3 Sheets—Sheet 1.

S. H. BODFISH.

Excavator.

No. 197,451. Patented Nov. 27, 1877.

Fig. 1.

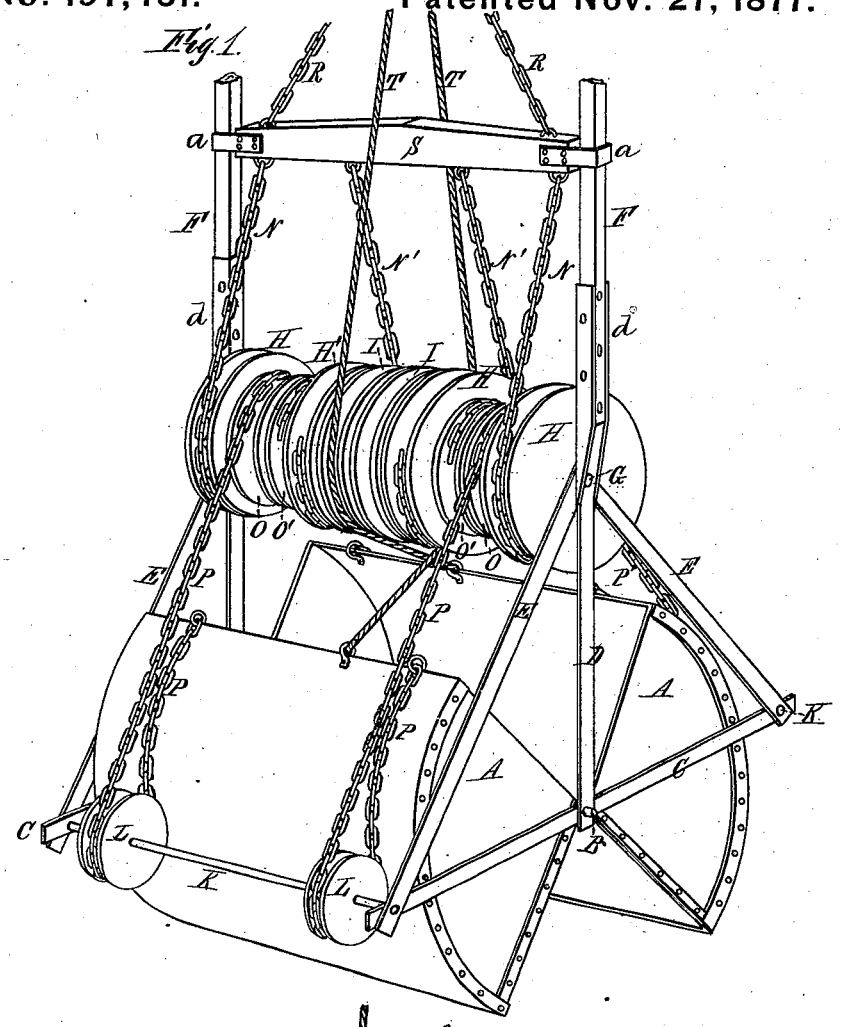
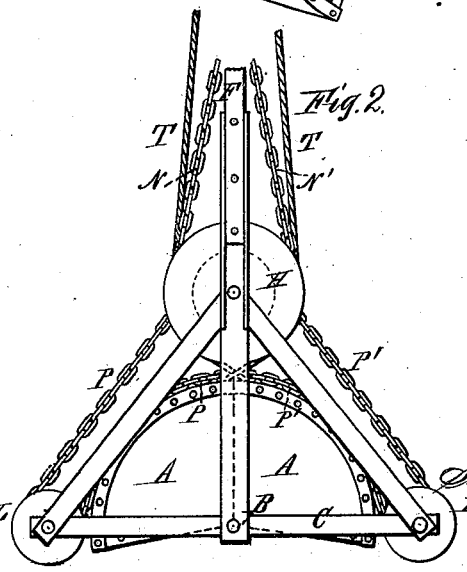


Fig. 2.



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3 Sheets—Sheet 2.

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Fig. 3.

