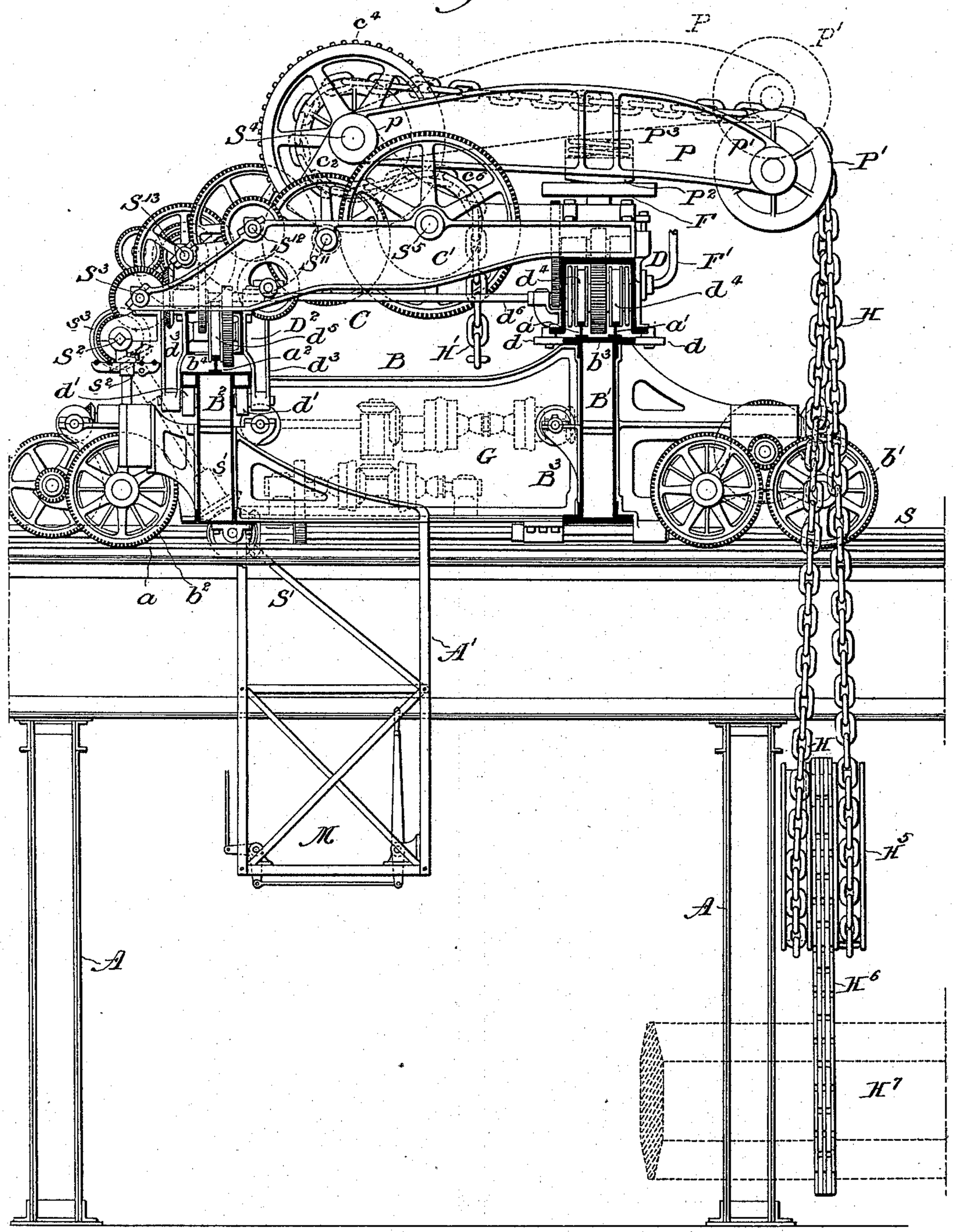
(No Model.) 4 Sheets—Sheet 1.

F. W. TAYLOR.

CRANE.

No. 568,174. Patented Sept. 22, 1896.

Fig. 1.



WITNESSES:
D. Stewart
Edw. F. Ayres

INVENTOR:
Frederick W. Taylor
by his att'y.
Francis T. Chambers

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F. W. TAYLOR.

CRANE.

No. 568,174. Patented Sept. 22, 1896.

