

F. R. KNIGHT.

EXCAVATOR.

APPLICATION FILED AUG. 10, 1911.

1,058,066.

Patented Apr. 8, 1913.

2 SHEETS—SHEET 1.

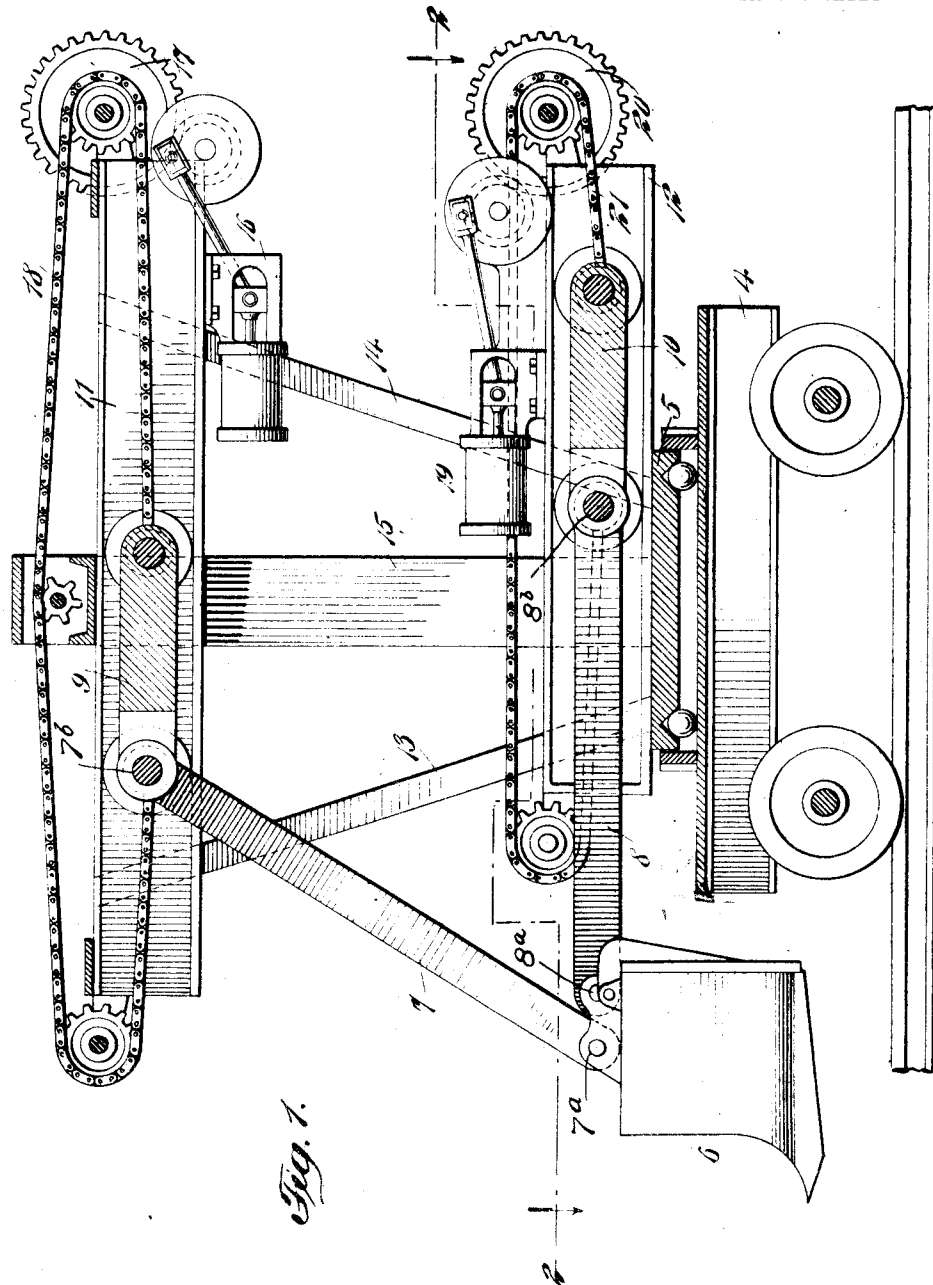


Fig. 1.

