(No Model.) 3 Sheets—Sheet 1.

J. KENNEDY.

CRANE.

No. 484,437. Patented Oct. 18, 1892.

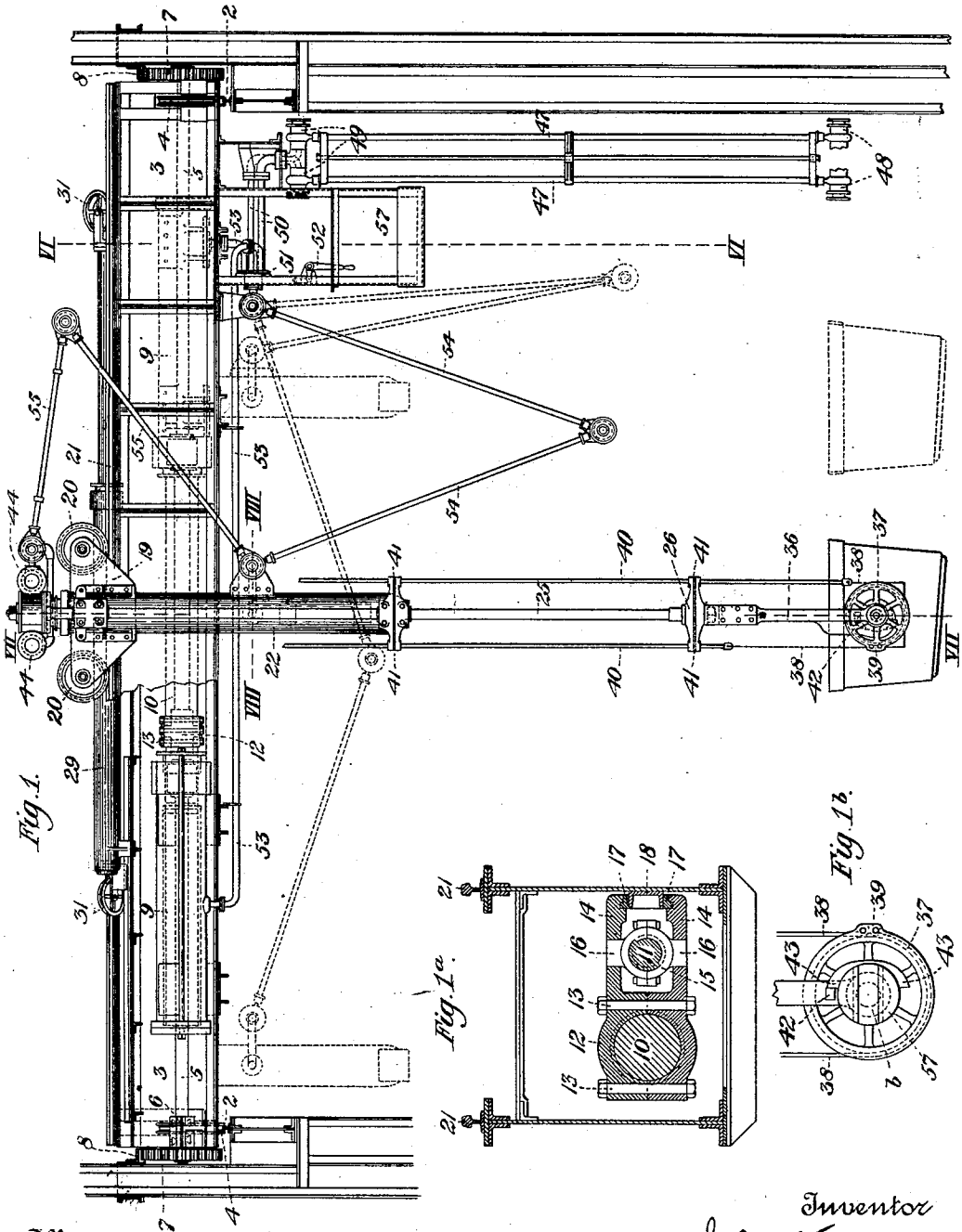


Fig. 1.

