2 Sheets--Sheet 1.

EDWARD B. MEATYARD.

Improvement in Excavators.

No. 126,729. Patented May 14, 1872.

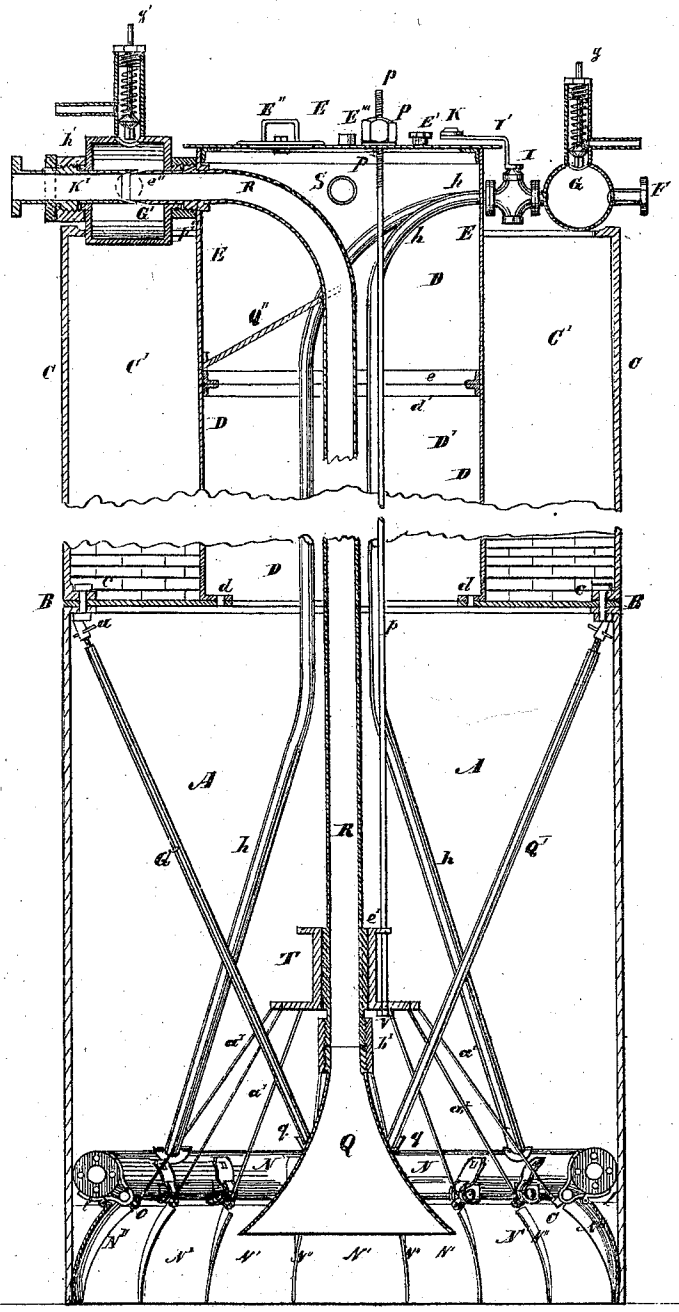

Fig. 1.

Witnesses:

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Henr. T. Bruns.

Inventor:

Edward B. Meatyard

per Lewis L. Coburn

Attorney

2 Sheets--Sheet 2.

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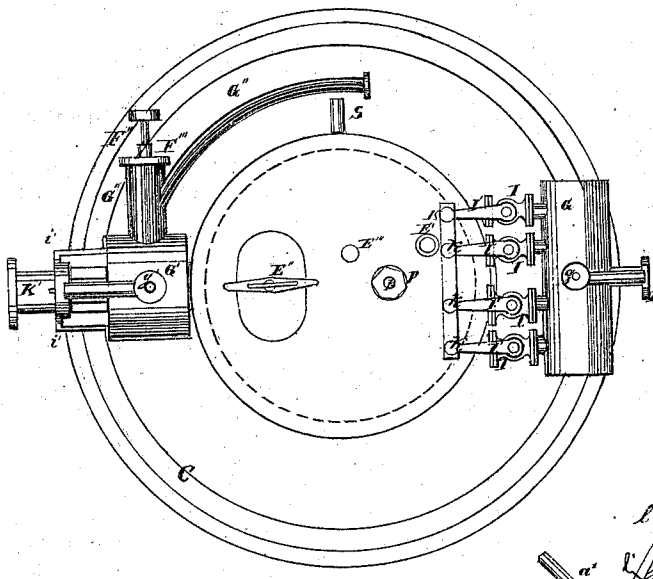

Fig. 2

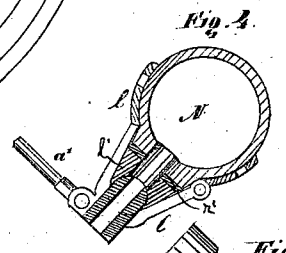

Fig. 4.

