No. 669,991. Patented Mar. 19, 1901.

O. HETLESAETER.

EXCAVATOR.

(Application filed May 7, 1900.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

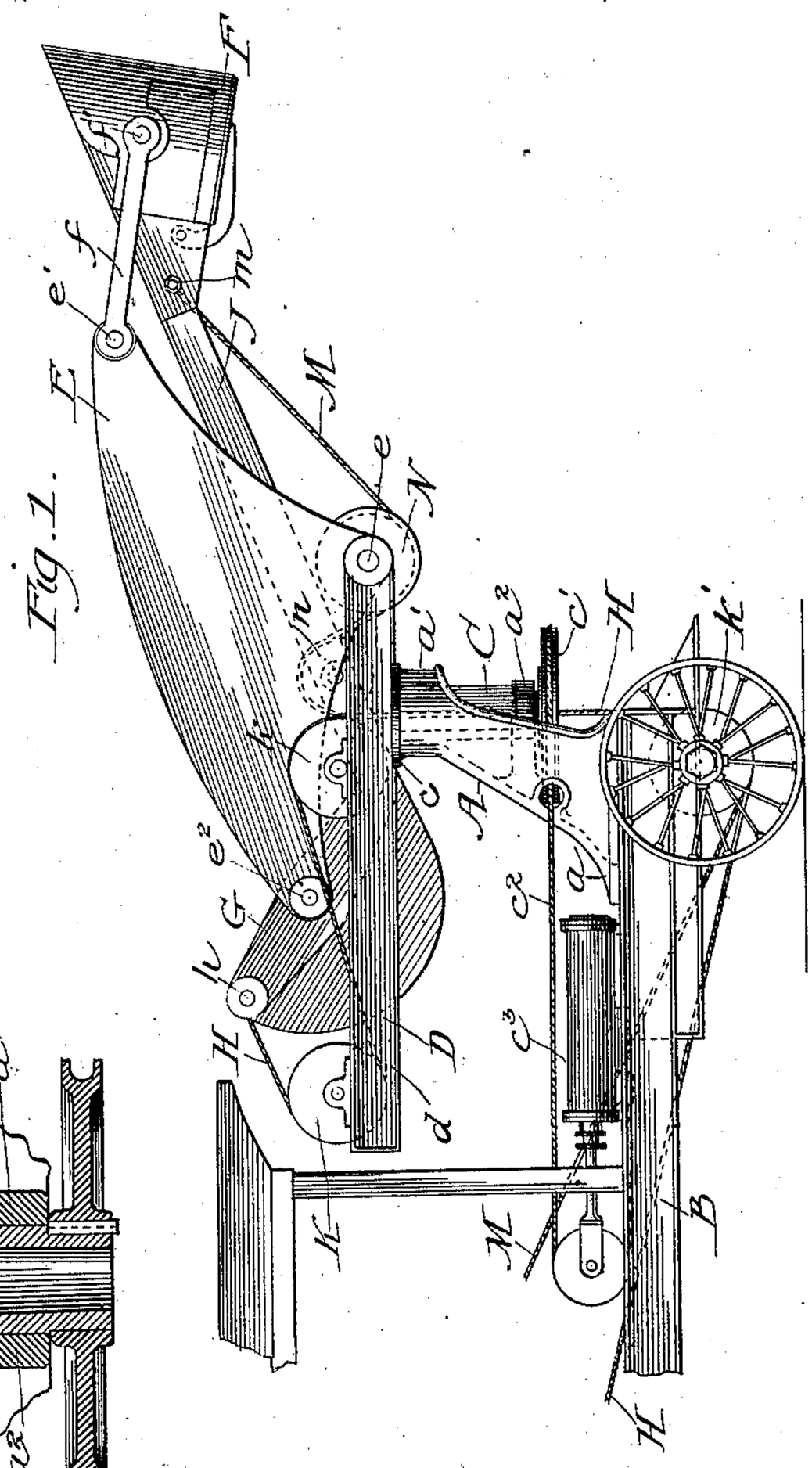
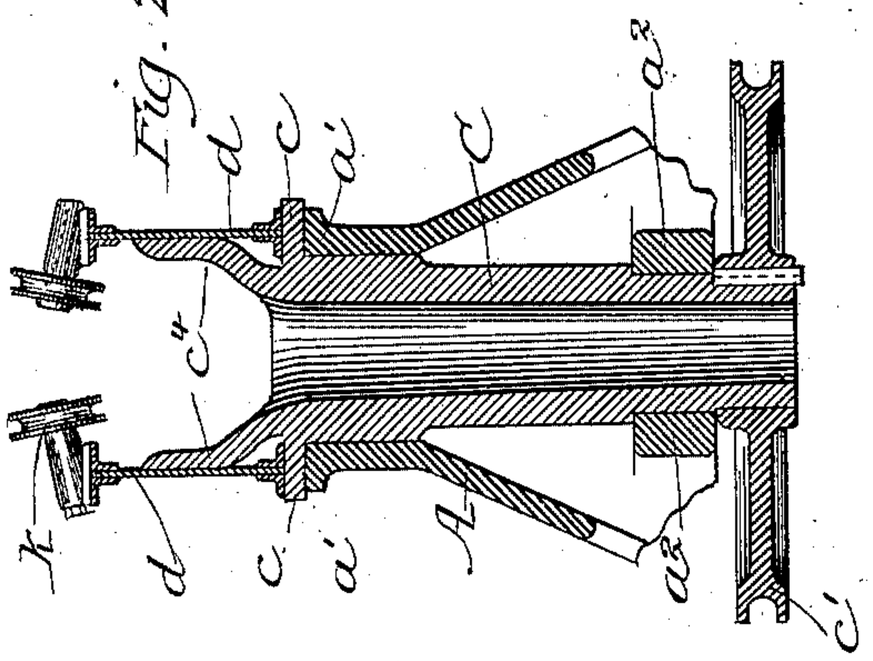