Fig. 1a.

Fig. 1b.

Witnesses
H. M. Corwin
H. C. Gill

Inventor
Julian Kennedy
by W. Baxewell & Sons
his Attorneys

(No Model.) 3 Sheets—Sheet 2.

J. KENNEDY.

CRANE.

No. 484,437 Patented Oct. 18, 1892.

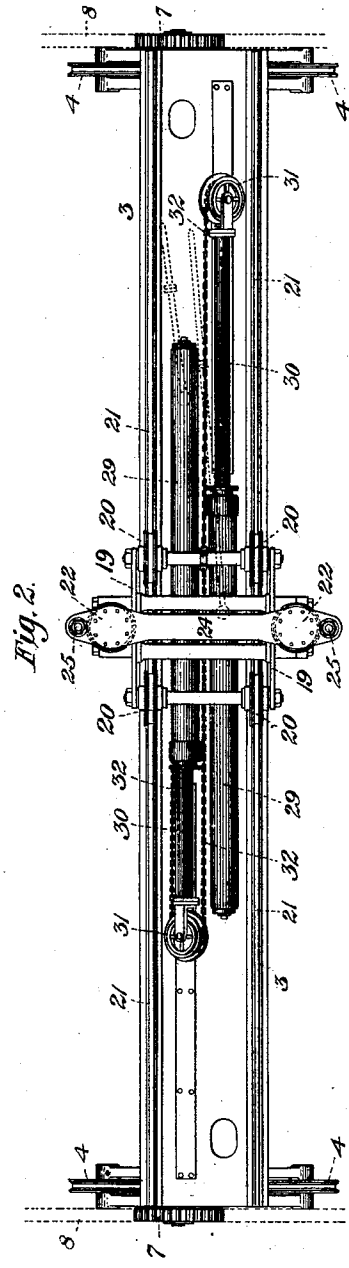


Fig. 2.

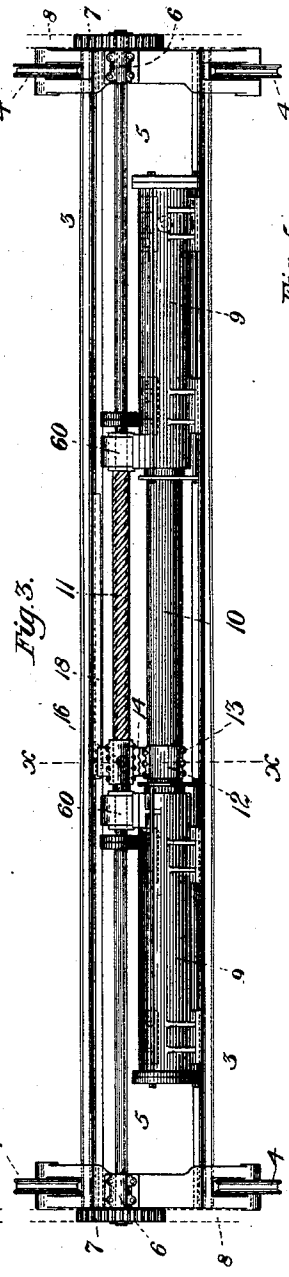


Fig. 3.

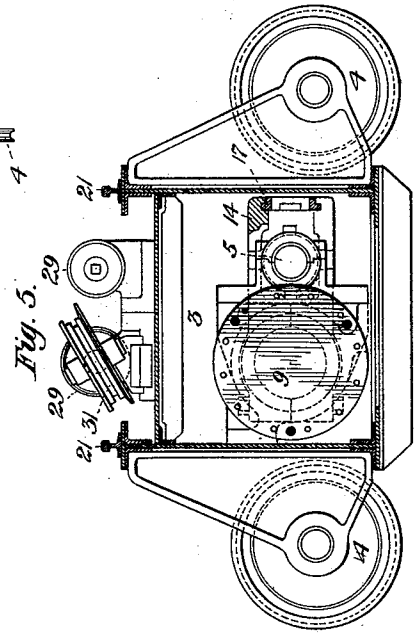


Fig. 5.

