(No Model.) 2 Sheets—Sheet 1.

A. J. SHAW.

ELECTRIC CRANE.

No. 430,487. Patented June 17, 1890.

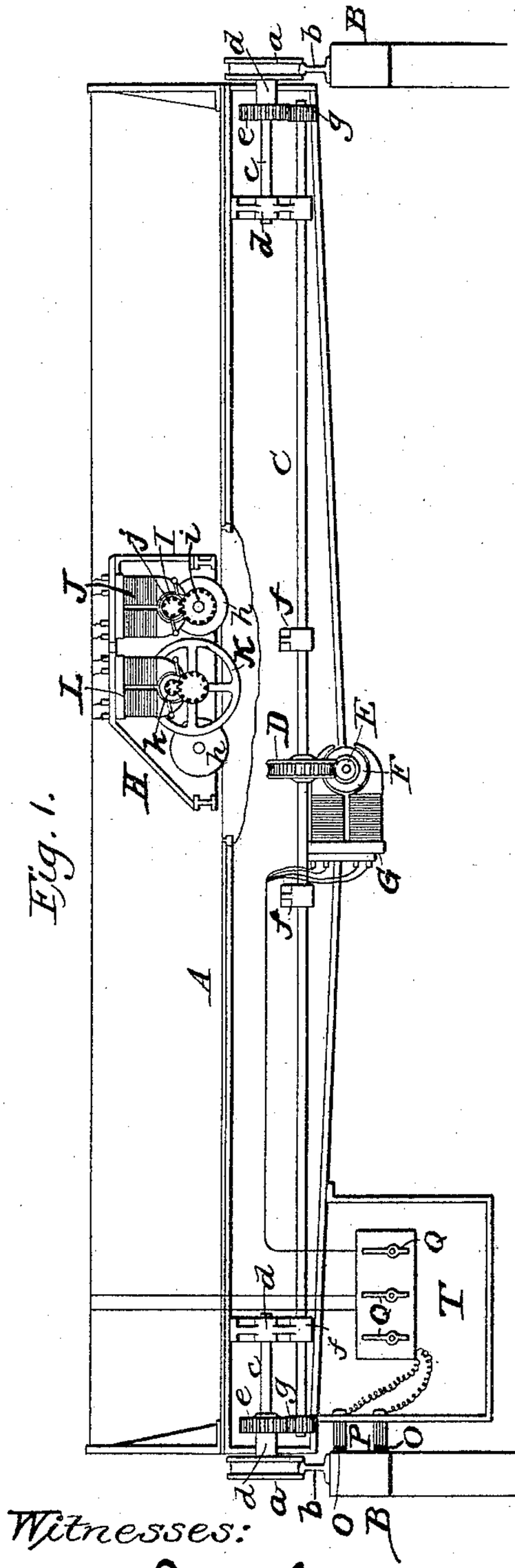

Fig. 1.

