

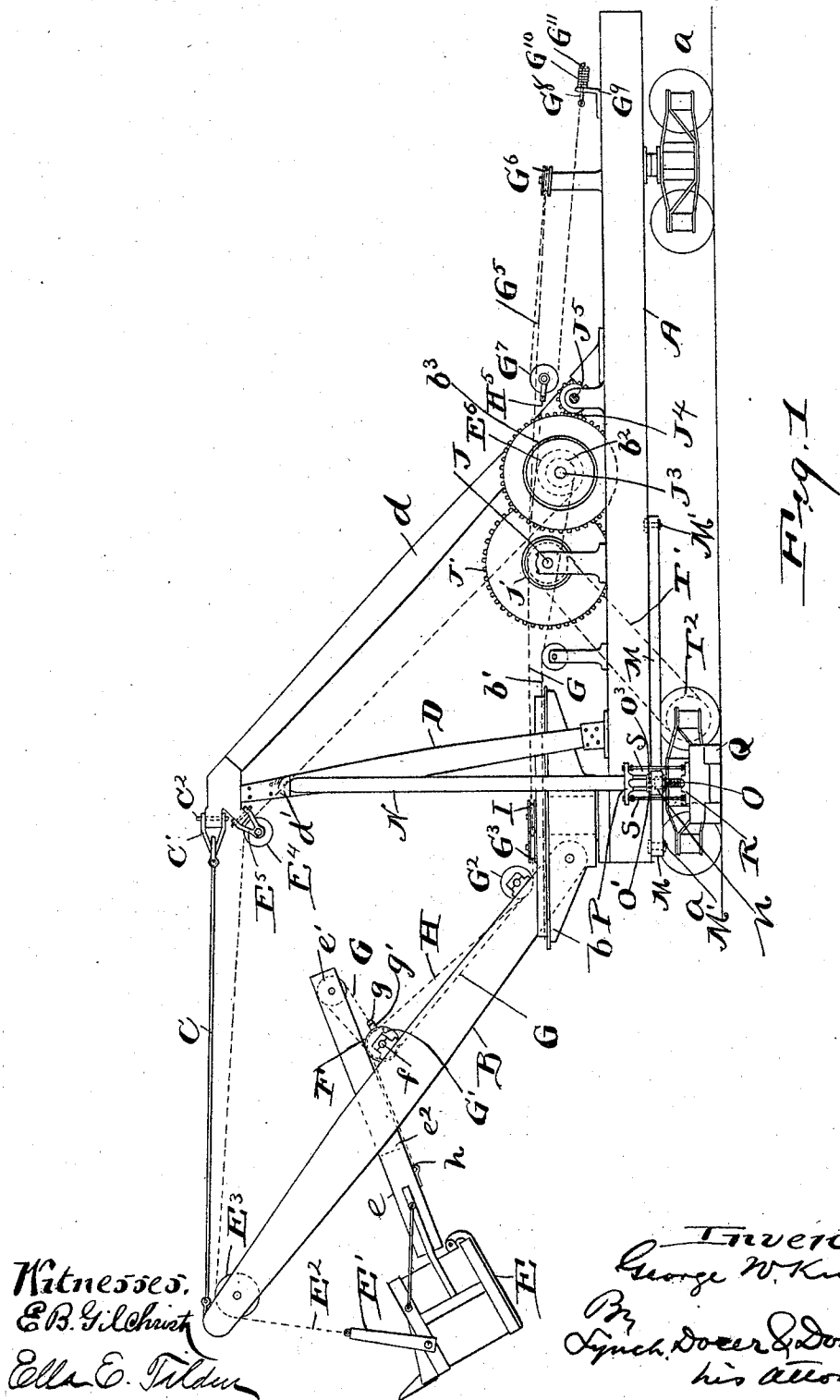
(No Model.)

3 Sheets—Sheet 1.

G. W. KING.
EXCAVATOR.

No. 586,099.

Patented July 13, 1897.