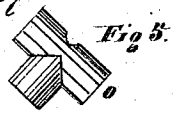

Fig. 5.

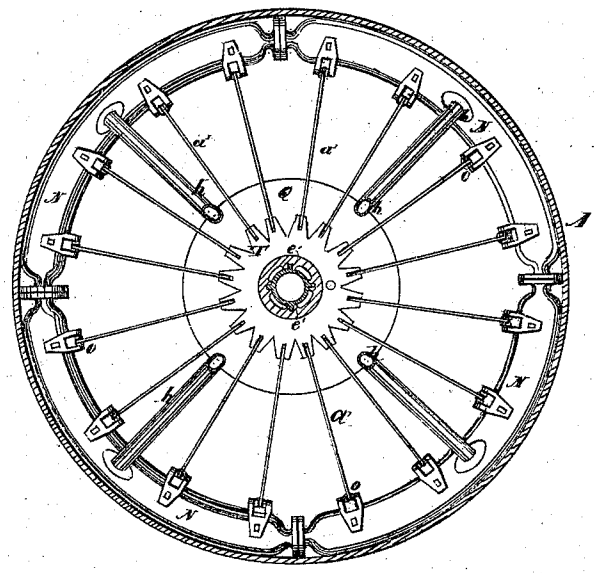

Fig. 3.

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UNITED STATES PATENT OFFICE.

EDWARD B. MEATYARD, OF CHICAGO, ILLINOIS.

IMPROVEMENT IN EXCAVATORS.

Specification forming part of Letters Patent No. 126,729, dated May 14, 1872.

SPECIFICATION.

I, EDWARD B. MEATYARD, residing in Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Earth-Excavators, of which the following is a specification, reference being had to the accompanying drawing which forms a part hereof.

Nature and Object of my Invention.

My invention relates to the process of excavating earth for the purpose of sinking caissons in the construction of bridge-piers, docks, and similar structures by means of water or air under pressure; and it consists, first, in the construction of hollow columns or caissons, which shall be capable of receiving mechanism employed to produce the excavation, and enable the operation of excavation, sinking, and building foundations therein or thereon to be conveniently and safely carried on. Second, it also consists in the combination and arrangement of the feeding-pipe F, receiving-chamber G, supply-pipes *h*, sectional chambers N, and jet-tubes; the object of this part of my invention being to conduct water or air, under pressure, from any suitable force-pump through the several parts described, so that it will impinge upon the surface of the earth to be excavated, or create a current of water against it with sufficient force to excavate it. Third, it also consists in the combination of the nut P, shaft *p*, sliding sleeve T, connecting-rods *a'*, and jet-tubes O; the object of this part of my invention being to direct the current from the walls of the caisson toward its center. Fourth, it also consists in the combination of the adjustable bell-shaped mouth-piece Q with the discharge-tube R; the object of this part of my invention being to gather the current where it is the strongest and conduct it into the discharge-tube R; my general object being to produce the results mentioned in an effective, convenient, and inexpensive manner, and without the danger to human life usually attending other modes of sinking structures of this kind.

Description of the Drawing.

Figure 1, Plate 1, represents a vertical central sectional view through the caisson A and chambers C′ and D′, showing the construction and arrangement of the mechanism connected with them, as well as the same can there be shown. Fig. 2, plate 2, represents a top or plan view of a caisson, with my mechanism attached. Fig. 3 represents a horizontal sectional view of the same. Fig. 4 represents a vertical sectional view of a jet-tube, enlarged and attached to one of the sectional chambers N, with a connecting-rod, *a'*, attached to the jet-tube. Fig. 5 represents a top view of a jet-tube enlarged and detached.

General Description.