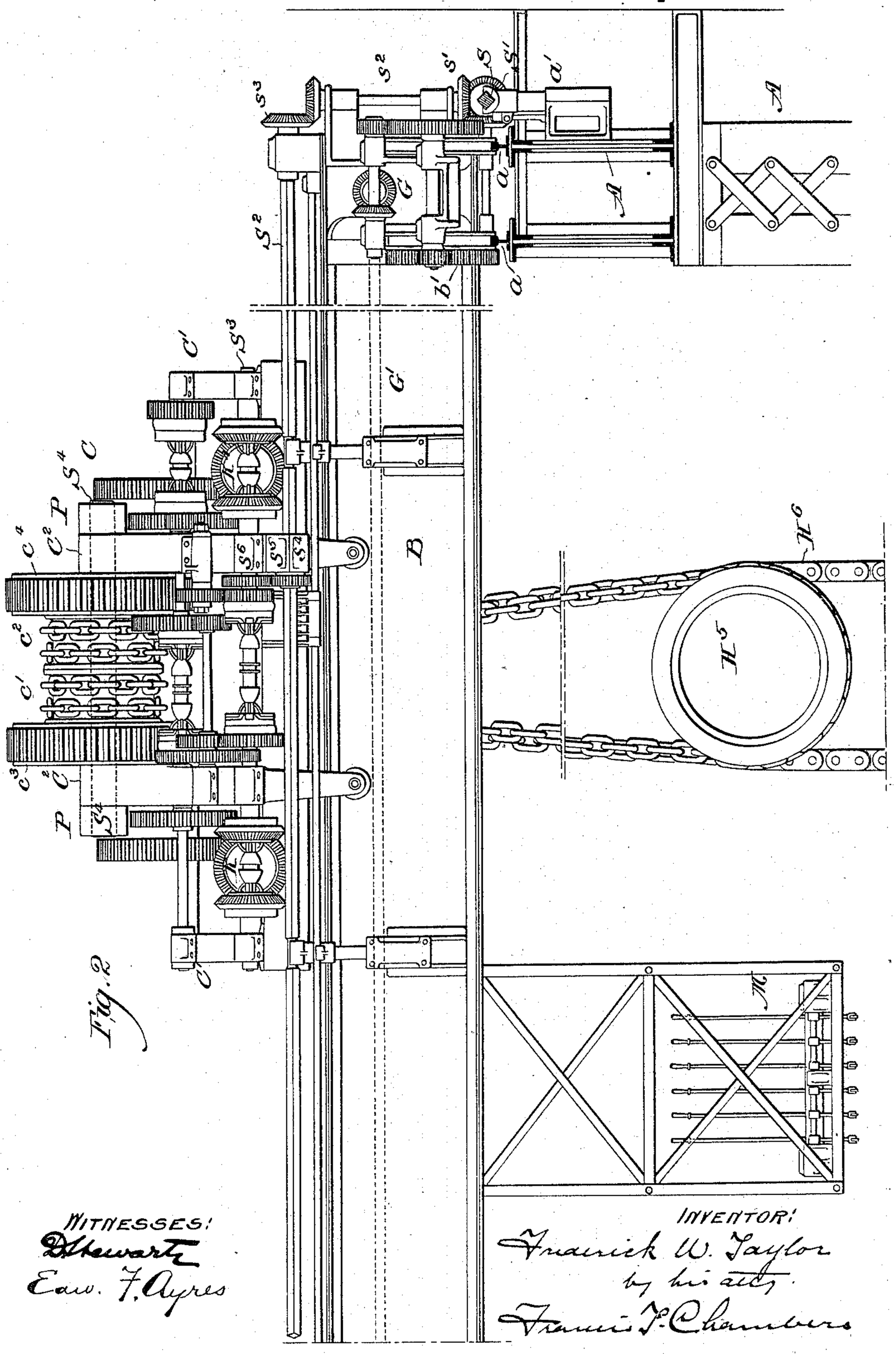

Fig. 2.

WITNESSES:
D. Stewart
Edw. F. Ayres

INVENTOR:
Frederick W. Taylor
by his atty.
Francis P. Chambers

(No Model.) 4 Sheets—Sheet 3.

F. W. TAYLOR.

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Fig. 5.