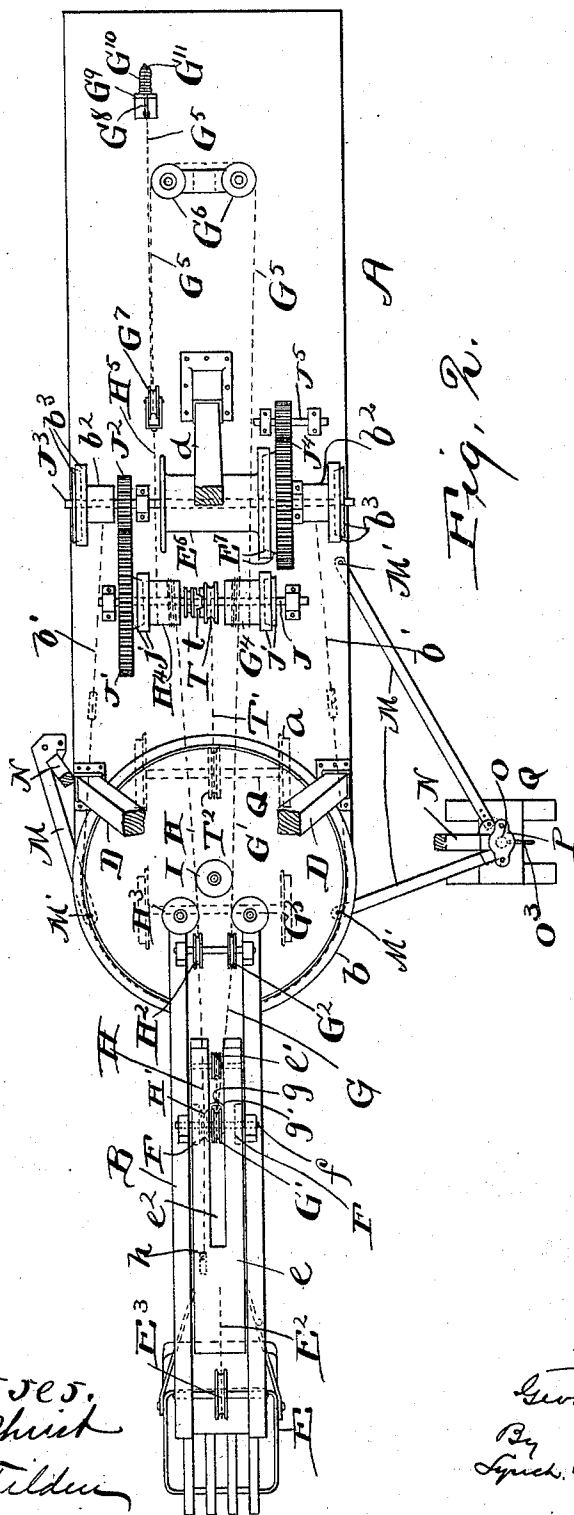
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3 Sheets—Sheet 2.

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Witnesses,
E. B. Gilchrist
Ella E. Tilden