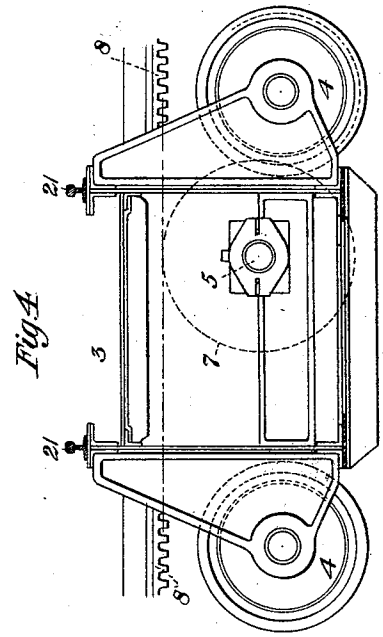


Fig. 4.

Witnesses

H. M. Cameron

H. C. Gill

Inventor

Julian Kennedy

by W. Baxewell & Sons

his Attorneys

(No Model.) 3 Sheets—Sheet 3.

J. KENNEDY.

CRANE.

No. 484,437. Patented Oct. 18, 1892.

Fig. 7.

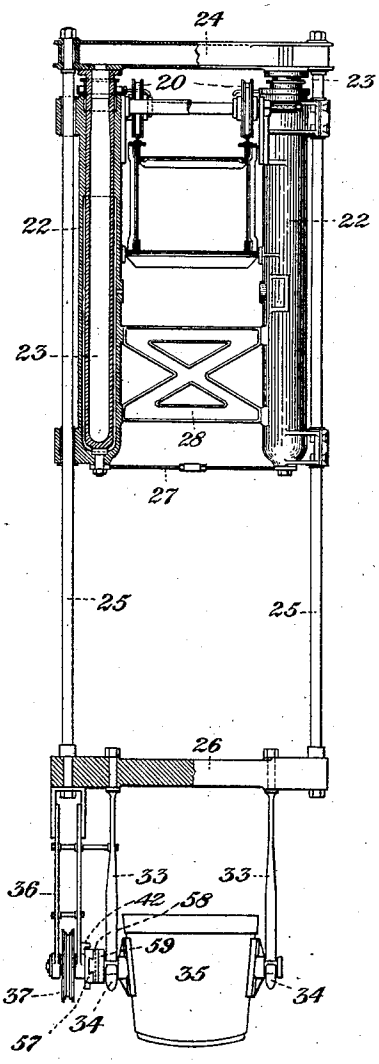


Fig. 6.

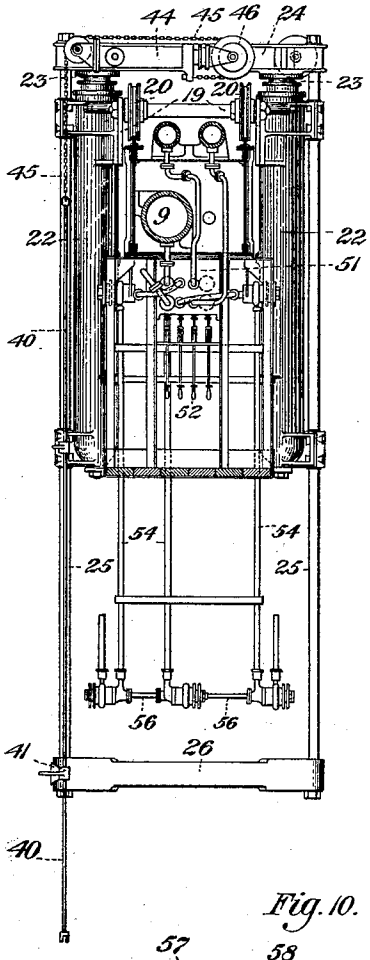


Fig. 10.