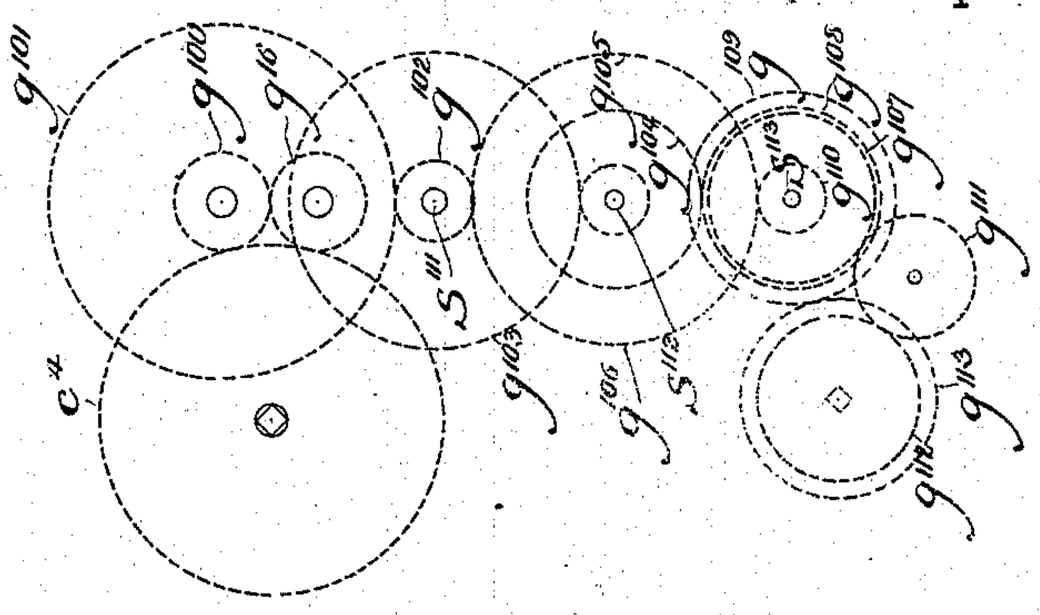


Fig. 4.