A represents a hollow column or caisson, provided with a flange, *a*, turned inward around its upper edge. B is an annular plate resting upon the flange *a* and extending horizontally toward the center of the caisson, as shown in Fig. 1. Upon the annular plate B, and over the flange *a*, a hollow column, C, is placed, and the column C and the annular plate B are held in place upon the caisson A by bolts being passed through the flange *c*, turned around the bottom of the column C, which bolts also pass through the annular plate B and flange *a*. A hollow column, D, somewhat less in height than the column C, and having a flange, *d*, rests upon the inner edge of the annular plate B, and is secured thereto by bolts passing through the flange *d* and plate B. This column D is provided about its upper edge with an angle-iron, *d'*, as shown, upon which rests the cap E. *e* is an angle-iron about the bottom of the cap E, through which bolts pass to secure it upon the angle-iron *d'*. A cylindrical chamber, D′, is formed by the cap E and cylinder D. The supply-tubes *h* enter the cap E as near the top of the chamber C′ as may be convenient, and the discharge-tube R leaves the cap E at the same altitude, the depth of the cap E below the top of the chamber C′ being sufficient to give these pipes or tubes a gentle curve as they pass downward, and these pipes are so constructed and connected with their lower portions as to be capable of being disconnected above the line of the flange or angle-iron, *e*, so that the cap E may be removed, with its attachments, and allowed to rest upon its lower edge without injury to the mechanism within. The top of the chamber or cap E is tight, as are also the walls of the cap and chamber D′ and of the caisson, and also the floor of the chamber C′. It will be observed that the

cylindrical chamber formed by the columns within the annular chamber c' connects with the chamber of the caisson, while the chamber C′ does not, and that the chamber C′ has an open top. F is a feed-pipe or hose, connected to any suitable force-pump for forcing air or water into the receiver G, according as either element may be used. h are supply-pipes or hose to conduct the water or air from the receiver G to the sectional chambers N, and they have suitable bearings or supports to keep them in place. I are taps in the tubes or pipes h, to which are rigidly attached the bent levers I′. K is a bar lying across the levers I′, and small pegs pass freely through the bar K and enter the levers I′, so that by operating the bar K all the taps I may be operated at once, and by removing any of the said pegs a corresponding tap may be independently operated. The sectional chambers N rest firmly upon brackets or supports N′, and each sectional chamber is bored or perforated to communicate with the jet-tubes O, and a supply-tube h enters them. There are flattened surfaces upon the sectional chambers N, directly back of the jet-tubes O, and upon these flattened surfaces a piece of rubber, r, or other suitable packing is placed, and over this packing a plate of metal, l', which may be non-corrosive, is fastened. The trunnions of the jet-tubes rest in depressions in these plates, and a loop or bent link, l, passes over the trunnions of the jet-tubes, and is securely fastened to the sectional chamber N. By this arrangement the jet-tubes are firmly held in place, but not so firmly as not to be capable of having a vertical movement, while they are prevented from moving laterally, as will be observed by reference to Fig. 5; and it will also be observed by reference thereto, that the loops l are made in two parts, which are hinged together, so that the jet-tubes may be removed without entirely removing the loops. It will also be observed that the bore of the jet-tubes is somewhat smaller than the apertures in the sectional tubes or chambers N and plates l', so that the jet-tubes may move in a vertical plane without obstructing the flow of water or air from the sectional tubes or chambers. The brackets N′ are provided with projections N″ to prevent the earth from crowding against the jet-tubes, but admit of the streams being projected downward, when desired. a' are connecting-rods, which are pivoted or hinged to the jet-tubes O at one end, and to the sliding sleeve T at the other, as shown. This sleeve T slides over keys e', which are rigidly attached to the pipe R, and these keys rest in grooves in the sleeve T, and prevent the sleeve from turning as it moves up and down, as shown in Fig. 3. p is a shaft or connecting-rod passing through the flanges on the sleeve T loosely, upon the lower end of which shaft is the nut V. This shaft p passes upward through the bearing p^2. The shaft p has a screw-thread run about that part of it which passes through the cover of the cap E, and a nut, P, is run upon this thread, and has a bearing on the cap E, as shown, so that, by turning the said nut, the sleeve T is raised or lowered, and the stream from the jet-tubes thereby made to move over the surface of the soil to be excavated toward the center of the caisson or from it, as may desired. Q is a bell-shaped tube near the bottom of the caisson, extending out so as to gather the current formed by the stream of air or water ejected from the jet-tubes O, and it is provided with a male screw about its upper end, which engages with a female screw upon the inner part of the band v', which may be rigidly fastened to the tube R, so that the bell-mouth Q is adjustable therein, and may be raised or lowered by being turned. There may be also a band or belt, q, resting upon the upper part of the bell-shaped mouth Q, to which the braces Q′ may be attached to keep the mouth Q and tube R from being forced upward by the pressure or current against it. The tube R may also be braced or supported, as shown at Q″. This tube R may be made in sections and its parts joined in any suitable manner. The upper end of the tube R is chamfered off, as shown at e'', to fit the chamfered end of the tube K′. G′ is an accelerating-chamber into which the discharge-tube R enters, as shown. F′ is a nut passing about the enlarged part of the tube R and a flange of the accelerating-chamber, as shown, for the purpose of securing the accelerating-chamber in its place; but it may be secured in any convenient manner. The pipe K′ also enters the accelerating-chamber, and it is also provided with a chamfered end, as shown, and it is made adjustable by means of turning the nut h' upon the thread upon the pipe K′, the nut h' being held in place by its contact with the accelerating-chamber upon one side, and brace i', which supports the pipe K′, upon the other side, as shown. The pipe K′ is provided with keys or projections, which slide in grooves in the brace i', so that the pipe K′ will not turn upon its axis. Any discharge-hose is attached to the outer end of the pipe K′ to lead away the matter discharged. G‴ is a tubular projection entering the chamber G′; and G″ is a supply-pipe connected with any force-pump, and entering the chamber or tube G‴. F″ is a shaft, having any suitable bearing in the tube G‴; and F‴ is a loose sleeve over the shaft F″. Upon the inner end of the shaft F″, and between the chamber G′ and the tube G″, may be placed a revolving current-wheel, similar in its construction and operation to a "turbine" wheel, which may be operated by the water entering the tube G‴ through the pipe G″. Any gearing may be placed upon the outer end of the shaft F″ for the purpose of operating a small air-pump. The loose sleeve F‴ has a plug on its inner end, which fits into a central opening through the wheel, and when the plug is in said opening said wheel revolves by means of the water passing about its blades; but when the plug is withdrawn the water passes through the central opening of the wheel and does not revolve it. This plug is pushed into or out of the said cen-