Witnesses:
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Herman Eustice

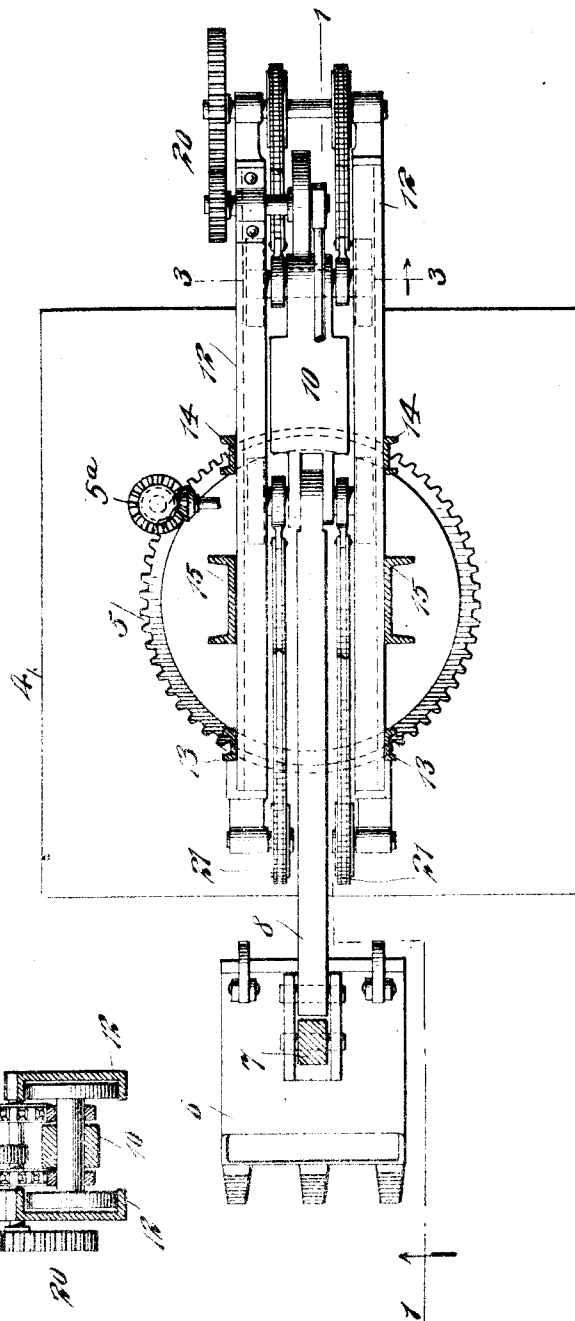
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2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

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EXCAVATOR.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, FRANK R. KNIGHT, a citizen of the United States, residing at Cornwall, in the county of Orange and State of New York, have invented a new and useful Excavator, of which the following is a specification.

The invention relates to an improved excavator and has for its object the production of an excavator which is better than those heretofore known in the provision made for the application of the power, in its availability for much work which cannot be performed efficiently by excavators heretofore known, in its adaptability to all conditions encountered in use, and otherwise.

In using excavators the dipper or shovel must be forced into the material and the material removed. It is obvious that the more accurately and directly the power is applied in the direction in which it is desired to move the dipper, the less the power required for these purposes, and that under many circumstances accurate control of the dipper is necessary to secure a full load with speed and economy of operation. In the excavator of my invention, the movement of the dipper is fully subject to the accurate control of the operator, so much so that in the hands of one accustomed to operate it the dipper may be moved with almost as much accuracy and with much the same motion as in the case of a shovel handled by a pair of hands. Again, excavators heretofore used are not adapted to many classes of excavating, as, for example, in small-tunnel work, by reason of the space required for their operation, chiefly on account of the crane used to lift the dipper, common to such excavators.