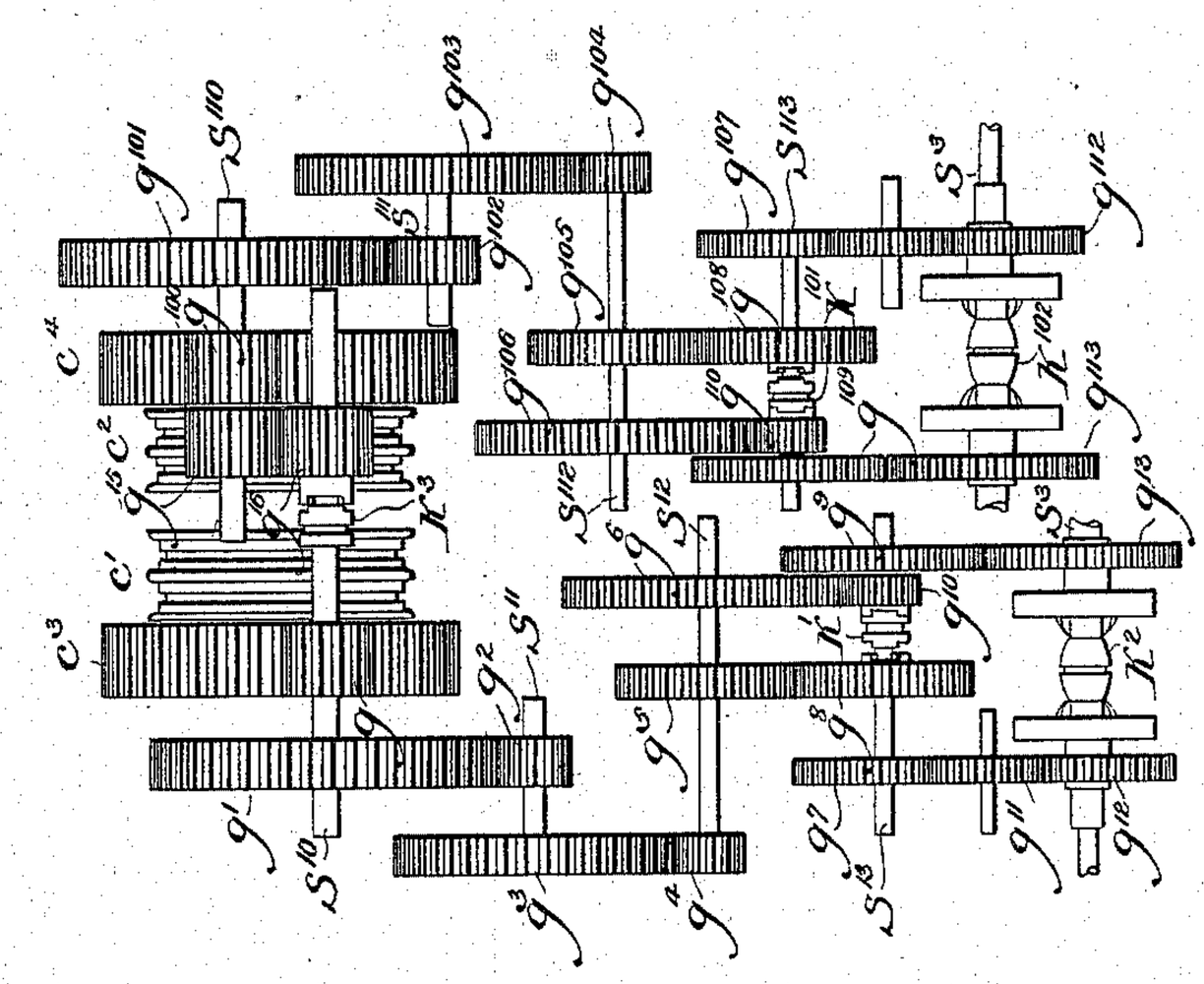
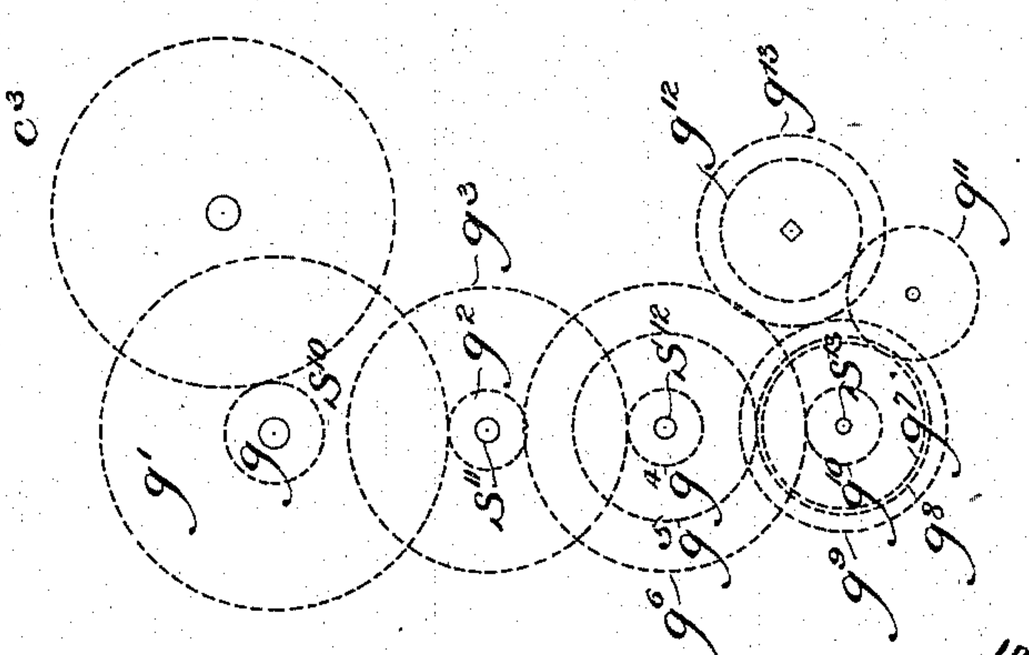


Fig. 3.



WITNESSES:
D. Stewart
Edw. T. Ayres

INVENTOR:
Frederick W. Taylor
by his att'y.
Francis J. Chambers

(No Model.)

4 Sheets—Sheet 4.

F. W. TAYLOR.

CRANE.

No. 568,174. Patented Sept. 22, 1896.