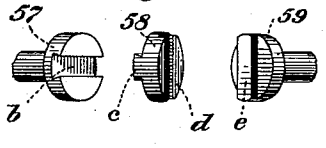


Fig. 8.

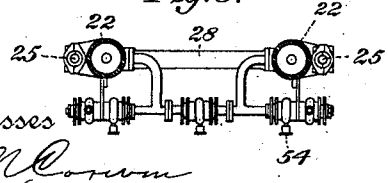
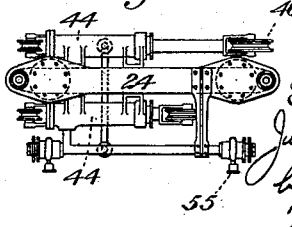


Fig. 9.



Witnesses
H. M. Conron
H. C. Gill.

Inventor
Julian Kennedy
by W. Baxendale & Son
his Attorneys

UNITED STATES PATENT OFFICE.

JULIAN KENNEDY, OF PITTSBURG, PENNSYLVANIA.

CRANE.

SPECIFICATION forming part of Letters Patent No. 484,437, dated October 18, 1892.

Application filed March 4, 1892. Serial No. 423,742. (No model.)

To all whom it may concern:

Be it known that I, JULIAN KENNEDY, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Cranes, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is an elevation of my improved traveling crane. Fig. 1ª is a view on a larger scale, being a cross-section on the line *x x* of Fig. 3. Fig. 1ᵇ is a view on a similar scale, showing in side elevation the mechanism for tipping the ladle. Fig. 2 is a plan view of the crane, showing mechanism for moving the trolley back and forth thereon. Fig. 3 is a horizontal section showing the mechanism for moving the crane laterally. Fig. 4 is an end elevation of the crane, not showing the trolley carried thereby. Fig. 5 is a similar view showing the cylinder for moving the crane and the cylinders for moving the trolley thereon. Fig. 6 is a vertical section on the line VI VI of Fig. 1. Fig. 7 is a vertical section on the line VII VII of Fig. 1, one of the lifting-cylinders also being shown in section. Fig. 8 is a section on the line VIII VIII of Fig. 1. Fig. 9 is a plan view of the mechanism for moving the trolley on the crane. Fig. 10 is a perspective detail view illustrating the trunnion connections of the ladle.

Like symbols of reference indicate like parts in each figure.

In the drawings, 2 represents an elevated track on which my improved crane is mounted.

3 is the body or frame of the crane, having truck-wheels 4, which ride upon the rails of the track. This frame is made, as shown in the drawings, of a single box-girder closed at all sides. The lifting mechanism, as hereinafter explained, is set at the opposite sides of the girder, and the crane-moving motor, about to be described, is set within the girder.

For the purpose of moving the crane laterally on its track I employ a shaft 5, which extends across the crane and is journaled in end bearings 6. Pinions 7 are fixed to the ends of this shaft and are in gear with stationary racks 8, which extend parallel with the tracks 2. When this shaft is rotated by means hereinafter described, the rotation of the pinions in gear with the racks actuates the crane, moving it laterally on its track. For the purpose of turning the shaft I employ peculiar mechanism, which is most clearly shown in Figs. 3, 1ª, and 5.

9 9 are two single-acting hydraulic cylinders set opposite to each other and in the same axial line and having a ram 10, which is common to both cylinders, so that on admitting water to one of the cylinders the ram shall be moved longitudinally in one direction and on admitting water to the other cylinder it shall be moved longitudinally in the reverse direction.

11 is a screw-threaded shaft, which is interposed in the line of the shaft 5 and is securely coupled thereto. It is journaled in suitable bearings 60, in one or more of which it has a thrust bearing.

