J. P. DOWD.

MECHANISM FOR OPERATING CRANES.

APPLICATION FILED JAN. 11, 1912.

1,024,836.

Patented Apr. 30, 1912.

3 SHEETS—SHEET 1.

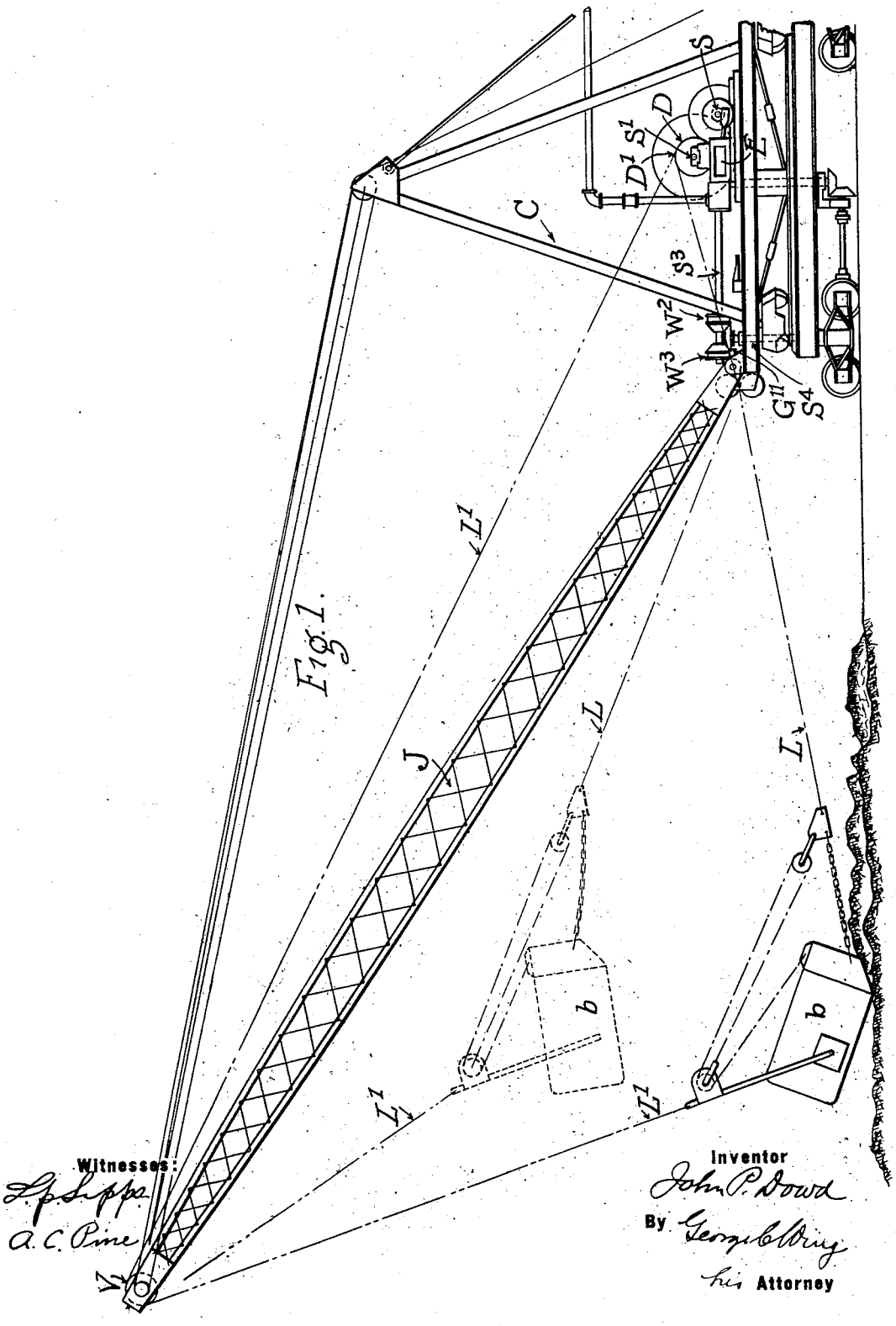

Fig. 1.