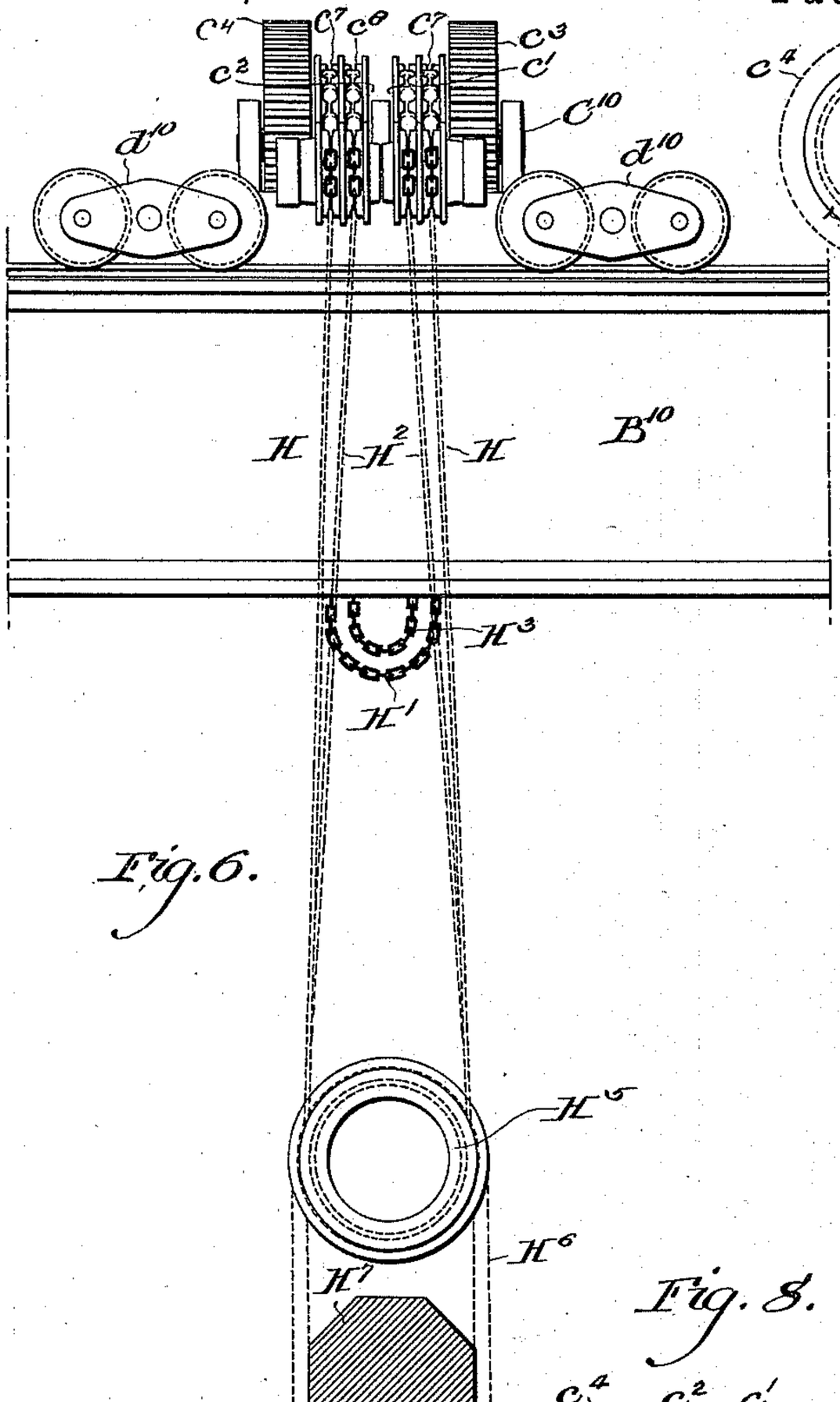


Fig. 6.