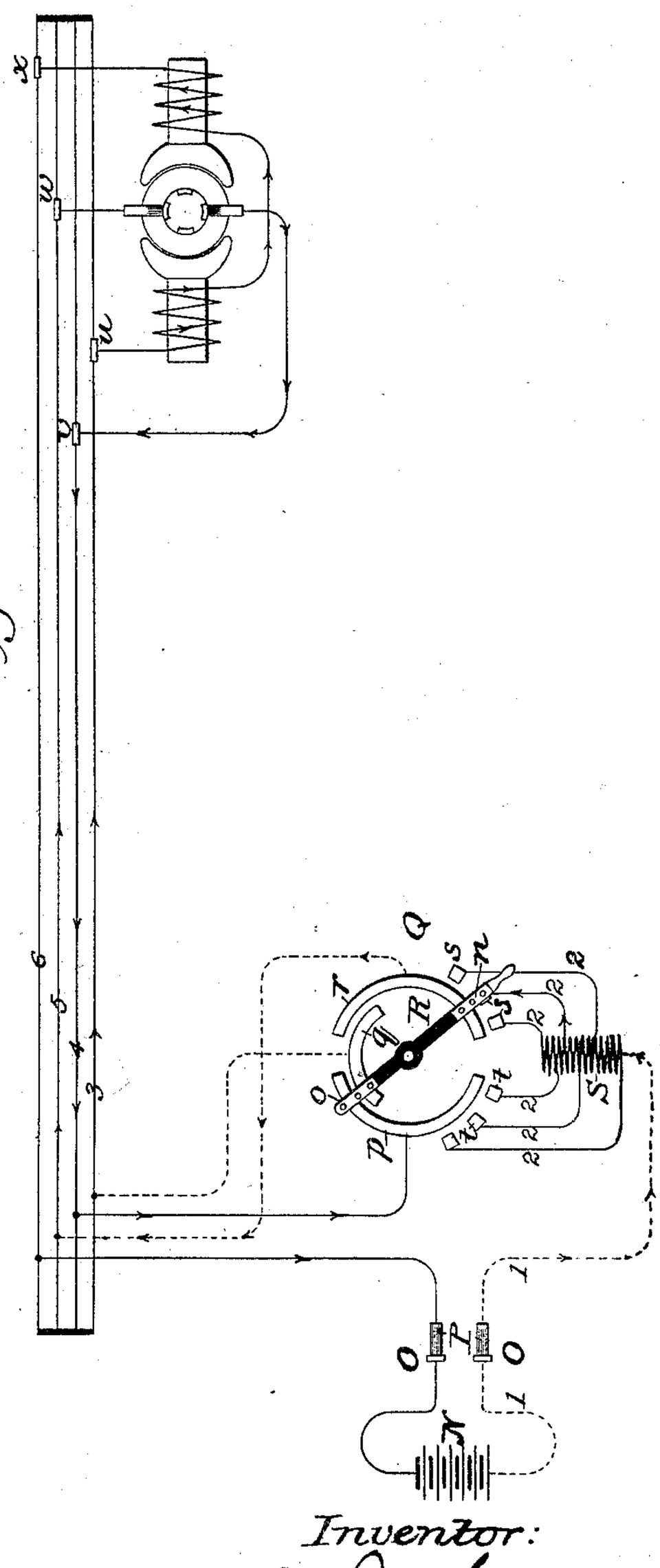

Fig. 2.

Witnesses:
James F. Duhamel.
Horace A. Dodge.

Inventor:
A. J. Shaw,
by Dodger Sons,
his Attys.

(No Model.) 2 Sheets—Sheet 2.

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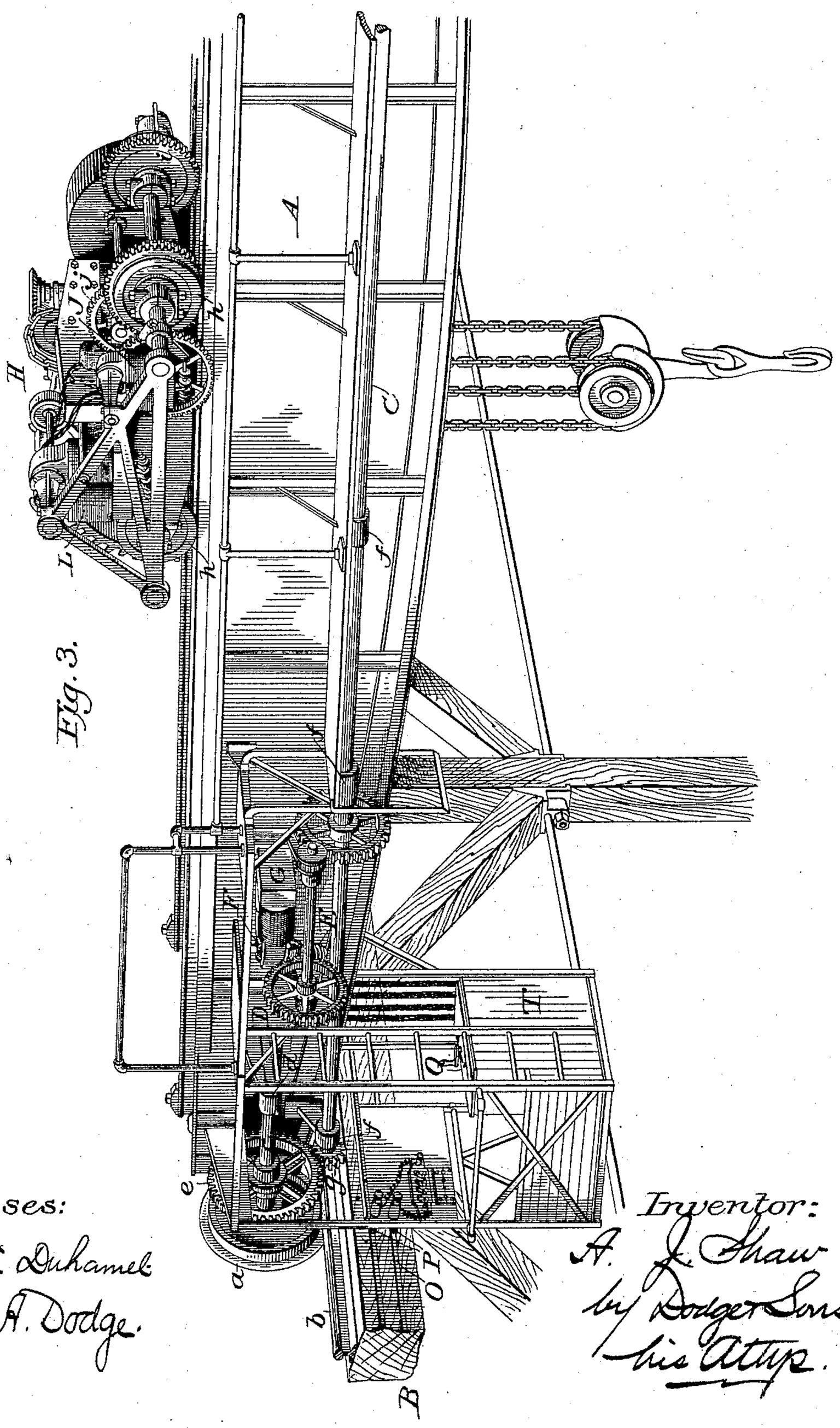