Inventor:
George W. King
By
Spicer, Dorer & Donnelly
his Attorneys

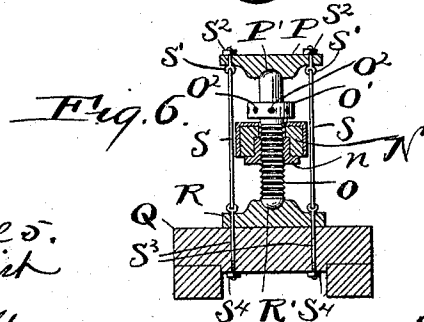
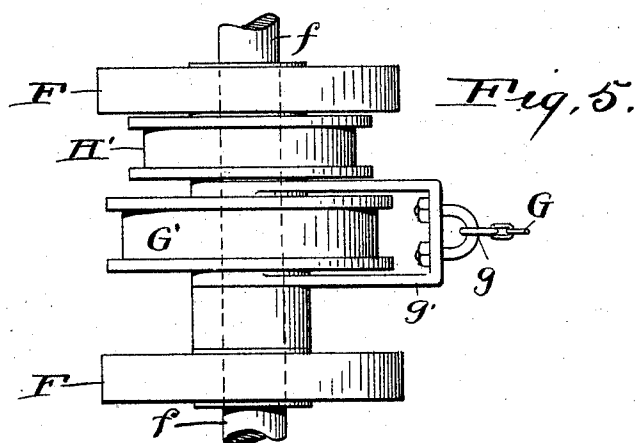
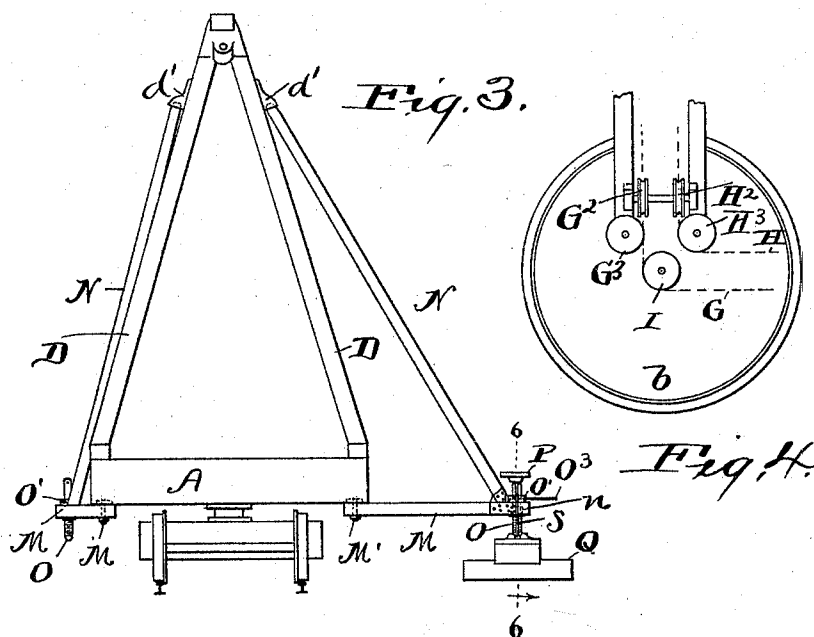
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his Attorneys.

UNITED STATES PATENT OFFICE.

GEORGE W. KING, OF MARION, OHIO.

EXCAVATOR.

SPECIFICATION forming part of Letters Patent No. 536,099, dated July 13, 1897.

Application filed March 6, 1896. Serial No. 582,028. (No model.)

To all whom it may concern:

Be it known that I, GEORGE W. KING, of Marion, Marion county, Ohio, have invented certain new and useful Improvements in Excavators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same.

My invention relates to improvements in excavators; and it consists, among other things, in improved apparatus involving a new arrangement of actuating or propelling chains or cables and pulleys for thrusting or actuating the dipper or shovel of the excavator in and out and capable of effecting a slow and powerful excavating thrust or stroke and a comparatively rapid return of the shovel after excavating.

My invention consists also in a peculiar arrangement of three sheaves for guiding the two shovel propelling or feed chains side by side and at opposite sides, respectively, of and in close proximity to the axis of the boom or crane bearing turn-table, so that the tension of said chains or cables shall not be materially interfered with in swinging the crane or boom laterally.

My invention consists, furthermore, in the combination, with the shovel-feed chains and feed-chain-actuating drums, of a peculiar arrangement of tightening-chains for preventing slack in said feed-chains and accommodating the rotation of one of said drums more rapidly than the other drum.

My invention consists also in improvements in bracing the excavator externally and laterally, and comprising a jack or brace capable of being swung laterally alongside of the excavator as a convenience in transportation or shipment of the machine and having its upper bearing in close proximity to the upper extremity or apex of the so-called "A-frame," that is instrumental in supporting the boom or crane.

My invention consists also in a peculiar brace construction that accommodates the employment of a foot, brace, or platform having a wide or large bearing upon the ground or supporting-surface and that can be raised bodily by turning the brace's screw in the required direction without requiring the separation or detachment of any member or members of the brace.

My invention consists, moreover, in certain features of construction and combinations of parts hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a side elevation of a steam shovel or excavator embodying my invention. Fig. 2 is a top plan and has portions broken away to more clearly show the construction. Fig. 3 is a front side elevation of the boom-supporting A-frame and a brace employed in bracing the excavator externally and laterally. Fig. 4 is a top plan showing the position of the three horizontally-arranged shovel-feed-chain-guiding sheaves and engaging cables when the boom or crane is swung laterally at right angles to the car or body portion of the excavator. Fig. 5 is a top plan showing the rollers or wheels for bearing the handle of the excavating dipper or shovel and for preventing said handle from riding on the feed-chains and chain-guiding pulleys in the operation of the machine. Fig. 6 is a central vertical section on line 6 6, Fig. 3.

