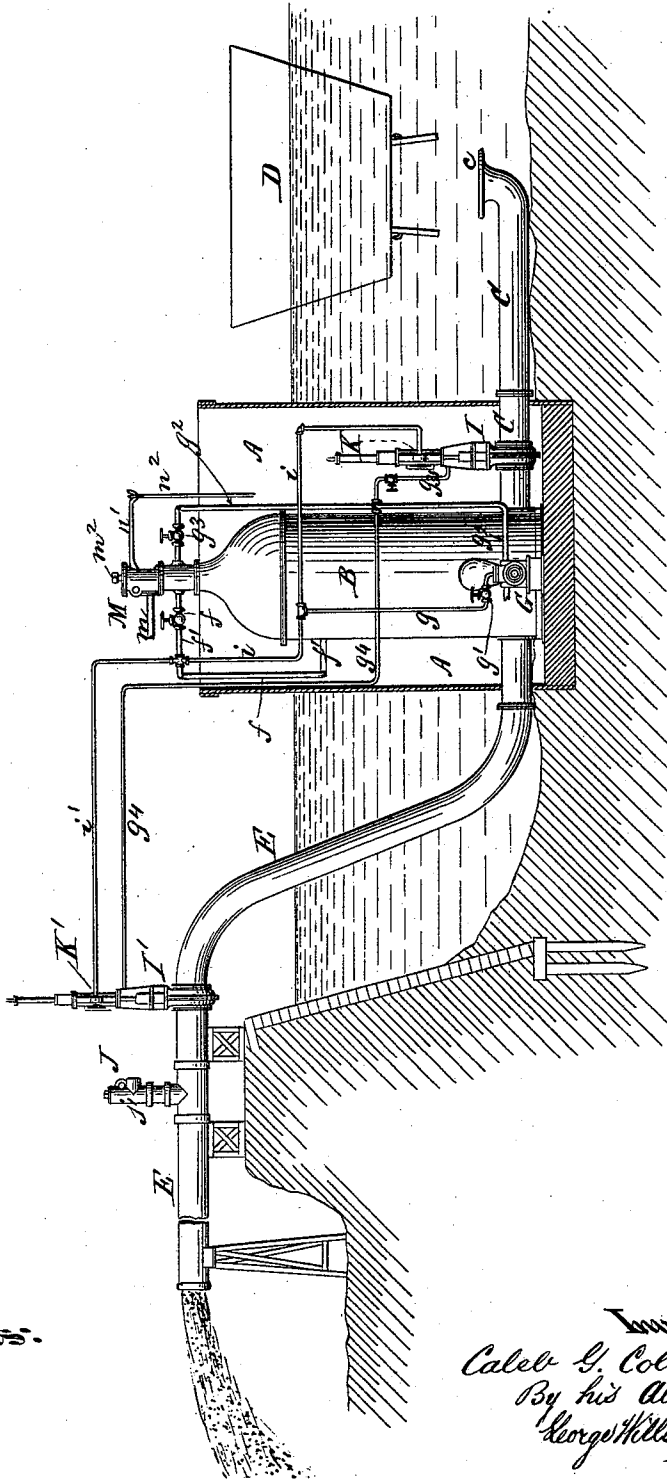
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Fig. 3.



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UNITED STATES PATENT OFFICE.

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DREDGING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 496,344, dated April 25, 1893.

Original application filed September 5, 1892, Serial No. 445,070. Divided and this application filed December 7, 1892. Serial No. 454,357. (No model.)

To all whom it may concern:

Be it known that I, CALEB G. COLLINS, a citizen of the United States, residing at Woodsburg, in the county of Queens and State of New York, have invented certain new and useful Improvements in Dredging Apparatus, of which the following is a specification sufficient to enable others skilled in the art to which the invention appertains to make and use the same.

My improvements relate to the class of apparatus set forth in my prior applications for patent, Serial No. 434,534, filed May 27, 1892, and Serial No. 436,998, filed June 16, 1892, in which vacuum chambers are employed in excavating and transferring the spoil in connection with water acting as a vehicle.

The present application shows and describes an arrangement and construction of parts substantially the same as that shown in my application, Serial No. 445,070, filed September 5, 1892, and of which this application is a subdivision.

My present invention is designed, first, to obviate the severe strain and danger of fracture to which the parts are subjected in operation owing to the impetus imparted to the spoil under the action of the vacuum, resulting frequently in the fracture or derangement of the apparatus.

The invention is designed secondly, to effect a more economical use than heretofore of steam within the vacuum chamber by lessening or preventing its direct contact with the water which acts as the liquid vehicle for the spoil.