My invention contemplates the avoidance of this difficulty and provides an effective apparatus operative in limited space.

These and other objects I attain by providing an excavator which comprises a dipper, two dipper-arms or beams, and means for supporting and moving the same. The dipper may be of any convenient kind, the well-known type provided with teeth and means for opening the back or bottom to empty it being satisfactory. The dipper-arms may be connected directly or indirectly with it in any suitable way, the requirement in this respect being merely that the

connection of the dipper-arms be such that the force exerted by each may be along different lines, as, for example, from the upper and lower portions of the frame-work. The means for supporting the dipper-arms and thereby the dipper, may consist of any suitable frame-work, that shown in the drawings and hereinafter described being particularly suitable by reason of simplicity, economy of space and the provision it affords for advantageous disposition of the engines. The means for moving the dipper-arms should be such that each can be moved independently of the other. A cross-head connected with each dipper-arm running in the frame-work and moved by a connection with an engine or motor I regard as the most desirable means of accomplishing this.

In the accompanying drawings showing one form of specific embodiment of my invention, Figure 1 is a vertical section along the line 1—1 of Fig. 2; Fig. 2 is a plan view partly in section along the line 2—2 of Fig. 1; and Fig. 3 is a transverse section along the line 3—3 of Fig. 2, looking in the direction of the arrow.

The platform 4 is indicated in this instance as provided with wheels running on a track and the excavator is shown revolvably mounted thereon by means of a rotary bed-plate or turn-table 5 suitably driven through gearing 5^a. While the manner in which the excavator is revolvably mounted is old and well-known and any suitable mechanism will answer the purpose, the revolvable arrangement is of peculiar advantage in connection with the particular excavator of my invention inasmuch as it is designed, among other things, to supply for the first time a practical, efficient excavator for use in small tunnels and limited space, and in such work the full circle swing cooperates with the omission of the crane and compactness of the device to enable the excavated material to be delivered at the back of the excavator, as, for example, to cars on the same track.

In the embodiment of the invention illustrated in the drawings, dipper 6 is controlled and directed by a pair of dipper-arms 7 and 8 pivoted to the dipper at 7^a and 8^a respectively. The upper dipper-arm is also pivotally connected at 7^b to cross-head 9, while the lower dipper arm is similarly con-

nected at 8^b to cross-head 10. Cross-heads 9 and 10 are movably mounted on beams 11 and 12, respectively, which may be made of channel iron reinforced by a track upon which wheels supporting the cross-heads 5 run, and which with the uprights 13, 14 and 15 constitute the supporting structure or frame-work. The beams thus constitute superimposed fixed guideways along which the cross heads or supporting members may 10 travel in fixed paths which are most conveniently, substantially rectilinear and parallel. In this embodiment the control of the movement of the dipper-arm 7 is secured by means of an engine 16 seated under the beam 15 11, which engine by gears 17 and chain 18 is connected with the cross-head 9. Thus, the cross-head 9 may be moved forward or back at the pleasure of the operator, its movement imparting movement to the dipper-arm 7 and hence to the dipper 6. The dipper-arm 8 in the drawing is similarly operated and controlled by the engine 19 20 mounted upon the lower beam 12 of the frame-work and connected with the cross-head 10 by the gears 20 and the chain 21. While power may thus be separately applied to each dipper arm, it is obvious that the movements of the arms are more or less 30 interdependent by reason of the manner of their connection. It is to be noted that in the embodiment of the invention here illustrated the dipper-actuating means are disposed as a whole rearwardly of the dipper 35 and also substantially entirely within the upper and lower limits of the supporting structure. These features are particularly advantageous where the excavator is to be used in small tunnel work, since the necessity of a crane or similar member projecting 40 beyond the supporting structure proper is thus obviated. It is thus apparent that the operator is given exceptional control of the movement of the dipper, which may be 45 handled very much as a shovel is handled by a pair of hands. For example, in practice it sometimes happens that the dipper encounters a rock, which with the excavators now known often delays operations. With 50 the excavator of my invention in such a case it is frequently practicable, by simply moving back the cross-head 10 and advancing the cross-head 9 to force the teeth of the dipper 6 under the obstacle and then by advancing the cross-head 10 with or without 55 advancing at the same time the cross-head 9, as may be desirable, removing the obstacle as part of the excavated material. The arm 8 would then swing upwardly between the beams 12, with the arm 7 as a radius. As arms 7 and 8 are free to advance and withdraw with respect to the supporting structure to swing up and down 60 and are also adapted to be locked in any longitudinal position through the cross-