Referring to the drawings, A designates the car or body portion of the excavator, that is mounted upon wheeled trucks *a a*, arranged at the forward end and rear end, respectively, of the body portion. I call the body portion's end that bears the boom-swinging table its "forward" end.

B designates the boom or crane, that is operatively connected at its lower end with the horizontally-arranged turn-table *b*, supported in any approved manner from the forward end of the excavator's body portion. The boom comprises in the main two parallel bars or beams projecting upwardly and outwardly from the turn-table in the usual manner, and at its upper end is connected, by means of a rod C, (shown only in Fig. 1,) with a bracket or yoke C', hinged or pivoted vertically at C² to the upper end of the upright so-called "A-frame" or inverted-V-shaped frame D, arranged widthwise of the machine and straddling the rear portion of the turn-table. Frame D is supported at the rear by any suitable number of beams or bars *d*, connecting the upper end of frame A with the body portion of the machine a suitable distance rearward of said frame. The vertical axes of the

turn-table and bracket C' are coincident with each other and constitute the axes of the boom.

E designates the excavating dipper or shovel, E' its bail, and e its arm or handle, that has bearing upon the peripheries of two rollers or wheels F, loosely mounted upon a horizontally-arranged shaft f, placed transversely of and suitably supported from the central portion of the boom.

G and H designate the feed chains or cables for actuating the shovel or dipper in and out, respectively—that is, chain G thrusts the shovel outwardly for excavating and chain H returns or actuates the shovel inwardly after excavating. I desire to impart a slow and powerful movement to the shovel in excavating, and I accomplish this by attaching the chain G at one end, at g, to a vertically-swinging yoke or frame g', suitably supported from shaft f, thence passing the chain upwardly and inwardly to and over a vertically-arranged pulley or sheave e', suitably supported from the free end of the shovel-arm, within the slot e², (see Fig. 2,) formed centrally in and extending longitudinally of the arm, whence the chain returns (leads downwardly and outwardly) to and in under a pulley G', loosely mounted upon shaft f. From pulley G' chain G leads downwardly and inwardly along the boom to the drum hereinafter referred to. The other shovel-feed chain or cable H is attached at one end, at h, to the shovel-arm at any suitable point between the central portion and load-bearing end of the arm, and thence leads inwardly along said arm to and over a pulley H', loosely mounted upon shaft f at the side of pulley G', and from said pulley H' chain H leads downwardly and inwardly to the actuating-drum hereinafter referred to. By the construction thus far described it is obvious that, although both actuating-drums are driven at the same speed in winding up the engaging chain or cable, chain G, on account of the loop formed in said chain where it leads over the pulley at the free end of the shovel-arm, is actuated powerfully and much slower, as desired, than chain H, or, in other words, a slow and powerful movement is transmitted to the shovel during the latter's excavating stroke and a comparatively rapid return of the shovel after excavating is effected.

By the construction hereinbefore described, wherein chain G is attached to the vertically-swinging yoke or frame g', supported from the shaft that bears pulleys G' and H', the shovel-arm can be swung in a vertical plane without materially altering the tension of the chain or changing the position of the arm.

Both chains G and H lead in under the different sheaves, respectively, of a pair of suitably-supported vertically-arranged guide-sheaves G² H², arranged also longitudinally of the boom and side by side and a suitable distance forward and at opposite sides, respectively, of the turn-table's axis, as shown in

Fig. 2. From sheaves G² H² chains G and H lead side by side between and over the different sheaves, respectively, of a pair of horizontally-arranged sister guide-sheaves G³ H³, suitably supported from the turn-table at the outer side of the different sheaves G² H², respectively. Sheaves G³ and H³ are located between sheaves G² H² and the axis of the turn-table, and from said sheaves G³ and H³ chains G and H lead to and engage diametrically opposite points, respectively, of a horizontally-arranged guide-sheave I, suitably supported from and having its axis coincident with the axis of the turn-table, as shown in Fig. 2. By said arrangement of sheaves it will be observed that the swinging of the boom laterally will not materially interfere with the tension of the chains. In Fig. 4 is shown the position of sheaves G², H², and I and engaging chains when the boom is swung laterally and rearwardly in one direction at right angles to the body portion of the machine.