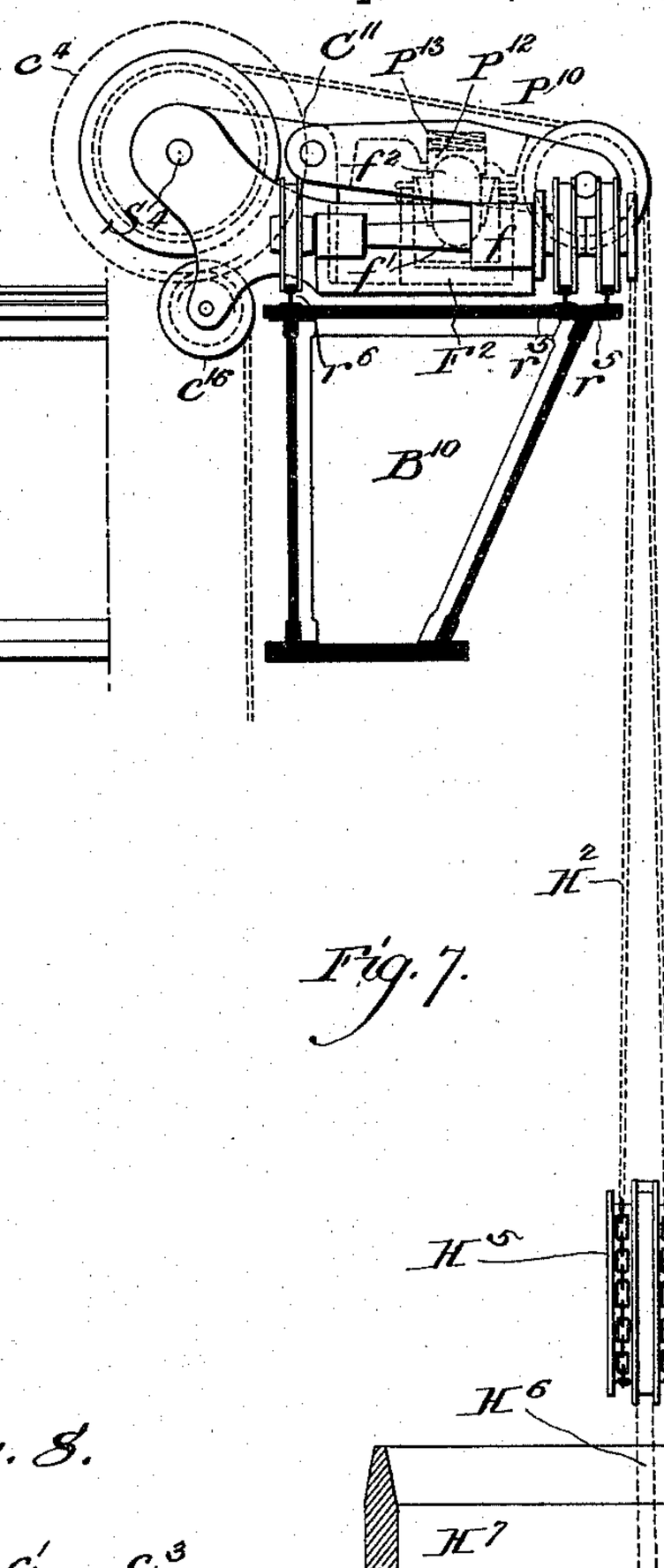
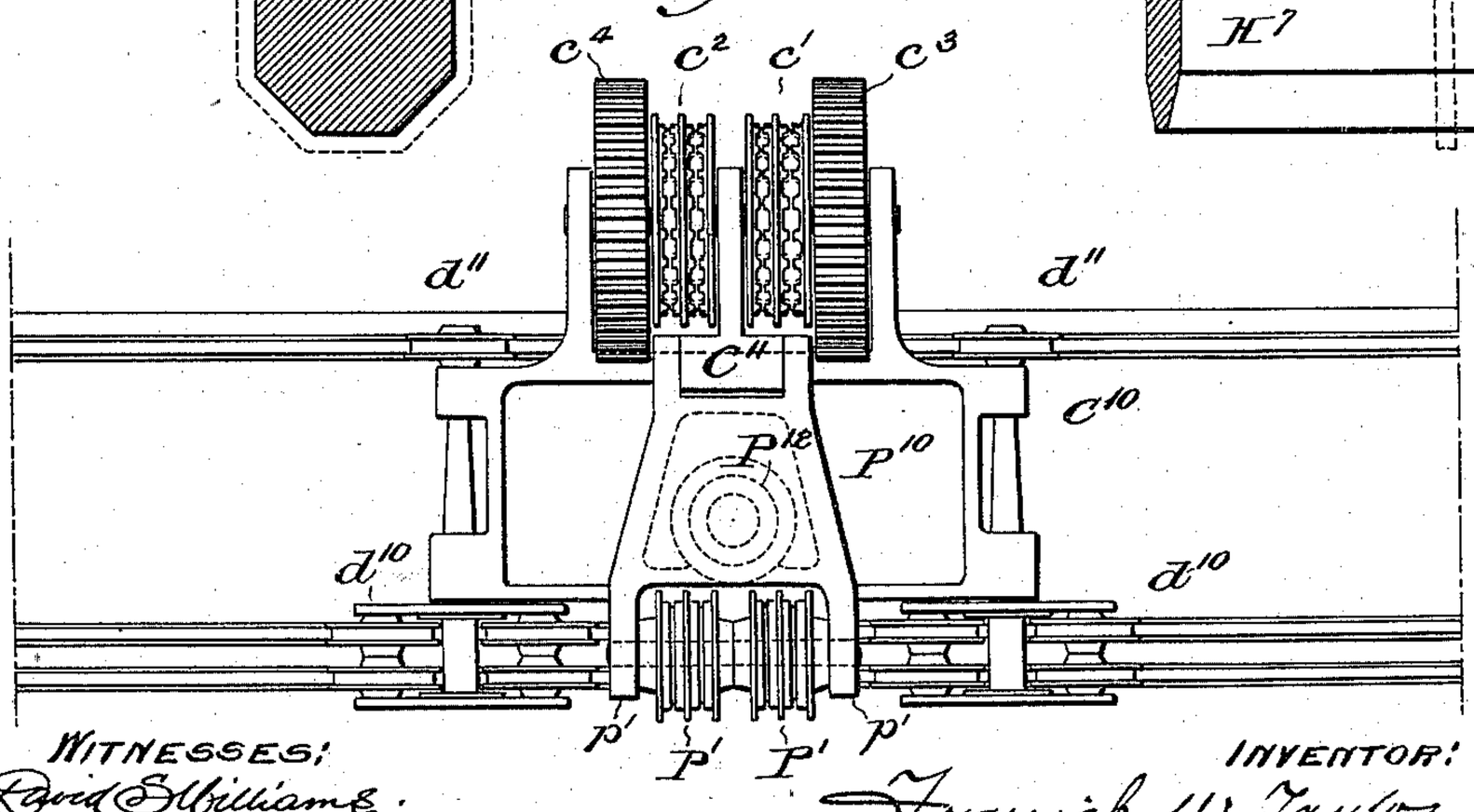