The first feature of my invention is the result of investigation and experiment resorted to in order to ascertain and counteract the cause of certain irregularities in the action of the vacuum apparatus, which resulted frequently in fracture and delay. I have ascertained that where the spoil is very much diluted the frictional resistance to its passage through the suction pipe is so slight that the spoil and water acquire a dangerous momentum in rushing in to fill the vacuum, sufficient in some cases to rupture the apparatus. Ordinarily the resistance afforded by the sides of the suction pipe to the passage of the spoil is

sufficient to retard its speed of passage within safe limits, so that a majority of the charges will enter the vacuum chamber without undue violence; but from the variable nature of the feed or supply of spoil to the suction pipe certain charges will unavoidably contain a greater proportion of water than others, there being no convenient way of ascertaining and regulating the character of each charge. In a similar manner and under like conditions of spoil, &c., the momentum required by the latter during its discharge before a pressure of steam is apt to create a dangerous re-action or "kick," and even to create a partial vacuum in the discharge pipe after the discharge gate is closed, and occasion the possible collapse of a part of the apparatus. I obviate all danger to the apparatus from these causes, first, by constructing the upper part of the vacuum chamber with a pressure relief valve which yields automatically whenever the velocity acquired by the spoil exceeds a degree of safety to which the relief valve is set,—the opening of the valve relieving the upper part of the vacuum chamber from undue impact and strain, and secondly, by forming the discharge passage beyond the exit gate with a vacuum relieving device which acts automatically when necessary.

In the use of the vacuum chamber a partial vacuum is first produced by admitting steam and spraying it with water, when the inlet gate is opened and the charge of mingled spoil and water rushes into the chamber. The inlet gate is then closed, the outlet gate opened and the charge ejected by the pressure of live steam admitted above the charge. I provide the vacuum chamber with a loose diaphragm or piston float which virtually divides the vacuum cylinder into two compartments during actual use,—the diaphragm floating upon the top of the liquid or semi-liquid charge of spoil and protecting the latter from direct contact with live steam admitted above to effect the expulsion of the charge. As a result the full expansive force of nearly the whole volume of steam admitted is utilized in the work, and there is little or no loss from condensation or absorption of steam.

In the accompanying drawings I illustrate

diagrammatically and in detail the essential features of my improvements.

The apparatus may be modified more or less in construction and arrangement of parts without deviating from the spirit and intent of the invention, however, and I do not confine myself strictly to the identical form and arrangement of parts shown. For instance the vacuum chamber is illustrated as situated mainly below the water line in a caisson, whereas it may be situated and arranged as indicated in either of my prior applications for patent hereinbefore referred to; and in like manner the several parts may be adapted and arranged as desired or to meet the requirements of special circumstances of use.

In the accompanying drawings, Figure 1, is a plan illustrating diagrammatically the arrangement of apparatus suitable for carrying out my improvements. Fig. 2, is a vertical section of a caisson and surroundings showing the apparatus in elevation. Fig. 3, is a view similar to Fig. 2, showing a modification in the arrangement of the parts. Fig. 4, is a sectional elevation of the vacuum cylinder. Fig. 5, is a transverse section thereof upon plane of line x, x , Fig. 4. Fig. 6, is a sectional elevation of a form of relief valve suitable for use in connection with the discharge pipe; Fig. 7, a section of the lower end of a stand pipe, showing perforated diaphragm used when a stand pipe is substituted for the relief valve shown in Fig. 6.

The caisson A, is of any ordinary or suitable construction, and is sunk and maintained in position in the usual way.

B, is the vacuum cylinder situated in and resting upon the bottom of the caisson, so that its receiving or suction pipe C, extending out horizontally from the bottom of the cylinder and from the side of the caisson is submerged sufficiently below the water line to permit dumping scows D, to pass over and above its mouth c . The discharge pipe E, extends upward from the opposite side of the cylinder and of the caisson to the point at which it is desired to discharge or distribute the spoil.

In the drawings the source of steam supply is represented symbolically as derived from a steam boiler F, situated within the caisson, although any other source of steam supply may be employed, as may be found most expedient in practice.

G, is a symbolical representation of a steam pump employed to afford the requisite supply and pressure of water to certain parts of the apparatus as hereinafter set forth.

I and I', are respectively the inlet and outlet steam gate valves.

J and J', are alternative forms of a relief device for the discharge conduit.