Fig. 2.



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(No Model.) 3 Sheets—Sheet 2.

Fig. 4.

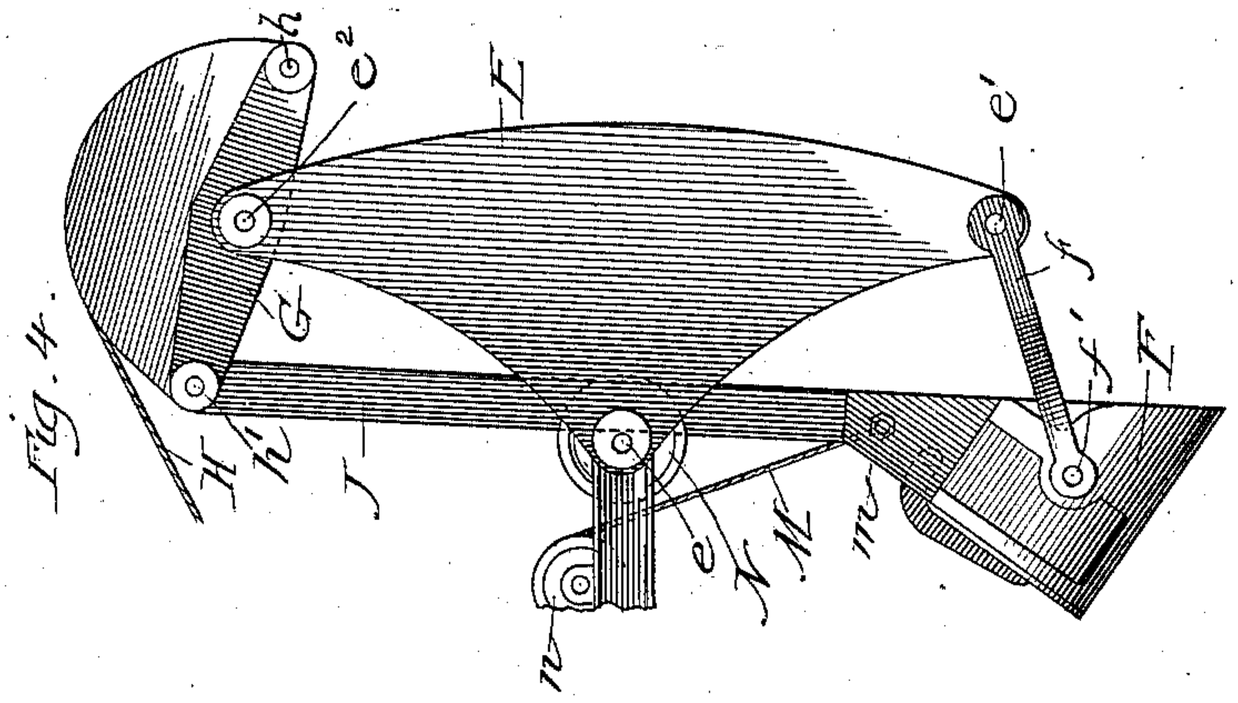
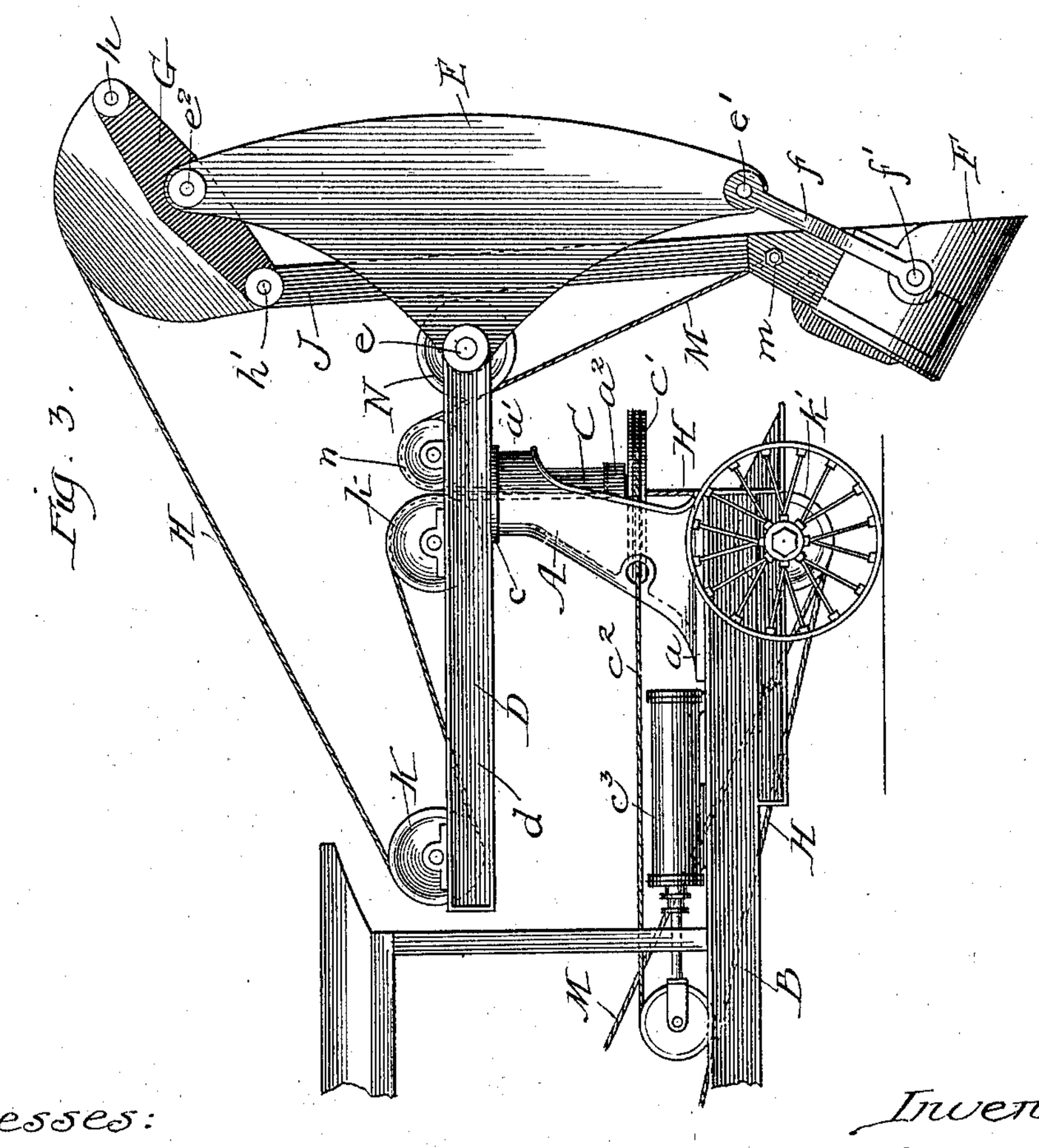


Fig. 3.