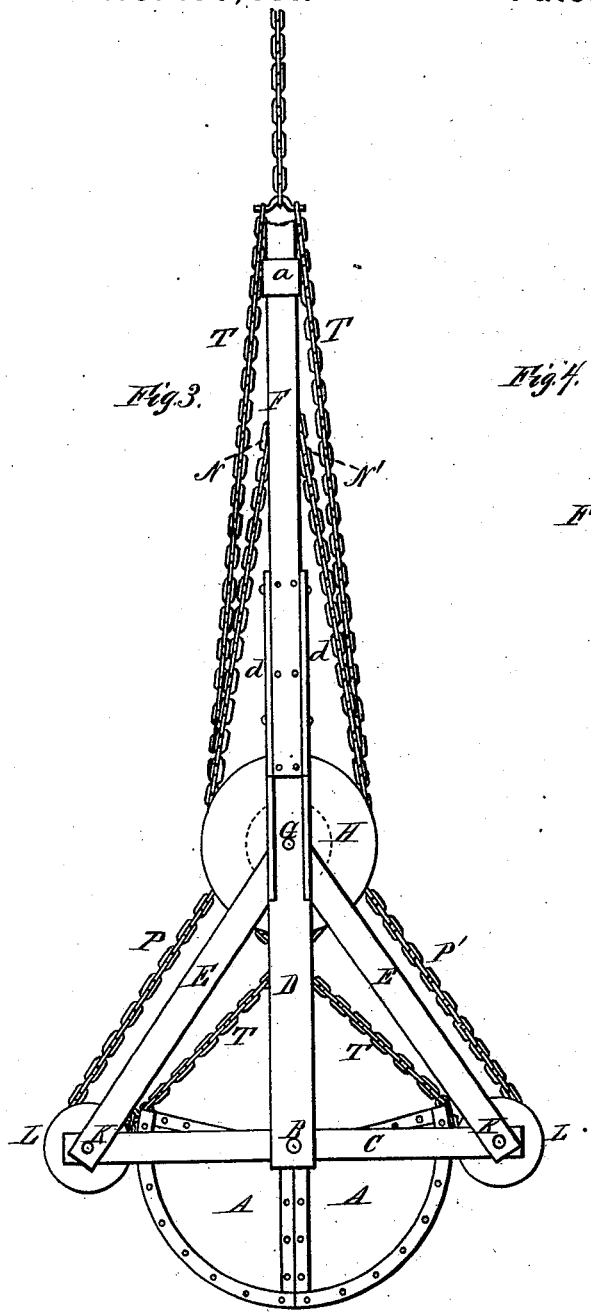
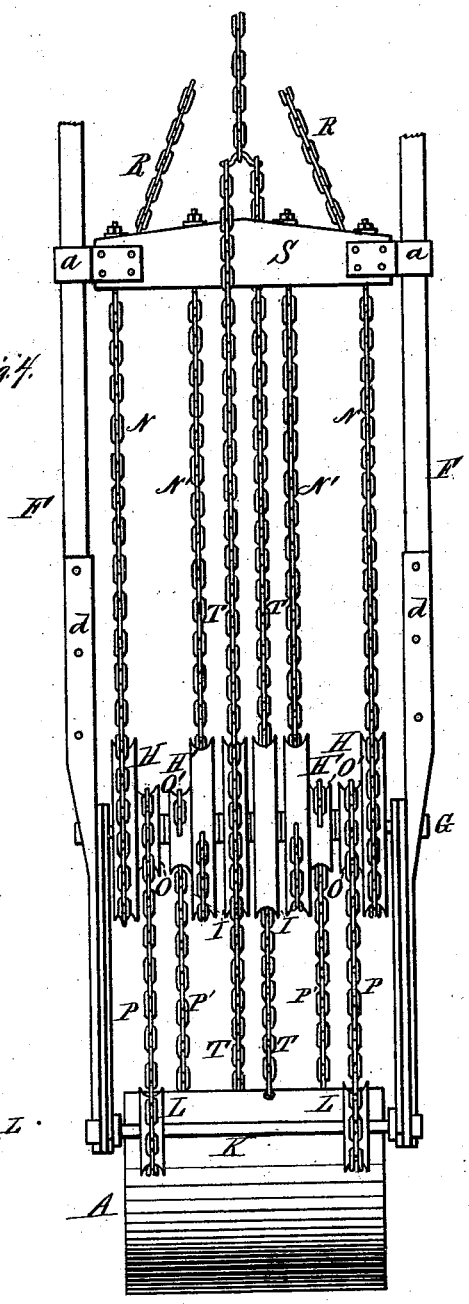


Fig. 4.