heads 9 and 10, it is evident that perfect control may be had through proper manipulation of the engines. And because of the rigid yet universally movable power arms force may be directly applied for digging 70 in any direction. As is apparent from this illustration, the excavator of my invention has far greater adaptability to all the varying conditions encountered in actual work than excavators heretofore known. It may 75 be noted, too, that it possesses advantages in economizing power, because the power is applied at the will of the operator in the direction best adapted to the particular circumstances and obviates the loss of power involved in the use of excavators heretofore 80 known wherein to secure movement of the dipper in one direction there is involved the application of power at an angle thereto, as, for example, to secure a horizontal movement 85 of the dipper a wasted upward push is often involved and the control over the dipper promotes economy by enabling the operator to get a dipperful of material in many cases where with present devices this 90 is not practicable.

It should be understood that many modifications and changes may be made in the particular embodiment of the invention shown in the drawings without in any way departing 95 from the scope of my invention. While the particular arrangement of dipper-arms, frame-work, and means for controlling the dipper-arms shown in the drawings possess particular advantages, it is obvious that extensive modification might be made in all 100 these respects without departing from the spirit or scope of the invention in its broader aspects.

I claim:—

1. An excavator comprising a dipper, a 105 framework having upper and lower supports for cross-heads, cross-heads movably mounted in said supports, means for moving each of said cross-heads independently of 110 the other, and dipper-arms connected with said cross-heads and extending thence at an angle to each other to support said dipper.
2. An excavator comprising a dipper, a 115 framework consisting of uprights and beams, cross-heads movably supported by said beams, means for moving said cross-heads independently of each other, and connections between said cross-heads and 120 dipper.
3. An excavator comprising a dipper, a framework consisting of uprights and beams at different heights, cross-heads movably supported by said beams, means supported 125 by said beams for moving said cross-heads independently of each other, and connections between said cross-heads and dipper.
4. An excavator comprising a dipper, a 130 framework, movable dipper-operating

means for dipper-arms, and dipper-arms connecting the same with the dipper and capable of angular movement relative to each other, said dipper-operating means being separated and arranged for longitudinal travel in said frame-work so that the dipper-arms meet at a considerable angle.

5. An excavator comprising a dipper, two power dipper-arms at least one of which is pivotally secured to said dipper and angularly movable with respect to the other, longitudinally movable dipper-operating means for said dipper-arms, guideways for such operating means, and means for moving said operating means.

6. An excavator comprising a dipper, two dipper-arms movable with respect to each other and at least one of which is pivotally connected to said dipper, movable, vertically separated dipper-operating means supporting said dipper-arms in swinging relation and arranged to travel therewith and means for moving such dipper-operating means, in combination with a platform upon which said excavator is revolvably mounted.

7. An excavator comprising a dipper, a frame-work having uprights supporting upper and lower beams provided with tracks, wheels running on said tracks, and supporting cross-heads, means for moving said cross-heads supported by said beams, and dipper-arms connected with said cross-heads and serving to move said dipper.