Fig. 7.

Fig. 8.



WITNESSES:
David S. Williams.
D. Stewart

INVENTOR:
Frederick W. Taylor
by his atty.
Francis T. Chambers

UNITED STATES PATENT OFFICE.

FREDERICK W. TAYLOR, OF MADISON, MAINE.

CRANE.

SPECIFICATION forming part of Letters Patent No. 568,174, dated September 22, 1896.

Application filed April 1, 1893. Serial No. 468,718. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK W. TAYLOR, a citizen of the United States, residing at Madison, in Somerset county, in the State of Maine, have invented certain new and useful Improvements in Cranes, of which the following is a true and exact description, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates, broadly, to an improvement in cranes, but is, however, particularly applicable and especially contrived for such cranes as are in use in a forge or smithing plant, where the crane, in addition to its power of transporting heavy objects, as forgings, should also have the capability of maneuvering them nicely between the dies of a steam-hammer or other smithing-tools.

In the following description I have illustrated my invention as embodied in an overhead crane having a traveling bridge and a bridge-traversing trolley wherein the feature of transportation or horizontal movements of the crane and its load is carried to its highest extent.

The chief object of my invention is to provide a forge-crane with an increased capacity for manipulating or portering its load, that is, an increased capacity for training and presenting a forging when suspended from the tackle of a crane to a smithing-tool, such, for instance, as the dies of a steam-hammer.

To this end, and also to improve the general construction of this class of devices, my invention consists in combining with a crane in a new manner not only a primary, but also a secondary lifting and lowering device, which devices are preferably so arranged that they may be operated together or separately.

My invention also consists in means whereby the crane is given an increased capacity for rotating its load, preferably continuously, which rotating apparatus may be operated either in conjunction with one or the other of the lifting or lowering devices or separately, and also in means for carrying the flexible tackle or chain to one side of the trolley and having so arranged it to maintain the trolley which carries it on its ways when transporting a load; also in an improved sling for the load and in the general construction of particular parts tending to carry out the objects above mentioned.