The main steam supply pipe f' , extends from the steam dome f , of the steam boiler F, to the cylindrical chamber b , upon the top of the vacuum chamber, a suitable valve f^2 , being interposed in its length. A branch pipe f' , extends from the main steam pipe f' , to

the throttle valve K', of the vacuum cylinder steam gate valve I'. Another branch pipe z , conveys steam from the main pipe f' , to the steam pipe g , which supplies steam through the valve g' , to the pump G; and to the throttle valve K, of the vacuum cylinder inlet steam gate valve I. The steam pump G, supplies water under pressure through the pipe g^2 , and valve g^3 , to the compartment b , upon the top of the vacuum chamber B, and through branches g^3 , g^4 , to certain packing boxes on the vacuum chamber steam inlet and outlet gate valves I, I'. 70 75 80

The apparatus is operated in the main substantially as set forth in my prior applications hereinbefore referred to,—that is to say the vacuum chamber steam gate valves I, I', being both closed, a suitable quantity of steam is admitted through the pipe f' , and valve f^2 , to the upper part of the vacuum chamber B, the valve f^2 , is closed, and the valve g^3 , in the pipe g^2 , is opened admitting sufficient water to spray and condense the steam. The valve g^3 , having been closed as soon as a desired degree of vacuum is attained within the cylinder the apparatus is now ready for the reception of the charge of spoil to be transferred. This is effected by dumping from the scow D, moored over the mouth c , of the suction pipe C, more or less of the comparatively compact material transported therein. The inlet gate valve I, being now opened the partial vacuum within the vacuum chamber B, causes the commingled water and spoil to rush into and through the conduit C, under atmospheric pressure. The vacuum chamber B, is emptied of the charge thus obtained by closing the inlet steam gate valve I, opening the discharge gate valve I', and ejecting the material through the discharge conduit E, by means of the direct pressure of steam admitted to the top of the vacuum chamber by means of the steam valve f^2 . But I have found that this operation of ejecting the spoil from the vacuum cylinder by means of live steam directly in contact with the spoil is wasteful in that much of the steam is condensed by the water mingled with the spoil, and performs no useful function in the ejection of the latter, to which it simply imparts heat. I have therefore devised means for counteracting this tendency and economizing steam, the device consisting of a diaphragm L, resting loosely within the vacuum cylinder B, and preferably made of wood or other comparatively light material so as to float readily upon the top of the commingled water and spoil admitted to the said chamber. This floating disk L, is either of somewhat less diameter than the interior of the cylinder, or is also preferably formed with a few perforations l, l , the design being, not to seal and divide the vacuum chamber into two compartments by means of the disk L, but to lessen as far as practicable the actual contact of the live steam with the surface of the liquid. 85 90 95 100 105 110 115 120 125 130

By making the diaphragm of less diameter

than the interior of the vacuum chamber, and by perforating it, I am enabled to separate the steam and water over nearly the entire area of the cylinder, and at the same time
 5 leave sufficient space for the relief of pressure when necessary. Thus when owing to the presence of a comparatively large proportion of water in the spoil, the latter by reason of the slight frictional resistance encountered
 10 in its passage through the suction conduit C, *c*, acquires a high velocity, it is desirable that the momentum be relieved or overcome gradually in order to avoid serious strain or even
 15 rupture of the parts. This I accomplish to a certain extent by providing for the escape of water around or through the disk L, after the latter has been raised into contact with the lower sides of the steps or brackets *b*², *b*², at the upper end of the cylinder, as indicated by the
 20 dotted lines in Fig. 4. But where the spoil is very much diluted the space above such upper position of the diaphragm is insufficient to relieve and counteract the impetus of the inrushing spoil, and therefore in order to provide, against all possibilities of danger from
 25 this cause, I form my vacuum chamber with a relief valve M, which opens and permits the escape of water should the internal pressure exceed a degree of safety, to which the relief
 30 valve is set. This relief valve may be formed in any desired or well known manner and I do not confine myself to any special form or construction of valve, although that shown in the drawings indicates the essential features
 35 thereof. As shown it consists of a cylindrical casing *m*, secured to the top of the compartment *b*, and closed at the upper end by a cap *m*¹, through which an adjusting screw *m*², projects. The lower end of the casing *m*, is
 40 formed with a valve seat *m*³, surrounding the opening *m*⁴, into the compartment *b*. The valve N, is pressed downward against its seat by a spring *n*, which is compressed more or less by the adjusting screw *m*², which thus regulates
 45 the degree of resistance normally presented by the valve against internal pressure. It is desirable however to provide for a temporary increase of resistance against internal pressure under certain conditions as when steam
 50 under pressure is admitted for the purpose of ejecting the charge of spoil. I therefore interpose between the adjusting screw *m*², and the upper end of the spring *n*, a lever *n*¹, pivotally connected at one end to the casing *m*,
 55 and extending out laterally from the other side of the casing a sufficient distance to afford ample leverage to compress the spring *n*, and hold down the valve N, when necessary, through the medium of a connecting rod *n*²,
 60 or equivalent. An overflow pipe *m*⁵, is provided to carry off escaping liquid. The upper end of the vacuum chamber B, is formed with the usual perforated screen O, for spraying the water admitted to the compartment
 65 *b*, &c.