12 is a divided collar, which is set upon the ram 10 and is securely clamped thereto by bolts 13. It has laterally-projecting arms 14, between which is set a nut 15, encircling the worm-shaft and provided with trunnions 16, fitting in sockets in the arms. At the ends of the arms 14 are slide-bearings 17, which fit against an interposed longitudinal guide 18. Now as the ram 10 is moved longitudinally it will carry with it the collar 12 and nut 15, and this nut moving over the screw-shaft 11 will rotate the same, together with the pinions 7, and by reason of the gearing of the pinions with the racks 8 the crane will be moved laterally. During this action of the parts the presence of the trunnions 16 allows the nut to adjust itself so as to prevent any injurious binding on the screw-shaft, and the guide 18 holds the arms 14, and the nut prevents them from rotating and causes the screw-shaft alone to rotate. The use of the opposite cylinders 9 and the use of the power-transmitting mechanism above described are of great advantage and add materially to the efficiency of the crane. It will be understood that instead of connecting the shaft 5 to the pinion 7 it may be connected directly to opposite supporting-wheels of the crane.

19 is the trolley, consisting of a frame provided with wheels 20, which are set upon rails 21 on the frame structure of the crane. This trolley supports upright lifting mechanism, which consists, preferably, of two parallel

hydraulic cylinders 22, though within the scope of my broader claims the construction may be modified so that there shall only be one such lifting-cylinder. These lifting-cylinders 22 are arranged outside the frame of the crane and are provided with plungers 23, Figs. 6 and 7, which project above the cylinders and are connected by a cross-head 24, provided with vertical lifting-rods 25, bearing at their lower ends a ladle-supporting frame 26. As the plungers are elevated or lowered they will correspondingly raise or lower the lifting-rods, together with the frame 26 and the burden supported thereby. To strengthen the structure, I prefer to connect the cylinders 22 by a brace-rod 27 and to interpose between them a separating-frame 28, Fig. 7.

For the purpose of moving the trolley 19 and the lifting-cylinders back and forth on the crane I prefer to employ the mechanism shown in Figs. 1, 2, 5, and 6. This consists of two parallel oppositely-directed single-acting cylinders 29, set on the frame of the crane and having projecting plungers 30, carrying at their ends sheaves 31. Each of the cylinders has a chain 32, which is fixed to the cylinder, passes around a sheave 31, and is attached to the frame of the trolley 19, so that when the ram of one of the cylinders is projected it will move the trolley on the crane and will simultaneously retract the ram of the other cylinder. The chains 32 are attached to the same end of the trolley, (the end next to the valve pulpit or carriage,) so that in moving outwardly the trolley shall have an unobstructed path the full length of its track, the forward end of the trolley being thus adapted to move beyond the end of its actuating-plunger. If desired, the chains may be crossed and attached to respectively-opposite ends of the trolley, so as to give the latter full movement in both directions.

I shall now describe the means which I employ for supporting and tipping the ladle.

33 are vertical hangers, which depend from the frame 26 and are provided at their lower ends with hooks 34, adapted to receive and to uphold detachably the trunnions of the ladle 35.

36 is a frame, which also depends from the frame 26 and carries a grooved pulley 37, whose shaft is adapted to be connected by a universal clutch (shown in detail in Fig. 10) with one of the ladle-trunnions. This pulley is rotated by chains or flexible cords 38, which are fixed to the pulley at a point 39 and are connected to lifting-rods 40, which move in guides 41 and are adapted to be moved vertically by cylinders hereinafter described. The pulley 37 is constructed so as to have only a limited rotation sufficient to tip the ladle and to restore it to a horizontal position. To this end I prefer to employ a stop 42 on the supporting-frame 26, which operates in conjunction with stops 43 and permits the limited motion above referred to. The lifting-rods 40 are operated by oppositely-acting single cylinders 44, which are supported by the cross-head 24. Chains 45, attached to these cylinders, pass around sheaves 46 on their plungers and around sheaves at the rear ends of the cylinders and are attached to the lifting-rods 40. By projecting the plunger of one of these cylinders the sheaves 37 will be turned, so as to tip the ladle, and by actuating the other cylinder the motion will be reversed so as to restore the ladle to its normal position.