Witnesses:
L. P. Lappa
A. C. Pine

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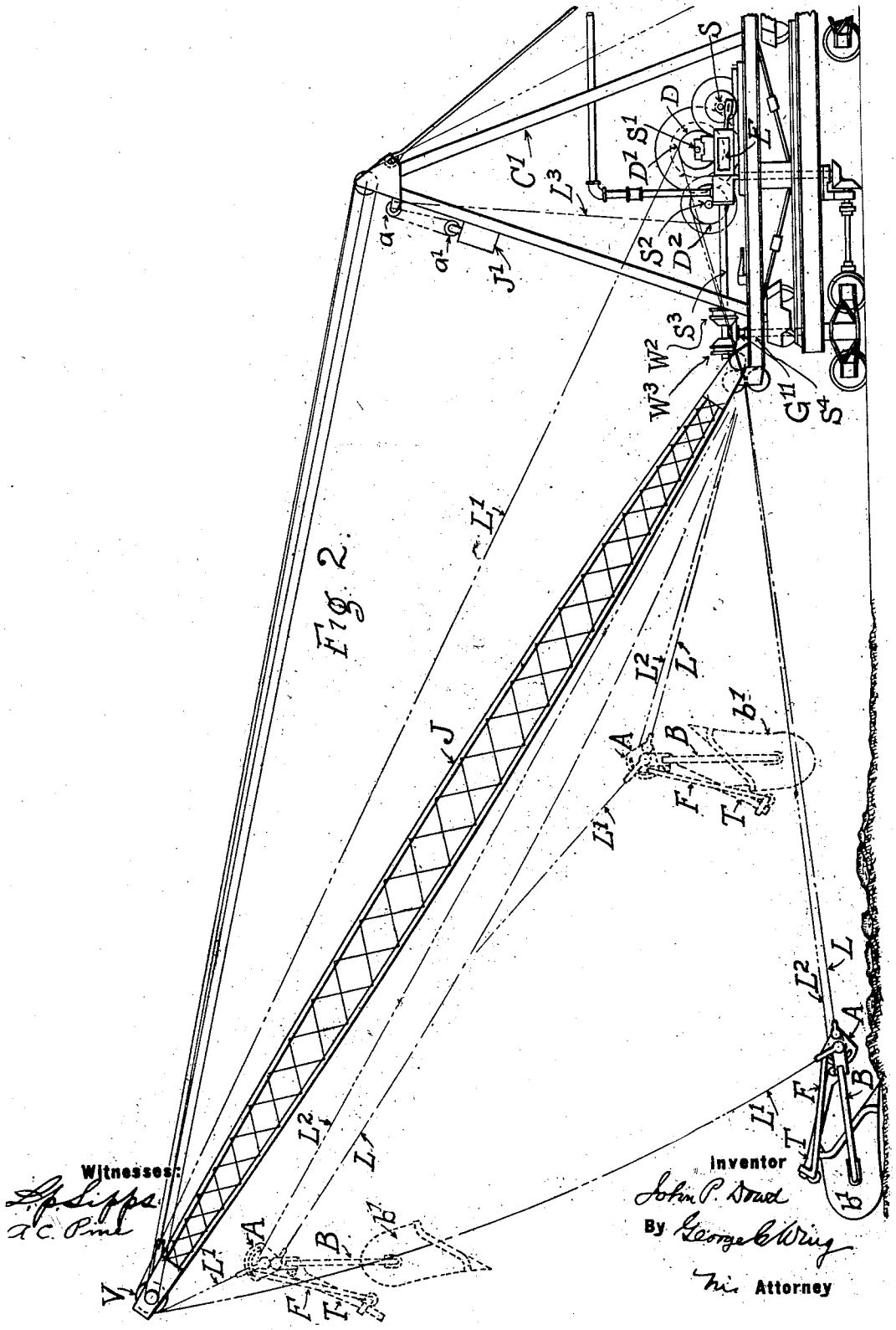