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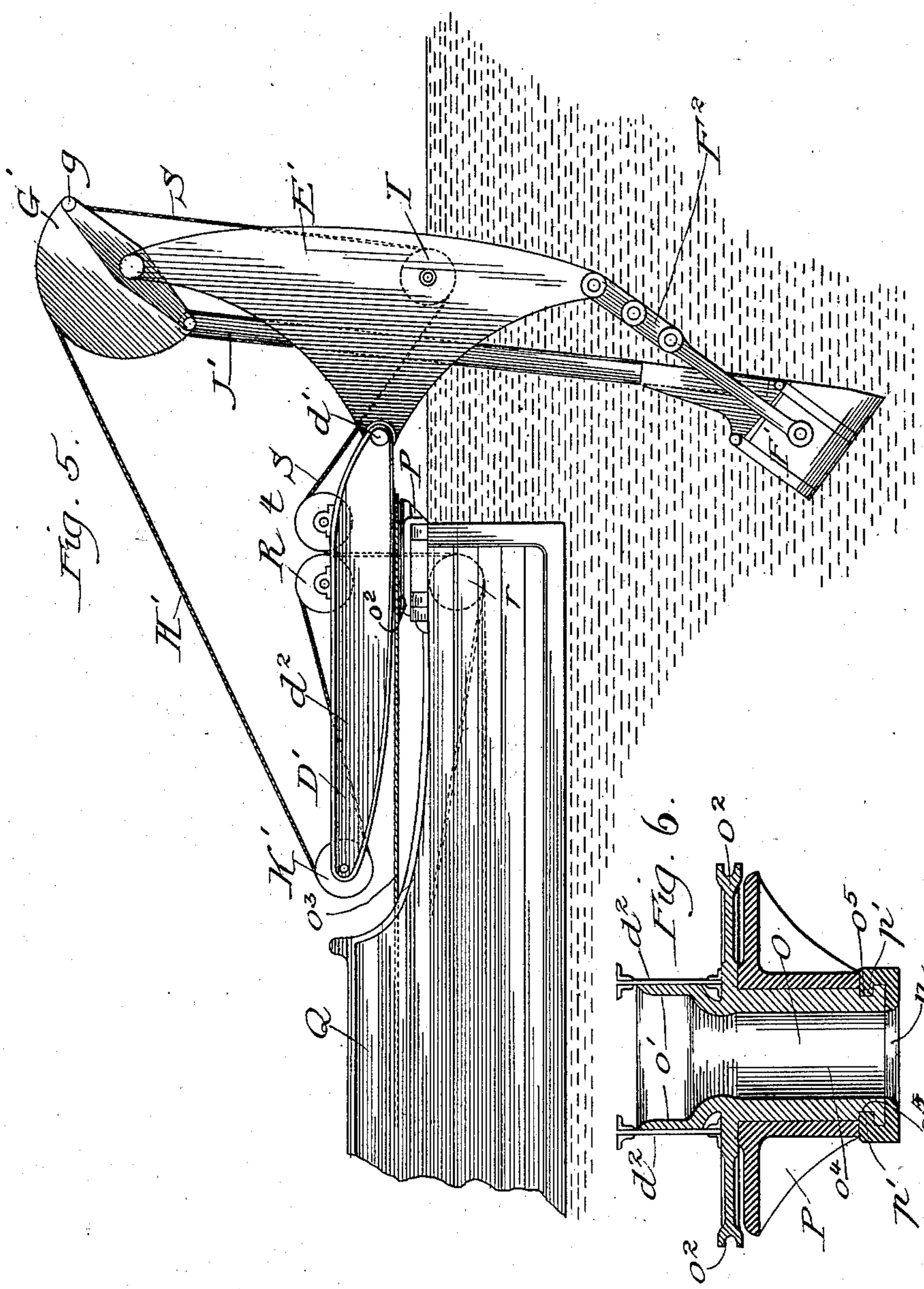

Fig. 5.

Fig. 6.

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UNITED STATES PATENT OFFICE.

OLAF HETLESAETER, OF CHICAGO, ILLINOIS.

EXCAVATOR.

SPECIFICATION forming part of Letters Patent No. 669,991, dated March 19, 1901.

Application filed May 7, 1900. Serial No. 15,702. (No model.)

To all whom it may concern:

Be it known that I, OLAF HETLESAETER, a citizen of the United States, residing in the city of Chicago, county of Cook, and State of Illinois, have invented a new and useful Improvement in Excavators, of which the following is a specification.

My invention relates to excavators wherein the bucket-arm resembles the bucket-arm shown and described by me in an application for Letters Patent of the United States filed September 7, 1899, Serial No. 729,706.

The objects of my invention are, first, to provide a bucket-arm and supporting-crane of such construction that said arm may be supported at a point adjacent to the axis about which said crane swings; second, to provide means whereby said crane may be enabled to swing through a complete revolution; third, to provide a support for said crane free from lateral, back, or fore braces, and, fourth, to provide the other details hereinafter set forth. I attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a side view of a ditching or grading machine adapted for use on land and embodying the principles of my invention. The bucket is shown in a hoisted position. Fig. 2 is a detail view taken vertically through the axis of the supporting-turret transversely to the crane. Fig. 3 is a side view of the machine as in Fig. 1 and shows the bucket in a position to take a cut at a point near the supporting structure. Fig. 4 is a side view of the bucket-arm as in Figs. 1 and 3 and taken in connection with Fig. 3 illustrates the raising and lowering effect upon the bucket consequent upon changes in the configuration of the bucket-arm. Fig. 5 is a side view of a machine embodying my invention in the form of a dredge. Fig. 6 is a detail sectional view of the turret or crane-support as shown in Fig. 3, the section being taken vertically through the axis of said turret and transversely to the crane.