Fig. 3.

Witnesses:
James F. Duhamel
Horace A. Dodge.

Inventor:
A. J. Shaw
by Dodger Sons,
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UNITED STATES PATENT OFFICE.

ALTON J. SHAW, OF MILWAUKEE, WISCONSIN.

ELECTRIC CRANE.

SPECIFICATION forming part of Letters Patent No. 430,487, dated June 17, 1890.

Application filed June 25, 1888. Serial No. 278,109. (No model.)

To all whom it may concern:

Be it known that I, ALTON J. SHAW, of Milwaukee, in the county of Milwaukee, and in the State of Wisconsin, have invented certain new and useful Improvements in Electric Cranes; and I do hereby declare that the following is a full, clear, and exact description thereof.

My invention relates to traveling cranes, such as are used in foundries and like places; and the improvements consist in the combination, with the bridge, the trolley, and the hoisting-drum, of independent electric motors controllable from a common point, and in other features and combinations hereinafter more fully set forth.

In the annexed drawings, Figure 1 is a side elevation of the bridge and trolley of a crane embodying my invention; Fig. 2, a diagram illustrating the arrangement of the circuits by which the motors are supplied; Fig. 3, a perspective view of the crane, the bridge being broken away for want of space.

In the practical use of cranes of the class mentioned it is often necessary or desirable that three operations be simultaneously carried on—namely, a travel of the bridge upon the supporting-rails, a traverse of the trolley or car upon the bridge, and a raising or lowering of the chain or cable which passes about or winds upon the hoisting pulley or drum—and it happens even more frequently that two of these three operations require to be simultaneously performed. To attain this end various plans have been devised. In some, use is made of endless chains or cables passing about band-wheels and receiving motion from a steam-engine, suitable gripping devices being employed to connect the bridge with the cable or to set the trolley or hoisting-drum in motion. Others and those now most generally in use receive motion from a polygonal shaft extending from end to end of the track over which the bridge travels, clutches and reversing-gear being employed for transmitting motion from said shaft to the bridge-trucks, the trolley, and the hoisting mechanism in the required directions. It has also been proposed to impart to the various moving parts of a hoisting apparatus their requisite movements through the use of fluids under pressure, two or more of the movements being in some cases effected simultaneously, but the travel of the apparatus as a whole necessitating the employment of clutch mechanism, which in my apparatus is carefully avoided. These and other plans heretofore proposed are attended with various drawbacks and difficulties, which increase rapidly as the capacity of the crane is increased. Thus with endless chains, cables, and the like the gripping devices involve complication, and are not sufficiently certain of operation where, for instance, large quantities of molten metal or heavy castings are to be handled, and a slip or failure is likely to be followed by loss of lives. The sagging of the chains, cables, &c., is also a difficulty which is not easily obviated, especially where the track is long and the bridge is of wide span, and the tension devices which are provided involve expense and add to the complication of the apparatus. With the polygonal shaft it is necessary to employ supports at intervals capable of being moved out of the way of the sliding pinion which gives motion to the gearing of the bridge, and here again expense, complication, and liability of disarrangement are encountered. Moreover, as the length of the track increases the size of the shaft must be increased to resist torsional strain, and expansion and contraction of the shaft cause it to bind in its bearings, frequently causing serious trouble. Reversing-gear, necessary to all prior cranes of this character, permits more or less play or lost motion, cannot be instantly reversed, and when suddenly reversed is subjected to great and dangerous strain; yet it is of the utmost importance that the movements, stopping, starting, and reversing of the crane or its parts be as nearly instantaneous as possible.