Where the spoil is considerably diluted there is not only danger of its entering the

vacuum chamber with undue violence unless controlled and relieved as hereinbefore described, but in a similar manner and for a
 70 similar reason, the forcible ejection of the spoil through the discharge pipe is apt to create a recoil and a straining of parts that is dangerous. The vacuum chamber inlet
 75 steam gate I', is closed immediately upon the passage of the charge of spoil, which latter, moving at the velocity imparted to it in driving it out of the vacuum chamber, creates a
 80 partial vacuum behind it and between it and the gate valve I', so that when the charge of spoil is ejected from the mouth of the discharge conduit E, the air frequently rushes
 85 in with such violence as to derange or injure the apparatus. To overcome this serious defect in the operation of the apparatus, I provide the discharge pipe E, with a device J, or
 90 J', for automatically equalizing the pressure within the discharge pipe. There are various means by which this may be accomplished, and in the accompanying drawings I show
 95 alternative forms, although I do not confine myself to either. Any device that will destroy or compensate for, the partial vacuum created in the discharge pipe by the ejection of the spoil will answer the purpose and will
 100 be within the spirit and intent of my invention in this respect.

In Figs. 1 and 2, a plain stand pipe J', is interposed in the discharge pipe E, beyond the exit gate valve I', of the vacuum chamber B. This stand pipe J', is made of sufficient height to compensate for and withstand
 105 the pressure exerted upon the discharge of the pump and will hence compensate for and relieve the partial vacuum created in the discharge pipe by the passage of the spoil after the exit gate I', is closed. A screen or grating *j*, shown in Fig. 7, is provided in the lower end of the stand pipe J, to exclude solid matter and admit water only from the spoil.
 110

The other method shown of effecting the relief sought consists in the use of a relief valve J, interposed like the stand pipe J', in the discharge pipe E, beyond the discharge gate valve I'. This valve is shown in detail
 115 in Fig. 6, and consists of a section *j*' of pipe connected with a T joint in the discharge pipe E, and formed with an inwardly opening flap valve *j*², which is free to yield before an excess of external pressure and thus relieve
 120 any tendency to vacuum within the discharge pipe E.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In an apparatus for transferring spoil, &c., the combination with a vacuum chamber; of a spoil-receiving suction pipe connected to the chamber, and a valve for releasing a portion of the charge of spoil admitted through said receiving pipe and there-
 125 by avoiding the effect of impact due to the momentum of the charge; substantially as described.
 130

2. In an apparatus for transferring spoil,

4
 &c., the combination with a vacuum chamber; of a spoil-receiving suction pipe connected therewith, a valve for releasing a portion of the charge of spoil and thereby relieving
 5 the apparatus from dangerous impact due to the momentum of the charge, and means for holding said valve in position during the discharge of the spoil; substantially as described.

3. In an apparatus for transferring spoil
 10 &c., the combination with a vacuum chamber; of a spoil-receiving suction pipe connected to the chamber, a valve for releasing a portion of the charge, and a disk or cover adapted to float upon the charge and to allow portions thereof to escape above the cover; sub-
 15 stantially as described.

4. In an apparatus for transferring spoil, &c., the combination with a vacuum chamber; of a discharge pipe connected with the
 20 vacuum chamber, and a vacuum relieving device connected with the discharge pipe, where-

by the vacuum caused by the rapid discharge of the spoil is automatically relieved; substantially as described.

5. In an apparatus for transferring spoil, 25
 &c., the combination with a vacuum chamber; of a spoil-receiving suction pipe connected to the chamber, a discharge pipe also connected to the chamber, a valve for releasing a portion of the charge of spoil from the vac- 30
 um chamber to avoid the effect of the impact due to the momentum of the charge in entering the chamber, and a vacuum relieving device arranged in the discharge pipe for the purpose of relieving the vacuum caused 35
 by the rapid discharge of the charge; substantially as described.

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Witnesses:

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