Similar letters refer to similar parts throughout the several views.

In the land-machine, Figs. 1 and 2, the turret A is rigidly mounted upon the wheeled car B, at the forward extremity thereof. Said turret is preferably of cast-steel and flares at the base a thereof for strength and for security of position upon the supporting structure B. Said turret tapers toward its upper extremity and terminates in an annular bearing or socket a' for supporting the crane-pivot C. Between its said base a and upper bearing a' said turret is provided with the cylindrically-apertured interior web or lug a^2, which encircles said pivot C at a lower portion thereof and forms a supplementary brace and bearing therefor. Said pivot C consists of a hollow shaft supported within said turret A and is provided near its upper extremity with the annular ledge c, which rests upon the bearing a' of said turret. The swinging sheave c' is rigidly secured to the lower extremity of said pivot C, concentrically therewith, and affords means for rotating said pivot and also for preventing the rise thereof from its seat upon the bearings provided in said turret A. Said sheave is operated by means of the swinging cable c^2, which extends from said sheave rearwardly through suitable apertures in the turret A to the swinging mechanism c^3. Near the upper extremity of said pivot C are the lugs c^4, which afford means of attachment for the parallel beams $d\,d$ of the crane D. Said lugs c^4 are so formed that said beams $d\,d$ may rest upon the ledge c of the pivot C, and by means of said lugs and said ledge said beams are rigidly secured to said pivot and rotate therewith. Said pivot C is located between the extremities of said crane, and the distance between the said beams $d\,d$ is sufficient to afford a passage for adjacent portions of the bucket-arm when said arm is in a position for discharging. The portion of said crane lying between said pivot and the bucket-arm-supporting pin e at the forward extremity of said crane is comparatively short, said arm being thus supported near the crane-pivot and the forward portion of said crane and the bucket-arm being to a certain extent counterbalanced by the weight of the rear portion thereof.

The crane D and the parts carried thereon are so arranged that if reference be had to any specified plane perpendicular to the axis of rotation of said crane no part of said crane lies at the same or equal distance from said axis as any part of the crane-support—that is, said crane may rotate through a complete

revolution without interference with the crane-support or the mechanism whereby said crane is rotated.

The oscillating beam E is pivotally supported upon the pin *e* and consists of parallel plates suitably fastened together and extending in both directions from said pin *e*. In the opposite extremities of said beam E are fixed the pins *e'* and e^2, said pin *e'* being located at the lower and said pin e^2 at the upper extremity of said beam when the latter is in a vertical position. The configuration of said beam E is preferably such that the perpendicular distance between said pin *e* and a line joining said pins *e'* and e^2 is greater than the width of the bucket-arm, thereby permitting all the parts of said arm to lie upon the same side of said pin *e*. By this construction said pin *e* may be located approximately contiguous to the turret A without interference of the bucket-arm with said turret, and, moreover, said pin *e* may extend entirely across the crane D, thus joining the beams *d d* and serving as a brace or distance-piece for strengthening the forward extremity of said crane. The bucket-links *f* are pivotally suspended on the pin *e'* at the lower extremity of said beam E and extend to and pivotally support the trunnions *f'*, located symmetrically on opposite sides of the excavator-bucket F.

Pivotally supported upon the pin e^2 at the upper extremity of the beam E is the thrust-segment G, which constitutes one of the members of the bucket-arm and has a curved periphery approximately concentric with said pin e^2. The periphery of said thrust-segment is grooved to receive the hoisting-cable H, which is attached to said segment at a point *h* thereon, said point lying at the forward extremity of said segment when the oscillating beam is in a vertical position.

The bucket-handle J is pivotally connected to the thrust-segment G by means of the pin *h'*, which is located in said segment at a point thereon opposite to said point of attachment *h* of the hoisting-cable H. At its lower extremity opposite to said segment G said handle carries the said excavator-bucket F, said handle and bucket thereby forming a connecting-link between said segment and the bucket-links *f*. The oscillating beam E, thrust-segment G, bucket-handle J, and bucket-links *f* therefore constitute a link-work bucket-arm the members whereof are movable relatively to each other.