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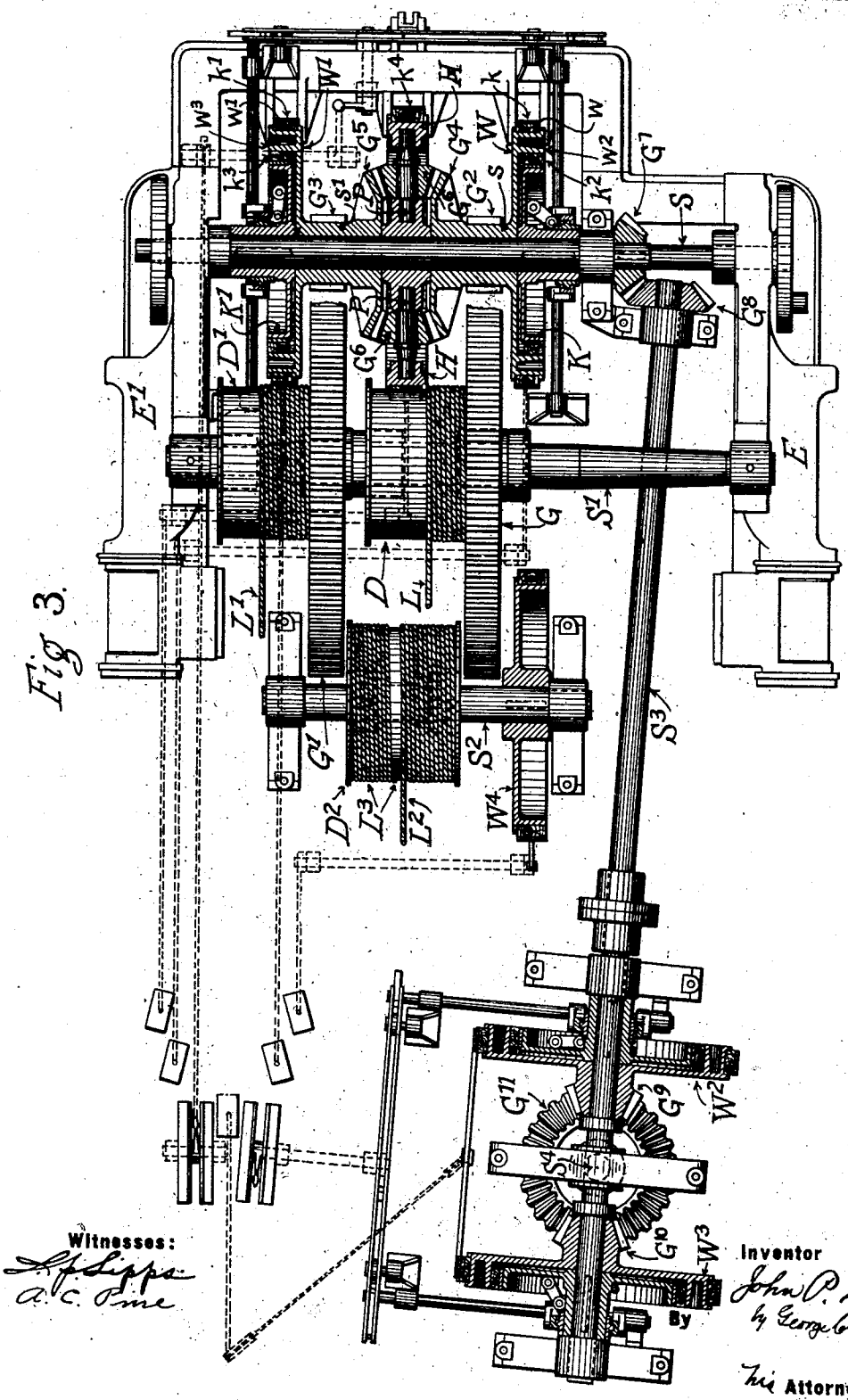

Fig 3.

Witnesses:

L. F. Sipps

A. C. Fine

Inventor

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UNITED STATES PATENT OFFICE.