From sheave I chains G and H lead to and engage different winding-drums G⁴ and H⁴, respectively, that are loosely mounted upon a horizontal shaft J, arranged transversely of and suitably supported from the machine's body portion. Shaft J is rotated, when operated, continuously in one direction. A comparatively diametrically large spur-gear J', operatively mounted upon shaft J, meshes with a pinion J², operatively mounted upon a suitably-supported shaft J³, arranged parallel with and a suitable distance rearward of shaft J, and shaft J³, that is rotated continuously in one direction, is intergeared at J⁴ with the suitably-supported driving-shaft J⁵, to which power is communicated in any approved manner. A suitably-operated clutch j is provided for each drum G⁴ and H⁴ and controls operative connection between the respective drum and shaft J. The one or the other of said drums is actuated to wind up and thereby positively actuate the engaging shovel-feed chain upon establishing operative connection between said drum and its supporting-shaft. While one drum winds up the engaging feed-chain, the other drum is free to pay out its engaging feed-chain, and consequently the shovel is actuated outwardly, as required to excavate, or inwardly, as required to return after excavating, according as the one or the other feed-chain is wound upon the engaging drum.

It will be observed that pulleys G' and H' are arranged between rollers or wheels F F and that the latter are diametrically larger than the rims of said pulleys, and hence the shovel-arm is not only prevented from riding upon the shovel-feed chains, but is also prevented from riding on said pulley-rims.

To automatically take up any slack in chains G and H at all times, regardless of the different speed at which drums G⁴ H⁴ rotate, I cause each of the shovel-feed chains to wind upon one end portion of the engaging drum

and have the other of said drums operatively engaged by a tension chain or cable and employ a suitable device to act upon and maintain both tension-chains taut at all times. G^5 designates the tension-cable engaging drum G^4 , and H^5 represents the tension-cable engaging drum H^4 , and the arrangement of parts is such that each tension-cable winds upon the engaging drum when the latter is paying out the engaging shovel-feed chain, and vice versa. Tension-cable G^5 leads rearwardly from the engaging drum over shaft J^3 and over and rearward of the driving-shaft to and over a pair of suitably-supported horizontally-arranged sheaves G^6 , thence returns (that is, leads forwardly) to and over the sheave G^7 of a pulley-block, and thence leads rearwardly again and thereby completes the formation of a loop in said cable, and is attached at its rear end to the eye of a longitudinally-adjustable eyebolt G^8 , extending through a stationary bracket G^9 and bearing a spiral spring G^{10} , confined upon the bolt between the rear side of the bracket and a nut G^{11} , mounted upon the screw-threaded shank of the bolt.

Tension-cable H^5 leads rearwardly from the engaging drum over shaft J^3 and is suitably attached at its rear end to the strap or frame of the aforesaid pulley-block. Spring G^{10} acts to maintain both tension-cables taut, and nut G^{11} accommodates the adjustment of the spring's tension.

As already indicated, the shovel-feed chain G , instrumental in effecting the shovel's excavating stroke, actuates the shovel, by virtue of the loop formed therein, slower than the cable H , instrumental in effecting the shovel's return stroke after excavating and having no shovel-retarding loop. It follows, therefore, that the drum that engages cable G when paying out said cable during the shovel's return stroke will rotate faster than the drum engaged in winding up cable H , and it will be observed, furthermore, that the drum that engages cable H when paying out said cable H during the shovel's excavating stroke will also rotate slower than the drum engaged in effecting said excavating stroke. The importance, therefore, of the formation of the retarding-loop in the tightening-cable that engages the drum that is operatively engaged by the looped shovel-feed cable will be readily understood, and it is obvious that by said arrangement of tension-cables the difference in speed at which the two drums are simultaneously rotated is accommodated, and both shovel-feed cables are kept under proper tension at all times.