tral opening by sliding the sleeve F''' longitudinally upon the shaft F''. The cap E may be provided with windows or bull's eyes to enable one to ascertain the depth of water within the chamber D' and to light it. S is a tube entering the cap E, and its length within and without the chamber D' is regulated so that it will perform the office of a syphon, when desired. It is also provided with a tap, so that it may be conveniently shut.

It will now be observed that the water, in passing out of the jet-tubes O, will impinge upon the surface to be excavated, taking with it a portion of the soil, and that the currents so formed will unite in one stream beneath the bell-shaped mouth Q of the discharge-pipe R with the upward velocity due to the head created by the force-pump above the central line of the discharge-pipe R, at its place of exit from the cap E, less the velocity it loses by carrying foreign matter with it, and by means of the currents striking each other at an angle. The force of the pump is sufficient to give this upward current a velocity sufficient to carry it up and out of the discharge-tube R. If the caisson and chambers D' should remain tight during this operation, there would necessarily be a lifting pressure upon the caisson, which may be avoided by opening the air-cock E'; and if from this or any other cause the current through the discharge-tube R is too slow or unequal, I put the accelerating-chamber in operation. A separate force-pump is then used to force water therein through the pipe G'' under such a pressure that it will pass into the chamfered opening. According to a well-established principle, the power or lifting force of this current is its volume into its velocity, and I can therefore regulate its force by means of the force-pump and by means of the adjustable pipe K', by increasing or diminishing the chamfered opening until the current in the discharge-tube R has a sufficient and uniform velocity. The revolving fan is made to operate the air-pump connected with it for the purpose of exhausting the air from the discharge-tube R, so as to facilitate the operation in the beginning. If the water passes into the caisson from the jet-tubes faster than it passes out of the discharge-tube, it will find an exit through the siphon-pipe S; and when the air-cock E' is closed, the pressure within the caisson is equalized by means of this pipe.

When air is used, and ejected through the jet-tubes O instead of water, for the purpose mentioned, the operation is the same, except in the following particulars: Free and ample vent must be provided through the cap E for the escape of any air which, after being ejected from the jet-tubes, may arise to the top of the chamber D', and for that purpose an air-cock, E', is placed in the top of the cap E. The end of the siphon S within the chamber D is bent upward, so that the influx of water through it, to replace that expelled, may not be impeded by the upward current created by the passage of air outside of the pipe R. The siphon-tube will supply the water as fast as it is discharged, or may be made to do so, according to its size, it being understood that its exit from the chamber D' is of the same or a greater altitude than the exit of the discharge-pipe R. The water, being agitated by the air from the jet-tubes O, will be thrown into a current like that produced by water ejected therefrom, and will carry the water and sand out of the discharge-pipe R in the same or a similar manner. The accelerating-chamber G' and the chamber or receiver G are each provided with an ordinary safety-valve, g' and g, for the purpose of keeping the pressure below any given strain.