The weight of the bucket-arm is so distributed relatively to the supporting-pin *e* that when free to move said arm tends to rotate about said pin in such a direction as to lower the bucket into a position for taking a cut.

The rotation of the bucket-arm about its supporting-pivot *e* is accomplished by means of the hoisting-cable H, above mentioned, which is attached to the thrust-segment G at the point *h* thereon. From said point *h* said cable extends to the sheave K, which is mounted upon the crane D near the rear extremity thereof. Said cable H trains around said sheave K, whence it extends to the sheave *k*, which is mounted upon said crane D in such a manner as not to interfere with the bucket-arm when said arm is rotated about its supporting-pivot *e*. Said cable trains over said sheave *k*, thence passing downward through the hollow crane-pivot C, thence to the guide-sheave *k'*, mounted below said pivot in the body of the supporting structure B, and thence in a rearward direction to suitable hoisting mechanism. The location of said sheaves *k* and *k'* is such that the reach of cable lying between said sheaves will be approximately coincident with the central longitudinal axis of said pivot C.

The distance of the bucket from the point of support of the bucket-arm upon the crane depends upon the positions of the members of the bucket-arm relatively to each other. The change in the configuration of said bucket-arm or the positions of the members thereof relatively to each other is effected by means of the controlling-cable M, which is attached to the bucket-handle J at a point *m* thereon adjacent to the bucket F. From said point *m* said cable M extends to the guide-sheave N, which for convenience is mounted upon the pin *e*, whereon the oscillating beam E is supported in the forward extremity of the crane D. Said cable M trains beneath and around said sheave N and extends therefrom and trains over the guide-sheave *n*, mounted upon the crane D above the said pivot C and shown in dotted lines. From said sheave *n* said controlling-cable M trains beneath and around a guide-sheave, which is so located in the body of the supporting structure B that said cable M between said last-mentioned sheaves approximately coincides with the axis of the pivot C. Said controlling-cable M is operated by suitable controlling mechanism upon the supporting structure B.

The operation of the mechanism is as follows: The hoisting-cable H is paid out, and the weight of the bucket F and adjacent portions of the bucket-arm causes the bucket to be lowered and to approach the supporting structure in a position ready for taking a cut, as shown in Fig. 3. When said bucket F is in a position for cutting, tension is exerted in the hoisting-cable H, and the thrust-segment G tends to approach the guide-sheave K at the rear extremity of the crane D. The tension in said cable H is resolved by the segment G into two forces, one whereof tends to rotate the bucket-arm about the pin *e*, and the other whereof tends to rotate said segment G about the pin e^2. The rotation of said bucket-arm about its pivot *e* tends to force the bucket in a forward direction, so as to take a cut, while the rotation of said segment G about its supporting-pivot e^2 tends to force the bucket-handle J and bucket F in a downward direction normally toward the bank. The depth

of the cut or the normal thrust of the bucket toward the bank, due to the last-mentioned component of the force of the hoisting-cable H, is controlled by means of the controlling-cable M. When the depth of cut is to be decreased—that is, when the bucket is to be raised directly away from the bank—tension is exerted in the controlling-cable M, and said tension causes the point *m* on the bucket-handle J to approach the sheave N upon the crane. The approach of the bucket F toward said sheave results in a shortening of the effective length of the bucket-arm below said pivot *e*, thus tending to raise said bucket out of the bank. When desirable, after the cut has been taken and the bucket filled said bucket may be caused to approach said sheave N and be maintained in its position relatively to the other members of the bucket-arm while said arm is being rotated and the bucket hoisted by means of the cable H. When said arm is raised to a sufficient height, said cable H may be held fast and said cable M paid out, with the result that said bucket F will be extended to its greatest distance from the guide-sheave N, and hence from the pivot-pin *e*. By suitably combining the operation of said cables H and M the bucket F may be placed in any position vertically, and by also employing the swinging cable c^2 any desired position of said bucket may be attained within the working limits of the machine.