JOHN P. DOWD, OF CLEVELAND, OHIO, ASSIGNOR TO THE BROWN HOISTING MACHINERY COMPANY, OF CLEVELAND, OHIO, A CORPORATION.

MECHANISM FOR OPERATING CRANES.

1,024,836. Specification of Letters Patent. Patented Apr. 30, 1912.

Application filed January 11, 1912. Serial No. 670,671.

To all whom it may concern:

Be it known that I, JOHN P. DOWD, a citizen of the United States, residing at the city of Cleveland, in the county of Cuyahoga and State of Ohio, have invented a new and useful Mechanism for Operating Cranes, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, that form a part of the specification, wherein similar parts are designated by similar letters in each case.

Although the invention, broadly speaking, has to do with locomotive-cranes in general, its more specific embodiment is that form of tool or apparatus when adapted for use in connection with scoops or shovel-buckets in excavation work, or in transferring ore, coal or similar material from a stock-pile or like source of supply to cars or other points for deposit. Operations of this kind generally comprise the use of buckets that are suspended within bails at points on their sides forward of the center of gravity of the bucket when empty, but behind the same when loaded, so that, when free to move upon the bail-trunnions, the bucket will automatically discharge its load and immediately right itself into proper relations with its bail to take in a new load. The operation further involves the use of oppositely-related hoist, and haul or drag-ropes, to, respectively, raise or lower the bucket as required, and drag the same against and along the material to gain the load, and, by their coöperation or joint action, to suspend and carry the bucket to or from any point beneath the boom desired. In these movements, the ropes referred to either act successively (as when the bucket is being dragged through the material toward the drums, or, is being lowered to the material from the head of the boom) or, simultaneously, as when the loaded bucket, is being carried in suspension from the ropes, outwardly, beneath such boom. In the former movement, the non-active rope is freely paid out from its drum and is under no greater tension than that due to its weight, while, in the latter movement, that of conveying the bucket and load outwardly beneath the boom, the ropes are in direct opposition, and the bucket's path is determined by these opposite forces as applied to the load to be sustained. Said movements, whether in succession or simultaneously, manifestly vary, relatively, according to the direction to be taken, the points to be reached, or, the pace to be maintained, but, are all determined or regulated by the drums to which said ropes are severally attached. In cranes of the kind in question, so far as I am informed, these drums are independent of each other, and are themselves controlled by separate and independent brakes and clutches and, in no case, act in entire unison. For this reason, the actuating force to be exerted on the drum of the hoist-line must always exceed the combined weight of the loaded bucket and the resistance of the drag-line drum when braked. When, for instance, it is desired to raise the loaded bucket and convey the same outwardly beneath the boom, the hoist-rope is wound up on its drum while the drum controlling the drag-rope is subjected to brake resistance. This resistance, however, must not be absolute, but, in such degree only as will serve to maintain the load at the desired height, and, at the same time sufficiently yield to the opposite pull of the hoist-rope, to permit the load to be traversed in the horizontal direction. Much of the entire force required in the operation is thus expended in overcoming this resistance, and the main purpose of the present invention is to provide a mechanical arrangement, in the class of instruments specified, wherein the forces exerted may be made to act in series, instead of in opposition, an exact correspondence be established in the movement of the drums, and a consequent gain in efficiency and motive strength be brought about. The arrangement also involves other features of advantage as will subsequently appear.

In the drawings Figure 1 is a side elevation of a locomotive crane of a two-rope type or system, with the rear portion of its frame structure removed; the bucket is shown in position to be hauled in for its load. Fig. 2 is a like view of a three-rope system, and, Fig. 3, is a plan view, partly in section, of a unitary system of operative mechanism applicable to cranes of either of said systems.

The cranes, as a whole, are respectively denoted by C and C^1, (Figs. 1 and 2) and the buckets by b, b^1.

L is the haul or drag-rope, in each case,

connected, at one end, to the buckets b and b^1, and, at the other end, to a winding drum D on a supporting shaft S^1 in the mechanism on the crane's frame. L^1 denotes the hoist-rope in each figure. It is connected, at one end, to said buckets, whence it extends upwardly around a sheave V, in the head of the boom J, and backwardly to the frame of the crane, where it is fastened to the hoist-drum D^1.