The clutch mechanism between the sheave 37 and the ladle is constructed as shown in Figs. 7 and 10. At the inner end of the shaft of the sheave is a head 57, provided with a diametrical key-slot *b*, to which is fitted a disk 58, having on the inner side a corresponding key *c* and on the outer side a key-slot *d*. The ladle-trunnion has at its end a head 59, provided with a key *e*, adapted to fit removably in the slot *d*. The parts 57 and 58 are not intended to be separable from each other. When the ladle is in position, as shown in Fig. 7, the key at the end of the trunnion fits in the slot in the disk 58, so that on rotating the sheave 37 the ladle will be tipped. When the ladle is righted and lowered upon the ground, the trunnions will lift themselves from the hooks 34 and the key *e* will be disengaged from its slot, thus automatically freeing the ladle, and then by adjusting the hooks under the trunnions of another ladle and raising the frame 26 the hooks will engage the trunnions and the key-slot *d* will adjust itself to the key *e*, so as to connect it operatively with the tipping mechanism. The loose connection between the head 57 and disk 58 affords a universal joint, which is self-adjusting to accommodate itself to any unevenness caused by wear of the parts. The construction of this universal joint may be modified by the substitution of equivalent devices. Where the crane is not used for a ladle-crane, but for some other purpose, such as for carrying ingots, &c., the ladle-tipping mechanism is replaced by other devices adapted to the particular work for which the crane is intended.

I shall now describe the means which I employ for supplying water to the several motors on the crane.

47 are the main water-supply pipes of the crane, provided with swiveled elbow-joints 48, connected with a point of supply off the crane and by swiveled joints 49, connected with water-pipes 50 on the crane. These pipes 50 are the main supply and exhaust pipes and lead to a valved box 51, having a series of valve-chambers and valves constructed to be controlled and operated by means of valve-levers 52. From these valves pipes 53 lead to the opposite cylinders 9 and the cylinder 30, and jointed pipes 54 lead to the cylinder 22 for the purpose of supplying water to the latter and to the cylinders 44, (a common supply-pipe being used for the cylinders 22, so that they shall act in unison.) The jointed pipes 55 for the cylinders 44 are arranged as shown

in Fig. 1. The adjacent swiveled joints for the various supply-pipes are constructed as shown in Fig. 6, being set axially with each other and connected by rods 56, which serve to insure parallelism and uniformity in their action.

As thus constructed the operation of my improved apparatus is as follows: The operator who attends and directs the motion of the crane may ride upon a pulpit or carriage 57 on the crane, so as to have the valves within easy reach. If it is desired to move the crane from place to place in the building in which it is situate, the proper valve is operated so as to admit water to that cylinder 9 which will rotate the shaft 5 in the required direction. To move the trolley 19, with the lifting-cylinders 22, the valve is operated so as to admit water to the proper one of the cylinders 29 and to exhaust it from the other. To lift or lower the ladle, the valve is operated so as to admit the water or exhaust it from the cylinders 22, and to tip the ladle and to right it water is admitted to the proper one of the cylinders 44. The crane mechanism is thus very easy to operate, and its action is quick and easily controlled. The work of picking up, tipping, and releasing the ladle will be readily understood from the foregoing description.

The advantages of my invention will be appreciated by those skilled in the art. By employing a box-girder to constitute the frame of the crane the strongest possible construction is afforded, the frame is not liable to be deflected on sudden starting of the crane, and the safety of the mechanism is thus enhanced. By employing the screw-shaft-traversing gear I dispense with the usual cog-gearing and obtain mechanism operating more smoothly than cogs and capable of resisting much better and more safely the heavy strains to which it is put when in use. The mechanism is also very compact, and, being capable of being inclosed within the box-girder, may be effectually protected from sparks, &c. The heavy strain is all exerted in line with the shaft and the transverse strains incident to other mechanisms are avoided. The use of two opposite single-acting cylinders is also of material advantage; but the sliding nut and screw may be employed with a cylinder or cylinders otherwise arranged. By the use of the two lifting-cylinders with an interposed girder I get advantages in respect of strength and even balancing of the crane. The ladle-actuating mechanism and the detachable connection for the ladle are also of material benefit and are claimed, broadly. By setting the trolley-moving cylinder under the trolley it is removed from the way of the latter and an unobstructed path is left in which the trolley can be moved to the full extent of its track. Other advantages will be suggested on reading the foregoing description.