8. An excavator comprising a dipper, dipper-arms at least one of which is pivotally attached thereto and capable of angular movement relative to the other, and dipper-operating means arranged to travel in fixed paths for advancing and withdrawing the dipper-arms, said dipper arms being pivotally attached thereto.

9. An excavator comprising a supporting frame-work carrying fixed guideways, a dipper, independently movable dipper-arms connected to said dipper at an angle to each other and pivotally connected to operating means, and means arranged to travel in said guideways for operating said dipper-arms independently.

10. An excavator comprising a supporting frame-work carrying upper and lower guideways, a dipper, an upper dipper-arm connected to said dipper, a lower dipper-arm connected to said dipper at an angle to said upper arm and movable with respect thereto, and separate dipper-operating means in each guideway to which said arms are attached in swinging relation for separately applying power to each dipper-arm.

11. An excavator comprising a dipper, a pair of dipper-arms at least one of which is pivoted to said dipper at an angle to the other arm, a pair of fixed guides, dipper-operating means movable along said guides

and pivoted to said dipper-arms, and means for separately moving either of said dipper-operating means.

12. An excavator comprising a suitable supporting structure, dipper-arm operating means supported thereby, a dipper, dipper-arms each of which is secured at one end to said dipper and at the opposite end to said dipper-operating means, and mechanism for independently moving such opposite ends of said arms in substantially rectilinear parallel paths through said dipper-operating means, so the angle the arms bear to each other may vary as such opposite ends are moved.

13. An excavator comprising a suitable supporting structure mounted on a revolvable base, a dipper, dipper-arms and means to operate the same, at least one of said dipper-arms being pivotally secured at one end to said dipper and both such arms being yieldably secured at the opposite ends to said operating means, and mechanism for independently imparting substantially rectilinear motion to such opposite end of said arms, so the angle the arms bear to each other may vary as such opposite ends are moved.

14. An excavator comprising in combination mechanism for operating a dipper disposed as a whole rearwardly of said dipper, dipper-arms for said dipper, and dipper-arm operating means comprising movable members operated through said mechanism to advance and withdraw said dipper, said dipper-arms engaging said dipper and pivotally engaging said dipper-arm operating means, whereby said dipper may be advanced or withdrawn and also swung in a plane at an angle to the plane of advancement.

15. An excavator comprising in combination a suitable supporting structure, a dipper actuating mechanism comprising power arms engaging said dipper at an angle, movable members supporting said power arms in swinging relation at different heights in said structure, and means for moving the portions of said power arms engaging said movable means in fixed and substantially rectilinear, parallel paths.

16. An excavator comprising in combination with a suitable supporting structure a dipper and dipper-actuating means, comprising movable members mounted to travel longitudinally on said structure at different heights and pivotally connected to said dipper and means for applying power to said members individually, whereby each said member may be caused to exert either a thrust or a pull on said dipper.

17. In an excavator, a truck, a dipper operated therefrom, and mechanism for operating said dipper, said mechanism comprising a power-arm arranged to advance and withdraw the dipper in an approximately hori-

zontal plane, and a power-arm attached to said dipper at an angle to the other arm and arranged to tilt the dipper in a plane at an angle to said horizontal plane and to elevate
5 said dipper above said horizontal plane.

18. In an excavator, a truck, a dipper operated therefrom and mechanism for operating said dipper, said mechanism comprising a cross-head with an attached power-arm arranged to advance and withdraw the dipper
10 in an approximately horizontal plane and an additional cross-head and attached power-arm arranged to tilt said dipper in a plane at an angle to said horizontal plane.

19. An excavator comprising a dipper, a pair of dipper-arms at least one of which is pivoted thereto, a pair of fixed guides, movable members supported by said guides and adapted to travel therein and pivotally connected to said dipper-arms, and means for
20 moving one of said arms in the direction of its length through one movable member and means for moving the other arm at an angle to the first arm through the other movable
25 member.