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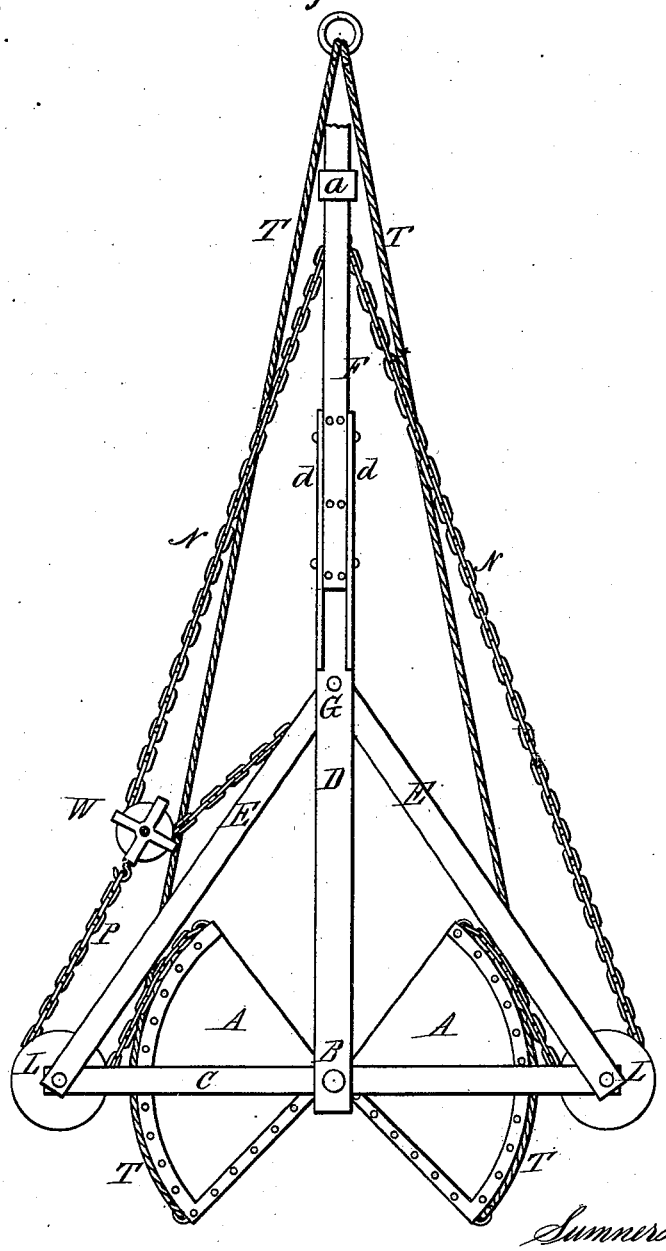
3 Sheets—Sheet 3.

S. H. BODFISH.

Excavator.

No. 197,451. Patented Nov. 27, 1877.

Fig. 5.



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UNITED STATES PATENT OFFICE.

SUMNER H. BODFISH, OF WASHINGTON, DISTRICT OF COLUMBIA.

IMPROVEMENT IN EXCAVATORS.

Specification forming part of Letters Patent No. **197,451**, dated November 27, 1877; application filed October 13, 1877.

To all whom it may concern:

Be it known that I, SUMNER H. BODFISH, of Washington, county of Washington, and District of Columbia, have invented certain new and useful Improvements in Excavators, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

Figure 1 is a perspective view of a machine embodying my improvements, the buckets or shells being represented in a position about half-way open. Fig. 2 is an end elevation of the same, the buckets being drawn entirely open. Fig. 3 is an end elevation, and Fig. 4 a corresponding side view, taken with the buckets completely closed. Fig. 5 is an end elevation of a dipper, showing at the right the hoisting-chain as led directly down to the loose sheave, and at the left an intermediate pulley for multiplying the closing power, and showing also a modified plan for arranging the opening chains or cables.

Like letters of reference in all the figures indicate corresponding parts.

My invention has relation to that class of excavators or dredging-machines commonly known as "clam-shell machines," "grapples," &c., wherein the dipper is divided into two parts, which are made to approach each other in order to inclose the material, and to open or recede from each other for the purpose of discharging the load.