The form of machine shown in Figs. 5 and 6, which is adapted for use as a dredge, is similar in its construction and operation to the machine hereinabove described. The principal differences between the two forms of machines shown are that in the device shown in Figs. 5 and 6 the construction of the crane-support is so modified that the crane lies nearer the platform whereon the crane is mounted and in the arrangement of the cable for controlling the configuration of the bucket-arm. In said dredge the oscillating beam E′, thrust-segment G′, bucket-handle J′, bucket F′, and bucket-links F^2 are substantially identical with the oscillating beam, thrust-segment, bucket-handle, bucket, and bucket-links in said described machine. Said oscillating beam E′ is pivotally supported between its extremities upon the pin *d*′, located in the forward extremity of the crane D′. Said crane D′ consists of the parallel beams d^2 d^2, which are supported between their extremities upon the pivot O. (Shown in detail in Fig. 6.) Said pivot consists of a hollow shaft having lugs *o*′ at its upper extremity, which form means of attachment for said beams d^2 d^2. The swinging sheave o^2 is concentric with said pivot O and forms a part thereof. Said sheave extends transversely to the axis of said pivot and is grooved in its periphery for receiving the swinging cable o^3. The portion of said sheave adjacent to the body of said pivot has a bearing upon the pivot-frame P in such a manner as to rotate thereon about the central axis of said pivot. Said pivot-frame P is adapted to be rigidly secured to the scow Q or other supporting structure and is so formed as to inclose and form a bearing for the lower cylindrical portion o^4 of the pivot O. The lower extremity of said pivot O has an annular groove o^5 in its exterior surface for receiving the collar *p*. Said collar *p* is provided with an annular tongue *p*′ for entering said groove o^5 in said pivot O. Said collar *p* is constructed in sections and when assembled in position upon said pivot O bears against the lower extremity of said pivot-frame P in such a manner as to hold said pivot in position within said frame and prevent the rise of said pivot from its bearings thereon. The rotation of the bucket-arm about its supporting-pivot *d*′ is effected by means of the hoisting-cable H′, which is attached to the thrust-segment G′, at the forward extremity *g* thereof. From said thrust-segment G said cable H′ extends rearwardly and trains around the guide-sheave K′, mounted upon the rear extremity of the crane D′. From said sheave K′ said cable H′ trains over the guide-sheave R, mounted upon said crane adjacent to the pivot O. Said cable trains over said sheave R and thence vertically downward through said pivot to the guide-sheave *r*, mounted in the body of the scow Q. The relative positions of said sheaves R and *r* are such that the reach of cable between them is approximately coincident with the central axis of the pivot O. From said sheave *r* said cable H extends rearwardly to suitable hoisting mechanism. The configuration of the bucket-arm is governed by means of the controlling-cable S, one extremity whereof is attached to the thrust-segment G′ at the above-mentioned point *g* thereon. From said segment G′ said cable S trains beneath and around the guide-sheave T, which is mounted upon the oscillating beam E′. The location of said sheave T is preferably near the forward edge of said beam E′ in order that said cable S may extend from said thrust-segment G′ at approximately right angles thereto when said segment is in the middle position of its rotation about its point of support upon the beam E′. From said sheave T said cable S extends to the guide-sheave *t*, mounted upon the crane D′ adjacent to the pivot O. Said cable S trains over said sheave *t*, thence vertically downward through the said pivot O, thence around a sheave (not shown) alongside the sheave *r*, and thence rearwardly to suitable hoisting mechanism. From said sheave T said cable S is so guided that the portion thereof lying within said pivot O will be approximately coincident with the axis of the latter.

In operation the rotation of the bucket-arm about the supporting-pivot *d*′ is effected by means of the hoisting-cable H′ in a manner similar to the manner of operation of the land-machine above described. The controlling-cable S is analogous in its operation to the cable M in said land-machine; but said

cable S raises the bucket F′ by causing the forward extremity *g* of the thrust-segment G′ to approach the guide-sheave T. The approach of the forward extremity of the thrust-segment G toward said sheave T causes the rear extremity of said thrust-segment G to recede from said guide-sheave T, and thereby effects the raising of the bucket. Conversely, the lowering of the bucket is permitted by paying out the cable S and permitting the forward extremity of said segment G′ to rise, thereby causing a lowering of the rear extremity of said segment, and consequently a lowering of the bucket-handle J′ and the bucket F′.

Certain features of the excavator herein shown are described and claimed by me in separate applications, numbered as "3" and "4," in a series of four applications for Letters Patent filed this day, Serial Nos. 15,704 and 15,705.

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

1. In an excavator, the combination of a horizontal member pivoted near its forward end upon a substantially vertical axis, said member constituting the crane; a linkwork pivoted to the front end of said crane upon a substantially horizontal axis, said linkwork extending in opposite directions from its supporting-pivot; a bucket at or near the lower end of said linkwork; and a power device connected to said linkwork at or near the upper end thereof.

2. In an excavator, the combination of a bucket-arm comprising members capable of motion relative to each other, a crane for supporting said arm, means for operating said arm, and a frame whereon said crane is pivotally mounted, said frame having no exterior guy or brace.