20. An excavator comprising a truck, guideways carried thereby at different heights, members movably arranged to travel in said guideways, mechanism for controlling the travel of said members, arms
30 pivoted to and operated by said movable members, and a dipper having said arms attached thereto.

21. In an excavator, a dipper, rigid power-arms for advancing, withdrawing, raising and lowering the dipper, said power-arms being secured to the dipper at an angle to each other, and means for operating the
35 power-arms independently.

22. In an excavator, a dipper, a suitable supporting structure and dipper power-arms between said structure and said dipper, each power-arm being arranged so as to constitute a radius upon which the dipper may be
40 swung by another power-arm, and means operating in approximately longitudinal paths for operating said power-arms independently.

23. In an excavator, a dipper, a suitable supporting structure and dipper power-arms between said structure and said dipper, each power-arm being arranged so as to constitute a radius upon which the dipper may be
50 swung by another power-arm, means operating in approximately longitudinal paths for operating said power-arms independently and for changing the position of the power-arms with respect to the supporting structure.

24. An excavator comprising a dipper, rigid power-arms connected to said dipper and adapted to support and move it, said power-arms extending from said dipper
60 angularly with respect to each other to separated movable members, movable members

adapted to be independently advanced or withdrawn and thereby operate said power-arms, a frame-work carrying said movable members, and operating means for moving
70 said movable members independently.

25. An excavator comprising a dipper, a framework and rigid power-arms secured at one end to the dipper and extending therefrom, one above the other and at an angle to each other, to operative power
75 means, and means carried by the framework for advancing and withdrawing the other end of said power-arms in approximately longitudinal paths.

26. An excavator comprising a framework, a dipper and a plurality of dipper-arms supporting and controlling said dipper, said dipper-arms being connected with the dipper and with operative power means whereby each may be advanced or withdrawn independently, and means operating
80 said arms mounted on a framework at vertically separated points so that said arms are disposed angularly with respect to each other.

27. An excavator comprising a supporting structure, movable members carried thereby at vertically separated points, rigid dipper-arms operatively connected with said
85 movable members and extending therefrom at an angle to each other to support the dipper, means for moving said movable members longitudinally so as to advance the dipper out from the supporting structure, raise or lower it and withdraw it in proximity to the structure, and means for revolving the supporting structure.

28. In an excavator, a dipper, a suitable supporting structure, and power-arms between the supporting structure and the dipper, each power-arm being arranged to exert either a thrust or a pull upon said dipper, said power arms being independently operable at different speeds and arranged so that
100 an end of either may be locked in any longitudinal position, whereby the locked or slower moving power-arm may serve as a radius around which the dipper may be swung by the other arm, and means for moving said arms independently, at different speeds, or for locking the end of one arm against longitudinal travel relative to the other.

29. In an excavator, a dipper, a supporting structure, sets of beams arranged thereon at different levels, and each set of beams constituting spaced tracks, dipper-arms attached to the dipper and to operating means movable along said tracks, and operating means for said dipper-arms, said arms being arranged with respect to the dipper and operating means so as to swing between
125 said spaced tracks.

30. In an excavator, a dipper, a supporting structure, an upper dipper-arm and a
130

lower dipper-arm, the upper dipper-arm arranged with respect to the supporting structure and the dipper to exert a thrust to lower the dipper and a pull to elevate it, 5 the lower dipper-arm arranged with respect to the supporting structure and the dipper to exert a thrust to advance or elevate the dipper and a pull to withdraw or lower it, and mechanism for independently operating 10 each dipper-arm.

31. In an excavator, a dipper, a supporting structure, a plurality of dipper-arms, each arranged to exert a thrust or a pull upon the dipper in a different direction

from the other and attached in swinging relation with the supporting structure, and means for advancing and withdrawing the ends of the arms opposite the dipper independently of each other at the same or different rate of speed and to secure any of such opposite ends stationary with respect to said supporting structure while the other opposite ends are traveling.

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Witnesses:

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