Previous to my invention it has been customary to operate the hinged buckets through the medium of rigid arms applied thereto, and either forced asunder or drawn together by suitable chains for the purpose of opening and closing the dipper. Chains have also been previously attached directly to the shells or buckets, but leading from drums or pulleys located within the space inclosed by said buckets, thereby occupying some of the room required for the excavated material, and being more or less exposed to the disadvantage of becoming clogged up during the working of the machine. In each form of which I am aware the application of the power to close the shells together is such that it must operate with a varying intensity upon said shells, owing to the angle which the line of direction of this power makes with its lever, and in each instance the power to overcome the resistance is least at the time when the resistance is greatest. Further, by the means heretofore employed the shells or buckets have been so arranged as to make it difficult to open them to their fullest extent, thereby diminishing the area of the mouth of the dipper, and detracting from the facility with which the load should be discharged.

The object of my invention is to produce such an arrangement of parts as shall obviate the several objectionable features alluded to, while the mechanism shall be more simple than heretofore, less liable to get out of order, and capable of being more easily repaired in case of damage; and it consists in so locating the closing-chains that they shall lie outside of the buckets, and, when tightened up or strained, they shall draw in a direction practically tangent to the curved surface of said buckets, whereby the lever-arm of the closing power is made constant, and always equal to the radius of the bucket, and in crossing the opening-chains over pulleys so arranged that the shells may be made to open to their fullest extent.

To illustrate the principles of my invention I have chosen a machine such as is shown in the accompanying drawings, and, inasmuch as the means or manner of connecting this class of dippers with the crane or boom is very well known, it has not been deemed necessary to represent more than the mere working parts of the dipper itself, together with so much of the operating chains and guiding-poles as will be sufficient to indicate their direction.

A A are the two parts of the dipper, suitably hinged about an axis, as B, which axis, as well as the dipper, is sustained by the iron frames C D E E C D E E. The vertical bars D D are bent at their upper parts, as at *d d*, so as to form sockets within which the guide-poles F F are secured.

Between the junctures of the braces E E E E is placed the axle G, upon which are mounted the loose drums H H H′ H′ and the sheaves I I, the offices of which will be hereinafter explained.

Near the extremities of the horizontal bars C C the axles K K are secured, and upon these axles are mounted the sheaves L L L L, over

which the closing-chains are run. For convenience of illustration and description it is assumed that only two closing-chains are attached to each shell, but it is obvious that any desired number may be employed.

Attached to one side of each of the drums H H H′ H′ are the smaller drums O O O′ O′.

The closing chains or cables are passed from the drums O O O′ O′ around sheaves L L, &c., from the outside thereof and are suitably connected with the upper portions of the shells A A. The hoisting-chain is divided, as at R R, the better to grapple the sliding bar S, which moves up and down upon the poles F F, being guided thereon by the straps *a a*. This sliding bar carries the chains N N′ N N′, which are run around the larger pulleys H H′ H′ H, and in directions opposite to the chains P P′ P′ P, so that as the bar S is elevated the last-named chains shall be wound up, and thus made to draw the two portions of the dipper together, which they accomplish by reason of the change of direction effected by the sheaves L L, &c. These sheaves L L are so located with respect to the periphery of the shells that the closing-chains shall always pull upon said shells in the direction of a tangent to their surfaces, no matter what relative position the two parts may assume toward each other. This arrangement obviously affords a constant lever-arm for the closing power, since the closing-chains are maintained upon the surfaces of the shells, and this lever-arm is always equal to the radius of said shells. The maximum closing power is, therefore, exerted at every point in the path of the shells when being made to approach each other.

The increased power afforded by the variation in size of drums H O H′ O′ is, of course, at the sacrifice of time. This is desirable in hard digging; but in soft digging it may be desirable to omit the drums and to lead the closing-chains directly around the sheaves L L, as indicated in Fig. 5. This is no departure from the spirit of the invention, since the closing force operates with the same constant lever-arm. The drums may, if desired, remain mounted upon the axle during the use of the dipper, without employing them; but, that they may be readily unshipped, the axle is intended to be keyed in and made readily removable. So, also, with the several elements of the machine whereby any particular part may be removed for repairs and the whole taken apart for shipping, &c.

At the right of Fig. 5 the closing-chain is operated without the intervention of any device calculated to multiply the closing power. Under this modification, of course, the chains will be similarly arranged upon each side of the dipper, as they will in the other modification shown at the left of the figure. This direct-acting chain is most advantageous for light digging, because it affords a more rapidly operating means of closing the shells.