Referring, lastly, to my improved brace for bracing the machine laterally and externally, it will be observed that the brace comprises two horizontally-arranged bars M , vertically pivoted at their inner ends, at M^2 , a suitable distance apart, to the under side of the machine's body portion and extending laterally of the machine and converging toward their outer ends, where they are secured to an up-

right diagonally-arranged bar N , preferably rigid, at its lower end, with the outer end of the forward bar M and preferably detachably secured to the rearward bar M . Bar N has a swiveled bearing at its upper end in a socket d' , secured to or formed upon frame D near the upper extremity of said frame, so that bar N , together with the forward bar M , can be swung laterally, upon detaching the rear bar M , against the body portion of the machine preparatory to transportation or shipment of the machine. Bar N at its lower end is provided with a nut n , engaged by a vertical screw O , extending through said nut and above and below bars M . The screw is shown provided with a collar O' , formed upon the screw above bars M and having a series of holes O^2 (see Fig. 6) arranged at intervals circumferentially of the collar and adapted to receive a bar O^3 , (see Fig. 3,) instrumental in turning said collar and consequently the screw. A cap-plate or head P (see Fig. 6) rests upon the upper end of the screw and is provided upon its under side and centrally with a concavity or depression P' , engaged by the upper convex end of the screw. The screw is arranged to bear upon a platform, foot, or base Q , having comparatively large dimensions adapted to rest upon the ground or supporting-surface. A plate R is secured to the top of the base or foot and is provided upon its upper side and centrally with a concavity or depression R' , engaged by the lower convex end of the screw. Two perpendicular rods S are instrumental in operatively connecting together head P and foot or base R at opposite sides, respectively, of the screw.

The aforesaid construction of brace possesses great strength and durability, has great bracing capacity, affords a wide or large bearing upon the ground or supporting-surface, and has its foot or base raised by the screw upon turning the latter in the direction required to elevate it. The upper ends of rods S are secured, preferably, to the eyes of bolts S' , that extend upwardly through head P , and nuts S^2 , mounted upon the shanks of said bolts above said head, secure the bolts to the head. The lower ends of said rods S are secured similarly to the eyes of bolts S^3 , that extend downwardly through plate R and adjacent portion of base or foot Q , and nuts S^4 , mounted upon the shanks of said bolts S^3 below said portion of the foot or base, secure said bolts to the base or foot.

Of course it will be understood that the machine is provided with two braces arranged at opposite sides, respectively, of the machine. In Figs. 2 and 3 portions of one of the braces are swung laterally against the adjacent side of the machine's body portion for the purpose of more clearly illustrating this feature.

The hoisting chain or cable E^2 (shown in Fig. 1) is attached at one end to the shovel-bail, thence leads upwardly to and over a vertically-arranged guide-sheave E^3 , that is also arranged longitudinally of and supported

from the upper end of the boom, thence rearwardly a short distance below and along rod C to and over a vertically-arranged sheave E⁴, also arranged longitudinally of the machine and suitably supported from a laterally-swinging bracket E⁵, supported from the head of the A-frame. The axis of bracket E⁵ preferably obliquely traverses an imaginary line connecting the axes of the boom and is arranged parallel or approximately parallel with the portion of the hoisting-chain leading rearwardly and downwardly from said sheave E⁴, that is located just forward of the axial line of the boom, as shown in Fig. 1, by which construction said sheave and the engaging chain-section rearward of the sheave will be retained in their proper relative position or alinement when the boom or crane is swung laterally. From sheave E⁵ the hoisting-chain leads downwardly and rearwardly into operative engagement with a winding-drum E⁶, loosely mounted upon shaft J³, that, as already indicated, is arranged parallel with and rearward of shaft J, that bears the shovel-feed-chain-actuating drums. A suitably-operated clutch E⁷ (see Fig. 2) controls operative connection between the hoisting-drum and shaft. It is obvious that the excavating-shovel is hoisted by winding up the hoisting-cable and lowers by gravity upon permitting the hoisting-drum to pay out said cable.

The two chains or cables b' b' (see Fig. 2) for swinging the boom laterally in opposite directions, respectively, are attached to the turn-table in the usual manner at opposite sides, respectively, of the boom, and thence lead rearwardly to and operatively engage different winding-drums b² b², respectively, loosely mounted upon shaft J³. A suitably-operated clutch b³ is provided for each drum b² for controlling operative connection between said drum and the shaft, and it is obvious that the boom is swung in the one direction or the other, according as operative connection between shaft J³ and the one or the other of drums b² is established.