E and E^1 indicate the driving engines, S, the main driving shaft, duly mounted, near each end, upon engine bearings, and S^1, the hoisting, and drag-rope drum-shaft upon which the drums D and D^1 are loosely mounted. In order to provide for the turning of these drums about the supporting shaft S^1, in the various movements required of the same, gears G and G^1, meshing into actuating pinions G^2 and G^3, are respectively fastened to the ends of said drums. The pinions themselves are actuated by the movement of the sleeves s and s^1, on the driving shaft S, on which sleeves the pinions are severally mounted Said sleeves are loosely mounted on the driving shaft, and each terminates, near the middle point of the shaft, in oppositely related gears G^4 and G^5. The outer ends of the sleeves are, respectively, in the form of disk-like wheels W and W^1 having scores w and w^1 for the purpose of receiving annular brake blocks k and k^1 therein. Concentrically and on the same side of the wheels as said scores, are annular flanges w^2 and w^3, to afford the requisite support for friction blocks k^2 and k^3 that are fastened to the same.

Friction clutches, represented by K and K^1, are keyed to the shaft S, in suitable relations, respectively, to the friction blocks k^2 and k^3, to engage the same whenever it is desired to rotate one or both of said sleeves, and, freely mounted on the shaft S, between the disk-like wheels W and W^1 is a brake-wheel H, within the score of which suitable brake-mechanism, indicated by k^4, is adapted to operate. At points at the sides of this wheel, diametrically opposite to each other, and within the wheel itself, are radial pins P, P, each of which carries a loosely mounted pinion G^6, that meshes into the beveled gears G^4 G^5. By means of the intermediary connection thus established between the two sleeves s and s^1, it is evident that either sleeve, and the drum controlled thereby, may be revolved without a movement of the other sleeve and drum, or both sleeves, and their drums, may be rotated at the same time reversely with respect to each other. To this end levers with suitable mechanical connections, for applying, modifying or relaxing the several brakes described are indicated in the drawings.

As an additional feature of the unitary system already referred to, I provide a mechanical arrangement to be operated in connection therewith, when a three-rope system of handling shovel-buckets or scoops is to be employed, instead of a two-rope system for which the arrangement herein before explained is adapted. As is well understood, a third or tag-line, connected to the bucket at one end, and, to an independent winding drum on the crane at the other, is sometimes employed in devices of the class under consideration, for the purpose of effecting the dump of the load at the will and from the station of the operator, and at any intermediate point beneath the boom. The third rope, under these circumstances, is required both to relieve the pull on the bail by the haul-line, and thereby leave the bucket free to turn on its trunnions, but, on such release, to hold the same against swinging forwardly, on the hoist-rope, and away from the destined place of discharge. In many instances also, the third rope is so connected, at or near the bucket itself, that, when it thus assumes the function of the haul-rope for the time being, a slight movement of the load toward a new equilibrium must occur, which is utilized to automatically disengage the latch of the bucket and set it free to turn. Connections of this character are shown and described in United States Letters Patent numbers 1,008,247 and 1,009,653, that were granted to me on, respectively, November the seventh and twenty-first, 1911. To provide for these functions in the system referred to, I show a tag-line L^2, fastened at its outer-end to a sheave-like member A, connected to the bail B of the bucket b^1 (Fig. 2) with unlocking devices indicated by F and T, as set forth in said patent 1,008,247, and, at its inner end, connected to and wound around a special drum D^2 that is mounted upon a shaft S^2 upon the crane-structure or frame, in front of the mechanism thereon already described. This shaft is controlled by a brake-wheel W^4, and, in order to keep the tag-line taut at all times, I provide a counterweight system made up of the rope L^3 that is wound around the drum D^2, at its lower portion, reversely to the tag-line L^2, and is led around sheaves a, a^1, near the upper part of the crane's mast, at its other end, to a counterweight J^1.