So far as I am aware no plan has heretofore been proposed whereby shifting-clutches, gripping devices, and reversing-gear generally might be wholly dispensed with; but by the employment of reversible electric motors and the adaptation of the motors and the crane each to the other I am enabled to attain this important result. I am further enabled by such adaptation to give to each motor precisely the supply of power required by it regardless of the others. Under constructions hitherto adopted it has been necessary

to drive the master-shaft, cable, or other transmitter with a power sufficient to effect the travel of the bridge, the movements of the trolley, and the rotation of the winding drum or pulley when lifting its maximum load, and this power is necessarily developed and maintained whether the particular operation being performed requires much or little power. The electric motors, on the other hand, being wholly independent, are supplied with just so much current as their work demands, and consequently with self-regulating dynamos, storage-batteries, galvanic batteries, and various other sources of electric supply the consumption will be precisely in accord with the work actually done. So, too, where a self-regulating motor receives its supply from a general-supply current. The use of electric motors also enables me to transmit the power from its source to point of use with absolutely no loss of time, to stop, start, and reverse instantaneously, and to avoid entirely the use of catches, shifting-couplings, clutches, and the like.

Referring again to the drawings, the construction and arrangement of parts will be more fully explained.

A indicates the bridge of a traveling crane, furnished at its ends with truck-wheels *a*, which are flanged to cause them to retain their proper positions upon rails *b*, which form their supporting and guiding track, and which rails are themselves carried upon heavy timbers or girders B, running along the course to be traveled over by the crane and at such elevation as the character of the work to be performed may require. The truck-wheels are keyed or otherwise made fast upon axles *c*, which are journaled in boxes *d*, and each of which has keyed or otherwise secured upon it a gear-wheel *e*.

C indicates a shaft carried in suitable hangers or boxes *f*, secured to the side or face of bridge A, said shaft extending lengthwise of the bridge and nearly from end to end thereof and provided at or near each end with a pinion *g*, which meshes with and gives rotation to the gear-wheel *e* of the axle *c* at that end of the bridge.

At or about its mid-length, preferably, or at such other point as may be convenient, the shaft C is furnished with a worm-wheel D, to which motion is imparted by a worm or screw E. The worm or screw E is formed or secured upon one end of the shaft of the armature F of an electromotor G, suitably attached to the bridge A, and consequently as the armature rotates in one or the other direction the worm-wheel D, the shaft C, and finally the truck-wheels *a a* will be caused to rotate forward or backward, and thus the bridge will be caused to advance or recede along the tracks, as required.

As is well known, the direction of rotation of the armature may be reversed by reversing the direction of the current, and this in turn may be effected by a suitable switch, of which many forms are now well known. A convenient and suitable switch for the purpose is illustrated in Fig. 2 and will be explained farther on.

H indicates a car or trolley provided with truck-wheels *h*, to which rotary motion is imparted through a gear-wheel *i*, secured to one of said wheels or to its axle, and a pinion *j*, carried by the shaft of a rotary armature I of an electromotor J, which is carried by the trolley H. As in the case of motor G, so in this the direction of travel of the trolley may be reversed by reversing the direction of the flow of the current supplying the motor. The trolley carries also a chain-wheel or a hoisting-drum K, which may be geared to give such power or purchase as desired, as is now commonly done in such machinery, and which is turned in one or the other direction at will by means of a third electromotor L, which in the drawings is represented as having a pinion *k* upon the shaft of its armature, gearing into a second pinion or gear-wheel *l* on the shaft of the hoisting drum or pulley K.

The motor L is reversible in the same manner as motors G and J, and each is independently supplied with electricity, and each controlled independently of the others by means of a switch, this arrangement permitting any one or two or all three of the motors to be put in action at will.