It will be observed that the winding-drums instrumental in swinging the boom or crane and the hoisting-drum are mounted upon shaft J³, and that the drums employed for actuating the shovel-feed chains are mounted upon the more-slowly-rotated and forward shaft J. This arrangement is much more desirable than an arrangement wherein the shovel-feed drums are on the shaft that bears the hoisting-drum or boom-swinging drums, or both, when it is desirable to have the shovel-feed movements much slower than the shovel-hoisting and boom-swinging movements.

The shovel-feed shaft J has a chain-pulley T (see Fig. 2) loosely mounted upon its central portion, and said pulley is operatively connected by means of a chain T' with a chain-pulley T², operatively connected with the rear axle of the forward truck, by which construction no separate shaft for the car's propelling mechanism is required. A suit-

ably-operated clutch t is of course provided for controlling operative connection between pulley T and shaft J.

What I claim is—

1. The combination of the boom; suitably-supported excavating-shovel and its arm having its upper or inner portion slotted longitudinally and bearing a sheave within the outer end of said slot; two vertically-arranged pulleys arranged side by side and suitably supported from the boom and one of said pulleys being arranged in the same vertical plane with the shovel-arm sheave; a suitably-supported vertically-swinging U-shaped frame straddling the pulley lastly referred to, and said frame and the two boom-pulleys having their axes coincident; a suitably-actuated feed-cable attached to the central member of said U-shaped frame, thence extending upwardly to and over the shovel-arm sheave and thence returning and leading to and in under the straddled boom-pulley, and another suitably-actuated feed-cable attached to and nearer the arm's shovel-bearing end and thence extending to and over the other boom-pulley, substantially as shown, for the purpose specified.

2. The combination with the boom capable of being swung laterally, excavating-shovel, and the two suitably-actuated cables for feeding the shovel in opposite directions, respectively, said cables passing side by side and at opposite sides, respectively, of the boom's lower pivotal center, of a horizontally-arranged sheave having its axis coincident with said center and arranged between and engaging both of the aforesaid cables, and two other horizontally-arranged sheaves arranged at opposite sides, respectively, and forward of the central sheave, and having their opposite extremities arranged to be engaged by the different cables, respectively, substantially as and for the purpose set forth.

3. The combination with the horizontally-arranged turn-table and two suitably-actuated propelling cables or lines traversing said table side by side and at opposite sides, respectively of the table's axis, of a horizontally-arranged sheave having its axis coincident with the table's axis and engaged by the aforesaid propelling-lines at diametrically opposite points, respectively, and two other horizontally-arranged sheaves at opposite sides, respectively, and forward of the centrally-located sheave and having their opposing extremities arranged in line, or approximately in line, with the diametrically oppositely-located chain-traversed points, respectively, of the central sheave, substantially as and for the purpose set forth.

4. The combination with the boom capable of being swung laterally, excavating-shovel and the two suitably-actuated shovel-feed cables passing side by side and at opposite sides, respectively, of the boom's lower pivotal center, of a horizontally-arranged sheave having its axis coincident with said center and

arranged between and engaged by both of said cables, a pair of horizontally-arranged sheaves arranged at opposite sides, respectively, and forward of the centrally-located sheave and having their opposing extremities arranged to be engaged by the different cables, respectively, and a pair of vertically-arranged sheaves arranged to bear upon the different cables, respectively, forward of the aforesaid pair of horizontally-arranged sheaves, substantially as and for the purpose set forth.

5. The combination with two cables for feeding the excavating-shovel in opposite directions, respectively, and the winding-drums engaging said cables and rotated simultaneously in opposite directions, respectively, and at different speeds, of two tension-cables engaging the different drums, respectively, and adapted to unwind from or wind upon the respective drum according as said drum winds up or pays out the engaging shovel-feed cable, and the tension-cable connected with the drum adapted to pay out the engaging shovel-feed cable more rapidly, having a loop formed therein and having the closed end of said loop connected with the other tension-cable, substantially as shown, for the purpose specified.