3. In an excavator, the combination of a revolubly-supported bucket-arm the members whereof are movable relatively to each other, a crane supporting said arm, means for moving the members of said arm relatively to each other, a hoisting-cable for revolving said arm about its supporting-pivot, and a turret for pivotally supporting said crane, said turret having no external guy or brace.

4. In an excavator, the combination of a crane supported intermediate of its extremities, and a bucket-arm revolubly supported upon said crane upon one side of the support of said crane, said arm having a point of power application at or near the extremity thereof opposite to the excavator-bucket, and the revolution of said arm in a direction for taking a cut causing the power-receiving extremity of said arm to approach the extremity of said crane opposite to the point of support of said arm.

5. In an excavator, the combination of a bucket-arm, a pivotally-supported crane for supporting said arm, and means for operating said arm, having a direct connection between said arm and a point on said crane, between which point and the point of support of the bucket-arm is the supporting-pivot of the crane.

6. In an excavator, the combination of a crane supported intermediate of its extremities, a bucket-arm revolubly supported on said crane upon one side of the support of said crane, and a plurality of independently-operated power devices whereby the upper power-receiving extremity of said arm is caused to approach the extremity of said crane opposite to the point of support of said bucket-arm.

7. In an excavator, a linkwork pivotally supported at a point between its extremities and constituting the bucket-arm, said linkwork having all of its component parts lying upon the same side of the point of support of said linkwork, in combination with means for supporting and means for operating said arm.

8. In an excavator, the combination of a crane revolubly supported between its extremities, a bucket-arm the sole support whereof consists of a pivot at or near the forward extremity of said crane, the distance between the arm-supporting pivot and the axis of revolution of the crane being less than the distance between said axis of revolution of the crane and the rear extremity of said crane; the rear portion of said crane thereby tending to counterbalance the forward portion of said crane and bucket-arm; a power device applied to the upper portion of said bucket-arm, and tending to rotate the upper portion of said arm toward a point on said crane lying to the rear of the crane-axis.

9. In an excavator, the combination of a crane pivotally supported and extending in opposite directions from its point of support; a bucket-arm revolubly supported at one extremity of said crane between the extremities of said bucket-arm; a guide located upon said crane at a portion thereof opposite to said bucket-arm; a hoisting-cable attached to the upper extremity of said bucket-arm and training upon said guide, for causing the said upper extremity of said bucket-arm to approach said guide.

10. In an excavator, the combination of a crane for supporting the bucket-arm, a pivot for supporting said crane, and a linkwork bucket-arm, two of the members of which extend substantially the entire length of said arm, the upper extremity of said arm being at a greater distance from the point of support of said arm than the distance between the point of support of said arm and the point of support of said crane upon the crane-pivot.

11. In an excavator, the combination of a crane, a linkwork bucket-arm, two of the members of which extend in the same general direction, and extend substantially the entire length of said arm, the point of support of said bucket-arm lying at a distance from the upper extremity thereof greater than the distance between the point of support of said

arm and the point of support of said crane; and means for operating said arm.

12. In an excavator, the combination of an oscillating beam, revolubly attached to the excavator-crane at one extremity thereof, and forming one of the members of the bucket-arm; a thrust-segment revolubly supported upon said beam and forming another of the members of the bucket-arm; other members completing said bucket-arm; two beams substantially parallel and coextensive, and constituting the excavator-crane, said beams being supported intermediate of their extremities, and being located at such a distance apart, and so proportioned in length as to receive said thrust-segment at a point between the crane-support and the extremity of said crane opposite to said oscillating beam.

13. In an excavator, a linkwork forming the bucket-arm, said linkwork being supported at a point between its extremities, and having all of its component parts lying upon the same side of the point of support of said arm.

14. In an excavator, a linkwork bucket-arm, one of the members of said arm forming a thrust-segment which is pivotally supported upon a second member of the arm, said second member being also pivotally supported, a power device connected to said thrust-segment for revolving said arm about the supporting-pivot thereof, and a controlling-cable for changing the configuration of said linkwork arm, said cable being attached to one of the members of said arm, and having points of contact with said arm on two different members thereof.

15. In an excavator, the combination of a crane pivotally supported between its extremities, a linkwork bucket-arm pivotally supported upon said crane at the forward extremity thereof, a guide located upon said crane near the rear extremity thereof, a hoisting-cable for operating said arm, said cable being attached to said arm and extending therefrom to said guide, means for operating said cable and means for controlling the configuration of said bucket-arm.

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