The supply-current of electricity is derived from a dynamo-electric generator, a galvanic battery, a storage-battery, or any other convenient and suitable source, (one or more,) as indicated in the drawings by the letter N, Fig. 2. This source of supply will be located at any convenient point, and the electric current will be carried thence by suitable conductors O, preferably broad flat strips of copper, along one of the girders or timbers B, from which it should be carefully insulated. There may be but two of these strips or conductors, one for the outgoing and the other for the returning current, or, in other words, a continuous metallic circuit when completed through the motors on the crane, or there may be as many sets of conductors as there are motors, and they may be supplied from a common source or from independent sources, as preferred.

From the conductors O the current is taken by brushes, rollers, or equivalent traveling contacts P, carried by the bridge, and from these brushes they are led to suitable resistance coils or devices through a reversing-switch to and from the motors and back to the source of supply.

In Fig. 2 I have represented a switch suitable for the reversal of the current and adapted also to vary the resistance introduced into the circuit, and thereby to control the amount of current utilized in actuating the motor, or, in other words, to control the power or speed or power and speed of the motor, as required.

Q indicates the switch as a whole, consisting of a lever or bar R, mounted upon and mov-

able about a central pivot or support formed with a suitable hand-piece at one end and carrying at or near its ends insulated conducting-blocks *n o*, three segmental contact-plates *p*, *q*, and *r*, insulated from one another, but so arranged that the ends of strips *p* and *r* lap past the ends of the intermediate strip *q*, and two series of insulated studs or blocks *s* and *t*.

From the generator or supply-source N a conductor 1 passes to a resistance-coil S, from which conductors 2 branch off at different points and connect with the blocks or studs *s* and *t*, this arrangement being for the purpose of introducing more or less resistance into the circuit, as will be readily understood.

The lever R may be brought to such position that it shall not touch any one of the blocks *s t*, and that its opposite end shall stand midway between the ends of segments *p* and *r*, under which adjustment the circuit will be interrupted at the switch. Any other adjustment of the lever or bar R will, however, cause one end of the lever to make contact with one or another block of the series *s* or the series *t*, and the opposite end of said lever or bar will at the same time be caused to connect segment *q* with segment *p* or segment *r*, according to the direction in which the lever is moved.

Four wires or conductors 3, 4, 5, and 6 extend along the line of travel of the motors to be supplied, and in such position that they shall be swept by contact brushes or rollers *u*, *v*, *w*, and *x* thereof throughout such travel. Conductor 3 is connected by a wire or line with segment *q*, conductor 4 with segment *p*, conductor 5 with segment *r*, and conductor 6 with the return-pole of the supply N. If, therefore, the switch be set as indicated in Fig. 2, the current will pass from the source N through more or less of the resistance-coil S, according to which stud or block *s* the lever rests upon, thence by plate *n* of lever R to segment *r*, to conductor 5, to one of the brushes of the commutator of the motor, through the armature-coils, back by way of the second brush to conductor 4, thence to segment *p*, through the plate *o* of lever R to segment *q*, thence to conductor 3, and thereby to the field-magnet coils of the motor, thence by conductor 6 back to the source of supply. If the lever be thrown in the opposite direction, the path of the current to, through, and from the motor will obviously be reversed.

The arrangement of circuits and the construction of the switch above set forth are merely illustrative of a type or class; but I do not mean to restrict myself to any particular form. So, too, I propose to use any style or class of motor that circumstances may demand or render expedient.

A separate switch will be provided for each motor, and all will be arranged within the attendant's cab T, which is ordinarily suspended from the bridge, as indicated in Fig. 1.

I am aware that it has been proposed to employ an electric motor for operating elevators or hoists and jib-cranes; but so far as I am advised no one has heretofore provided separate electric motors independent of each other in their action and capable of performing, without the intervention of clutches, the several operations of traveling cranes—still less of performing these several operations simultaneously, which capability is essential under existing conditions.

I am also aware that it has been proposed to mount a steam-boiler upon the trolley of a traveling crane and to supply separate steam-engines or motors therefrom, said engines serving to effect the travel of the bridge and of the trolley and the operation of the hoist.

The great weight placed upon the bridge and moving over the same, the inertia and consequent delay in starting and stopping, the impossibility of instantly reversing the rotation of the main shaft of a steam-engine, the space required above the bridge for boiler and engines, and the danger from fire incident to the placing of the steam-boiler above the bridge and close to the roof, as would be the case in most buildings where cranes of this class are used, all combine to render undesirable the construction just referred to.

It will be seen that my invention is applicable not only to traveling cranes, but also to jib-cranes, provided separate and independent motors be employed for effecting the travel of the trolley upon the horizontal arm of the jib and for actuating the hoisting mechanism mounted thereon, so that the two motions may be effected simultaneously or independently, as circumstances may require.