6. The combination of the suitably-supported excavating-shovel; a suitably-supported and suitably-driven shaft rotated, when operated, continuously in one direction; two winding-drums loosely mounted upon said shaft; a clutch for each of said drums for controlling operative connection between the respective drum and shaft; cables for feeding the shovel in opposite directions, respectively, said cables being operatively connected with the different drums, respectively, and being so arranged, applied and guided that the cable adapted to thrust or feed the shovel in excavating shall transmit slower movement to the shovel than the shovel-return cable, whereby the drum instrumental in effecting the excavating or slower stroke of the shovel shall be rotated more rapidly in paying out the engaging shovel-feed cable than the other drum; two tension-cables operatively engaging the different drums, respectively, and arranged to wind upon or unwind from the respective drum according as the latter pays out or winds up the engaging shovel-feed cable, and the tension-cable engaging the drum instrumental in effecting the shovel's excavating or slower stroke having a loop formed therein and having the closed end of the loop connected with the other tension-cable, substantially as shown, for the purpose specified.

7. The combination with the suitably-supported excavating-shovel; a suitably-supported and suitably-driven shaft rotated, when operated, continuously in one direction; two winding-drums loosely mounted upon said shaft; a clutch for each of said drums for controlling operative connection between

the respective drum and shaft; cables for feeding the shovel in opposite directions, respectively, said cables being operatively connected with the different drums, respectively, and being so arranged applied and guided that the cable adapted to thrust or feed the shovel in excavating shall transmit slower movement to the shovel than the shovel-return cable, whereby the drum instrumental in effecting the excavating or slower stroke of the shovel shall be rotated more rapidly in paying out the engaging shovel-feed cable than the other drum; of two tension-cables operatively engaging the different drums, respectively, and arranged to wind upon or unwind from the respective drum according as the latter pays out or winds up the engaging shovel-feed cable, and the tension-cable engaging the drum instrumental in effecting the shovel's excavating or slower stroke having a loop formed therein; a pulley-block having its sheave engaging the closed end of said loop and having its frame or strap connected with the other tension-cable, and suitable means connected with the looped tension-cable and acting to tighten both tension-cables, substantially as shown, for the purpose specified.

8. The combination with the stationary part of the excavator, of an external brace comprising a frame arranged to brace the machine's body portion laterally and provided, at its outer and lower end, with an upright nut, a screw extending through and engaging said nut, a cap-plate or head resting upon the screw's upper end, a platform, foot or base borne upon by the lower end of the screw, and suitable connections between said base and head, substantially as set forth.

9. The combination with the stationary part of the machine, of an external brace comprising a frame arranged to brace the machine laterally and suitably connected with said stationary part, and provided, at its outer lower end, with an upright nut, a screw extending through and engaging said nut, a head resting upon the screw, a foot or base arranged to be borne upon by the screw's lower end, and two vertical rods arranged at opposite sides, respectively, of the screw and operatively connecting the base or foot with the head, substantially as set forth.

10. The combination with the stationary part of the excavator of an external brace comprising a frame arranged to brace the machine laterally and suitably connected with said stationary part, and provided, at its outer lower end, with an upright nut, a screw extending through and engaging said nut, a head resting upon the screw, a platform, foot or base arranged to be borne upon by the screw's lower end, any suitable number of vertical rods arranged between the head and base or foot, eyebolts having their eyes attached to the upper ends of said rods and extending upwardly through the head, nuts upon said bolts above said head, and other bolts

secured to the foot or base and to the lower ends of the rods, substantially as set forth.

11. A machine of the character indicated, having its hoisting-drum and boom-swinging drum loosely mounted upon one shaft, and the shovel-feed drums loosely mounted upon another shaft arranged forward of and parallel with and operatively connected with, but speeded slower than, the first-mentioned shaft, and a clutch for each drum for establishing operative connection between said drum and the shaft supporting it, substantially as and for the purpose set forth.

12. A machine of the character indicated, having its shovel-feed drums loosely mounted upon a shaft operatively provided with a gear, another and parallel shaft rearward of the shovel-feed-drum shaft and provided, operatively, with a gear diametrically smaller than

and meshing with the aforesaid gear, the hoisting-drum and the boom-swinging drums loosely mounted upon said rearward shaft, a clutch for each drum for controlling operative connection between the drum and shaft supporting it, a pulley loosely mounted upon the shovel-feed-drum shaft and operatively connected with the rear axle of the forward truck, and a clutch for controlling operative engagement between said pulley and shovel-feed-drum shaft, substantially as and for the purpose set forth.

In testimony whereof I sign this specification, in the presence of two witnesses, this 14th day of February, 1896.

GEORGE W. KING.

Witnesses:

C. H. DORER,
ELLA E. TILDEN.