Another air-pump, or set of air-pumps, may be used to exhaust the air from the caisson and chamber D', in order to fill them with water, as may be desirable for the reasons mentioned, as well as to create a downward pressure upon the caisson. A sufficient downward pressure will generally be produced by means of the masonry laid upon the caisson, as shown, while it is sinking, and the operation of sinking may be thus carried on above the water-line, while the masonry is at the same time protected by the walls C. When the caisson is sunk until the walls C are near the water-line the cap E with its fixtures is removed, and another section added to the walls C and D, and the cap E is then placed thereon, in a manner corresponding to that already described and shown, a corresponding section being added to the tubes h and R, and to the connecting-rod p.

By making the chambers or tubes N in independent sections, and by supplying them each with one of the pipes, h, I am able, by means of the taps I, to create a current in one direction only, as may be desirable when the caisson is sinking the first few feet in a stream having a current sufficient to create a scour upon one side of the caisson and bank up the sand upon the other side. By means of connecting-rods p and a', operating as described, I am able to direct the current over different parts of the surface of the soil to be excavated simultaneously.

After the caisson is sunken it is filled or loaded in the usual way, the operating parts being first removed, as well as the walls above the caisson, if desired.

It will be observed that my operation is directed from the top, thus avoiding the usual danger to human life attending other modes of accomplishing the same results, and that I effectually accomplish the other objects set forth above by means of the mechanism and its operations above described.

The caisson may be of any desired shape suitable for the purpose for which it may be designed, and any number of sectional chambers N of corresponding shape, as well as any number of jet-tubes, may be used.

It may also be here stated that the cap E may be provided with a trap-door, E'', in its cover, as shown, over which any suitable air-

lock may be placed, so as to enable a person to descend into the caisson without changing the pressure within.

E‴ is an aperture through the cap E, which may be tightly closed, and through which air or water may be conveyed either into or out of the caisson, when necessary or desirable, and the cap E is packed about all its openings so as to render it as nearly air-tight as possible.

I do not here claim the jet-tubes O or the accelerating-chamber G′, except in the combinations with which they are included in the mechanism herein particularly described, and I have herein described their construction with particularity only to show their operation when included in such combinations.

Claims.

Having described the construction and operation of my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination of the caisson A, brackets N′, and projections N″, as and for the purposes described.

2. The combination and arrangement of the pipe F, chamber G, and tubes *h*, provided with taps I, with the cap E, as and for the purposes set forth.

3. The combination of the tubes *h* provided with taps I and the sectional chambers N provided with jet-tubes O or their equivalents, substantially as and for the purposes specified.

4. The combination of the shaft *p*, sliding sleeve T provided with grooves for the passage of the keys *e′*, keys *e′*, and connecting-rods *a′*, when the latter operate vertically-swinging jet-tubes O, substantially as and for the purposes specified.

5. The combination of the adjustable bell-shaped mouth Q and the discharge-tube R, when operating substantially as and for the purposes described.

6. The combination of the discharge-tube R, accelerating-chamber G′ provided with the supply-tube G″, the adjustable tube K′, and cap E, when operating as and for the purposes specified.

7. The combination of the sectional chambers or tubes N, provided with jet-tubes O or their equivalents, brackets N′, projections N″, and caisson A, substantially as and for the purposes set forth.

8. In combination with the caisson A, the pipe F, chamber G, tubes *h*, provided with taps I, and the sectional chambers or tubes N, when the latter are provided with jet-tubes O or their equivalents, as and for the purposes specified.

9. In combination with the caisson A, the shaft *p*, sleeve T, and connecting-rods *a*, when the latter operate jet-tubes, substantially as and for the purpose specified.

10. In combination with the caisson A, the bell-shaped mouth Q and discharge-pipe R, as and for the purposes specified.

11. In combination with the caisson A and discharge-tube R, the accelerating-chamber G′, provided with a supply-tube, G″, and adjustable pipe K′, substantially as and for the purpose described.

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