In moderately-hard digging, the closing power may be increased by the intervening pulley W shown at the left of Fig. 5. In this instance the chain N is attached to the axle G, wound through the pulley W, and thence passes upwardly, and is connected with the operating power by any convenient means.

The principles and operations of this modification are sufficiently apparent to require no further explanation. They are precisely the same in effect as are those of the drums, save that the drums, being very heavy, add to the weight of the dipper, and thus hold the same down more firmly upon the surface of the material to be excavated.

After the dipper has been raised it becomes necessary to open the shells, and it is desirable that they be made to open as widely as possible, so as to inclose the greatest possible area when resting upon the bed of material. All the operating mechanism being located outside of the shells, this is very easily accomplished by crossing the opening chains or cables T T, as indicated at Figs. 1, 2, 3, and 4, running them over the loose sheaves I I. The chains T T are connected at some point—say, above the bar S—so that the shells shall be made to open uniformly, and the large sheaves I I render it possible to bring the upper edges of the shells into contact with each other.

The same result may be effected by carrying the opening-chains directly down, and attaching them to the lower edges of the shells, running them outside, as shown in Fig. 5. This modification is calculated for soft or light digging, and affords a very simple and easily-operating method of opening the buckets.

The invention contemplates any desired number of opening as well as closing chains, and the substitution of wire cables or ropes for the chains whenever such substitution may be found desirable.

The cables or chains may be connected with the moving power by any convenient means, and under any preferred arrangement, so that the rigid arms previously alluded to are omitted and the closing force made to operate with uniform intensity.

Under the arrangement shown it is apparent that as soon as the shells are completely closed the hoisting-chains operate to elevate the dipper, as in other machines of this class.

The invention is applicable as well to grapples and to dippers in which only one side is hinged, the other remaining stationary.

Having thus fully described my invention, I claim as new and desire to secure by Letters Patent—

1. In a machine of the character herein specified, the combination, with the hinged bucket or shell, of a chain one end of which is secured to the upper portion of said shell, and adapted to pull downwardly upon said bucket in a direction tangent thereto, said chain moving in the same direction with, and unwinding from, the curved exterior surface of the bucket, upon which it constantly bears as the bucket is being closed, the arrangement being substantially as shown and described, so that the

closing power shall be uniform throughout the path of the bucket, for the purposes explained.

2. In a machine of the character herein specified, the combination of the hinged bucket or shell, a loose sheave, and a closing-chain attached to the shell, and run under said sheave, the arrangement being substantially such as described, so as to make the closing-chain pull upon the shell in a direction practically tangent to its curved surface, for the purposes set forth.

3. In a machine of the character herein specified, the combination of the hinged buckets, the metallic frame supporting the same and carrying the axles for the sheaves, the sheaves for changing the direction of the closing-chains, located outside of said buckets, and the closing-chains, the several parts being arranged substantially as shown and described.

4. In a machine of the character herein specified, the combination of the hinged buckets in a direction tangent thereto, and the closing-chains, adapted to pull upon said buckets with uniform power, and means, substantially such as shown and described, for multiplying the closing power, for the purposes set forth.

5. In a machine of the character herein specified, the combination, with the hinged clam-shell buckets, of opening chains or cables, the same being attached at or near the upper edges of the buckets, and run under sheaves located upon an axle directly above the hinge B, common to the buckets, substantially as described, so that the bucket may be opened to its fullest extent, for the purposes explained.

6. In a machine of the character herein specified, the combination, with the hinged buckets, of closing chains or cables adapted to pull downwardly upon said buckets in directions tangent thereto, and with uniform power, and opening-chains arranged to run under loose sheaves, which are mounted directly over the bucket-hinge, substantially as described, so as to open the buckets to their fullest extent, substantially as and for the purposes set forth.

7. The combination, with the frame C D E E, of the hinged buckets A A, sheaves L L, and closing-chains P P P′ P′, substantially as shown and described.

8. The combination, with the frame C D E E, of the hinged buckets A A, closing-chains P P′, sheaves L L, drums H O H′ O′, and chains N N′, substantially as shown and described.

9. The combination, with the frame C D E E, of the hinged buckets A A, the shaft G, sheaves I I, and opening chains or cables T T, substantially as shown and described.

In testimony that I claim the foregoing I have hereunto set my hand in the presence of two witnesses.

SUMNER H. BODFISH.

Witnesses:
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WORTH OSGOOD.