The form, construction, and relative arrangement of the parts of the crane may be varied in many ways within the scope of my invention. Therefore, without limiting myself to the precise construction described, I claim—

1. In a traveling crane, the combination of a box-girder constituting the crane-frame, a trolley thereon, and two opposite upright lifting-cylinders secured to the trolley at the outer sides of the box-girder, substantially as and for the purposes described.

2. In a traveling crane, the combination of a crane-frame, a trolley thereon, and two opposite upright lifting-cylinders secured to the trolley at the outer sides of the frame, substantially as and for the purposes described.

3. The combination, with a frame mounted on wheels, of a screw-shaft adapted to transmit power for moving the frame, a nut mounted on the screw-shaft, and a motor adapted to move the nut longitudinally on the shaft to turn the latter, substantially as and for the purposes described.

4. The combination, with a frame mounted on wheels, of a screw-shaft adapted to transmit power for moving the frame, a nut mounted on the screw-shaft and provided with trunnions, and a motor carried by the frame and adapted to move the nut longitudinally on the shaft to turn the latter, substantially as and for the purposes described.

5. The combination, with a frame mounted on wheels, of a screw-shaft adapted to transmit power for moving the frame, a nut mounted on the screw-shaft, a motor carried by the frame and adapted to move the nut longitudinally on the shaft to turn the latter, and a guide for the nut, substantially as and for the purposes described.

6. The combination of a screw-shaft, a motor comprising two opposite cylinders and a common ram, and a nut carried by the ram and fitting on the screw-shaft, substantially as and for the purposes described.

7. In a ladle-crane, the combination, with a ladle-support, of rotatory tipping mechanism and a clutch comprising a key and recess detachably connecting the ladle and tipping mechanism, substantially as and for the purposes described.

8. In a ladle-crane, the combination, with a ladle-support, of a shaft situate in line with the ladle-trunnions and adapted to be connected therewith and mechanism for rotating the shaft, substantially as and for the purposes described.

9. In a ladle-crane, the combination, with a ladle-support, of tipping mechanism detachably connected with the ladle and capable of tipping the same and an interposed universal joint, substantially as and for the purposes described.

10. In a ladle-crane, the combination, with a trolley, of a ladle-supporting frame depending therefrom, a tipping-motor carried by the trolley, and power-transmitting mechanism extending on said frame from the motor to the position of the ladle and having a detach-

able connection, substantially as and for the purposes described.

11. In a ladle-crane, the combination of ladle-tipping mechanism carried by the crane, a ladle-lifting motor, and a motor which moves with the lifting-motor and is connected with the tipping mechanism to actuate the same, substantially as and for the purposes described.

12. In ladle-tipping mechanism, the combination, with a crane and a depending ladle-supporting frame, of a rotatory shaft adapted to be connected with the ladle, tipping mechanism connected to the shaft and adapted to rotate the same, and stops by which the rotatory motion of the shaft is limited, substantially as and for the purposes described.

13. In a ladle-crane, the combination, with the crane, of a frame carrying the ladle, a lifting-motor for the frame, and a ladle-tipping motor carried with the lifting-motor and movable vertically therewith, substantially as and for the purposes described.

In testimony whereof I have hereunto set my hand this 20th day of February, A. D. 1892.

JULIAN KENNEDY.

Witnesses:
W. B. CORWIN,
H. M. CORWIN.