In order to provide for the usual rotatory movements of the boom, in connection with the various operations above described, a crane rotating-shaft S^3 is shown as located in advance of the driving shaft S, and as actuated thereby, through the pair of intermeshing gears G^7 and G^8. Near the outer end of the shaft S^3, is a pair of brake and clutch wheels W^2 and W^3, whose hubs are provided with beveled gears G^9 and G^{10} which mesh into an underlying beveled gear G^{11} upon the upper end of an upright shaft S^4. This

latter shaft carries, upon its lower end, the usual pinion in engagement with the circular rack around the base of the crane.

As will appear by the foregoing arrangement, I have compactly organized upon the crane-body all the mechanical appliances necessary to effect the various movements required, and in a positive and economical manner. Let the bucket be at the initial point for getting its load as shown, for instance, in Fig. 2, with the driving shaft S revolving, and all brakes and clutches off, then, in order to complete an operative cycle, the clutch K is thrown in, whereby the sleeve *s* is coupled to the driving shaft S and the pinion and gear G^2 and G are actuated. Thereupon the drum D will be rotated and the haul-line L wound in, the tag-line L^2 being meanwhile wound in on its drum D^2 under the influence of the counterweight J^1. Under these conditions the drum D^1 being free to revolve upon its shaft S^1, the hoist line L^1 will run out, accordingly, until the bucket has been drawn in to the extent required to gain its load. The brake *k* is now set, the clutch K thrown out of engagement with the wheel W, and the clutch K^1 thrown into engagement with W^1. The sleeve s^1 is thereby coupled to the shaft S and the pinion and gear G^3 and G^1 actuated by the same and the direction of the rotation of the drum D^1 reversed whereby the hoist-line L^1 will be drawn in, in opposition to the haul-line L and the bucket and load raised to the desired height for carrying. The brake *k* is thereupon released, and, at the same time the brake k^4 is set, which will hold the brake wheel H against rotation around the shaft S, which will subject the pinions G^6 to rotation around their pins P, by the beveled gear G^5, and actuate the opposite beveled gear G^4 and its sleeve *s*. This, in turn, will actuate the drum D reversely from its former rotation and cause the haul-line L to unwind at the same pace as the hoist-line L^1 is wound in. The tag-line L^2, as is evident, will be correspondingly drawn off from its drum against the action of the counterweight J^1. During the operation last described, the boom itself, with the load, is to be swung around the crane-body to the place of discharge, by simply clutching the wheel W^2 or W^3 to the shaft S^3 (according to the direction the swing is to be made), until this place is reached under the conditions above stated, when the wheel H is unbraked, the wheel W^1 unclutched from the shaft S and braked, the drum D^2 being at the same time held against further rotation by applying the brake of the wheel W^4 to the drum shaft S^2. The tension on the haul-line is thereby at once transferred to the tag-line L^2, and, by the ensuing movement to readjust equilibrium hereinbefore referred to, the tail-latch arrangement on the bail bucket will be unloosed and the bucket will automatically turn over on its trunnions and precipitate its load below. The boom may now be reversely traveled until the empty bucket, in its righted position, is brought above the material bed as before, when the bucket may be lowered upon the bed, into the position first assumed, by paying out either the hoist-line L alone, or in conjunction with the haul-line L^1, according to the place on the material bed beneath the boom to which the bucket is to be lowered.

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

The combination, with a main driving-shaft having sleeves loosely mounted thereon provided with oppositely related gear wheels at the inner ends of the same, of a brake-wheel loosely mounted on said shaft intermediately of said gear-wheels, suitably mounted drums provided with gear-wheels for rotating the same, diametrically arranged pinions on said brake-wheel in mesh with said gear-wheels on the sleeves, pinions on said sleeves in mesh, respectively, with said gear-wheels on said drums, together with suitable means for severally clutching said sleeves to said driving-shaft, and for braking said brake-wheel against rotatory movement around said shaft, substantially as shown and described.

JOHN P. DOWD.

In presence of—
L. P. Lipps,
Howard M. White.