So far as I am aware no one has ever proposed to construct a crane with independent electric motors for giving motion to the several parts simultaneously or independently at will.

The term "conductor" as herein used means a conductor of electricity.

No claim is herein made to conduits of tubular form conveying steam, air, or gas under pressure to motors adapted to be driven by such agents.

It will readily be perceived that the gearing through which motion is transmitted from each of the several motors to the mechanism driven by it may be varied as desired, that represented in the drawings being adopted merely for the purposes of illustration, and not being designed to indicate a prescribed or necessary form or arrangement.

Therefore, having thus fully described my invention and pointed out wherein it differs from all prior constructions of which I am aware, what I claim, and desire to secure by Letters Patent, is—

1. In combination with a supporting-track, a bridge mounted and movable thereon, a trolley or car mounted and movable upon the bridge, a hoisting drum or pulley carried by the trolley, and three independent electric

motors each in communication with a source of electricity, one of said motors being carried by and serving to propel the bridge, and the other two being carried by the trolley and serving, respectively, to propel the trolley and to actuate the drum or pulley.

2. In combination with a supporting-track, a bridge mounted and movable thereon, a trolley or car movable upon the bridge, a hoisting drum or pulley carried by the trolley, an electric motor carried by the bridge and serving to impart motion thereto, a second electric motor carried by the trolley and serving to propel the same, and a third electric motor also carried by the trolley and serving to actuate the hoisting drum or pulley, the several motors being wholly independent of one another and all capable of reversal, whereby the attendant is enabled to cause a travel of the bridge in either direction, a movement of the car or trolley forward or backward, and a raising or lowering of the hoisting chain or cable simultaneously or at different times, and to perform each of said operations regardless of the others.

3. In a traveling crane, the combination of a bridge, an electric motor carried by and serving to propel the same, a trolley mounted upon the bridge, and an electric motor carried by the trolley wholly independent of the first and serving to propel the trolley over the bridge.

4. In a crane, the combination, with a track or support, of a trolley movable thereon, a hoisting drum or pulley carried by said trolley, two independent electric motors, also carried by said trolley, one serving to propel the trolley and the other to actuate the hoisting drum or pulley, and a source of power or supply outside of the crane.

5. In combination with a track or way, a bridge traveling thereon, a trolley movable upon said bridge, a hoisting drum or pulley carried by the trolley, and two electric motors, one carried by the bridge and the other by the trolley and capable of independent control, whereby either may be put into operation alone or both may be operated in unison.

6. In combination with the bridge and the trolley of a crane, independent electric motors carried, respectively, by the bridge and the trolley, conductors connecting said motors independently with a source of electricity, and independent switches grouped within easy reach of the attendant of the crane and serving to control the supply of electricity to the respective motors.

7. In combination with a crane, independent electric motors for actuating or propelling different parts thereof, electric conductors separately connecting each motor with a source of supply, and switches, substantially such as described and shown, introduced into the respective conductors and adapted to vary the strength of and to reverse the current passing to each motor.

8. In a traveling crane, the combination of a bridge, a trolley mounted and movable upon the bridge, a hoisting drum or pulley carried by the trolley, a motor carried by the bridge and serving to propel the same, and a second motor carried by the trolley and wholly independent of the first to propel said trolley, said motors being independently connected with a power-supply outside of the traveling crane, whereby they are adapted to be controlled independently without the aid of clutches or connecting-gear, and whereby also the bridge is relieved of the weight and bulk of the power-generator.

9. In a traveling crane, the combination of a bridge, a trolley mounted and movable upon the bridge, a hoisting drum or pulley carried by said trolley, and two motors carried by said trolley, one serving to propel the trolley and the other to actuate the hoisting-drum, said motors being independently connected with a source of power wholly outside the traveling crane, whereby either motor may be put into action without the other or both caused to operate in unison.

10. In a traveling crane, the combination of a bridge, a trolley movable thereon, a hoisting drum or pulley carried by said car, three separate motors, one carried by and serving to propel the bridge, another carried by and serving to propel the trolley, and the third also carried by the trolley and serving to actuate the drum or pulley, said motors being independently supplied with power from a source wholly outside the traveling crane.

In testimony that I claim the foregoing I have hereunto set my hand, at Milwauke, in the county of Milwaukee, and State of Wisconsin, in the presence of two witnesses.

ALTON J. SHAW.

Witnesses:
S. S. STOUT,
N. E. OLIPHANT.