My invention is best understood as explained in connection with the drawings in which it is illustrated, and in which—

Figure 1 is an elevation of a portion of an overhead traveling crane embodying my present invention, the point of view being sidewise of the ways and trolley and broadside of the bridge, only one of the overhead ways being shown. Fig. 2 is a view of the rear of the crane shown in Fig. 1 and taken at right angles to the point of view of Fig. 1. Figs. 3, 4, and 5 are diagrammatic, illustrating, respectively, a left-side projection, a plan, and a right-side projection, of the clutches and gearing for controlling and actuating a tackle or chain winding mechanism in the preferred form of the crane. Fig. 6 is a front view of a fragment of a modification of the chief devices shown in Figs. 1 and 2. Fig. 7 is a cross-section of the device shown in Fig. 6, and Fig. 8 is a plan view of the device shown in Fig. 6.

Referring to Figs. 1 and 2, there is shown an overhead traveling-bridge crane provided with a bridge-traversing trolley, as is usual in this class of machinery, and in order to lead up to the novel features of my present invention it will be sufficient to describe briefly certain parts familiar in this class of devices.

A A represent piers carrying girders A′, upon which are laid rails, (shown in this case double at *a a*, Fig. 2,) these constituting the overhead or bridge ways of the crane. B is the bridge, which, being supplied at its corners with suitable brackets, is equipped at the rear with single trucks b^2 and at the front with preferably double trucks b', adapted to bear upon and run along the rails of the overhead ways described. S is the main driveshaft of the device, and is of the ordinary square variety usual in cranes, and is journaled, as shown in Fig. 2, in suitable bearings a' along the outside of one of the overhead ways, and serves by means of a square-eyed traveling-gear S′, mounted upon it and collared endwise to the adjoining bridge to transmit motion to the bridge-actuating train. This actuating-train (indicated generally at G, Fig. 1, and shown in dotted lines) consists

of a combination of shafts and gears controlled by clutches operated at the will of the driver, and is a familiar mechanism in overhead cranes, and does not need particular description, inasmuch as it forms no part of my present invention, its function of course being to stop, start, reverse, and change the speed of bridge travel, as desired. In combination with this customary gear I employ a corresponding set of trucks and gears at the other end of the bridge, power being transmitted thereto by a shaft, as G′, so that the bridge will move uniformly along its ways, this gearing at the other end of the bridge not being shown for want of space.

In order to permit the trolley C, which runs across the bridge, to carry the preferred form of tackle or chain winding mechanism which I combine with the crane, I preferably build one side of the bridge, as the front side B′, which is supported by a double carrying-gear b', as described, larger and stronger than the rear side B^2. The bridge-girder of this side I also make higher and crown it with a substantial plate b^3, on which are fastened, preferably, two rails a' a', as shown in Fig. 1. The rear bridge-girder is also preferably provided with a substantial and laterally-projecting crown-plate b^4, on which is arranged a rail a^2, and the lower edges of which, formed parallel to this rail a^2, serve as bearings for bearing-wheels d', journaled in pendent brackets d^3, fastened securely to the frame of the trolley. These serve to prevent the trolley from being lifted from its support under the stress of a load lying on the forwardly-projecting tackle-beam P. Guide-wheels d d are also arranged to run along the edges of the plate b^3 on the front girder B′ and so steady the running of the trolley.

In order to transmit power from the main drive-shaft S, I employ a bevel-gear, as s, familiar in cranes of the square-shaft variety, which, being conveniently formed integral with the square eye of the bridge-traveling drive-gear, is carried wherever the latter goes and is continuously actuated from the drive-shaft S. From this gear a train of gear (indicated at s' s^3) serves as usual, in combination with a diagonal shaft s^2, to impart motion to the trolley drive-shaft S^2, which shaft, being suitably journaled across the rear face of the rear bridge-girder, has mounted on it the customary square-eye traveling gear s^4. Said gear being journaled rotatively to a bracket fixed to the trolley C, but collared endwise to the same, imparts motion continuously through gear-wheels, as s^5 s^6, to a shaft S^3, journaled to said trolley and parallel to the shaft S^2, all arranged in a manner usual to devices of this class. By means of power derived from this shaft, properly applied from the cage M by the driver through clutches K K^4, the trolley is made to move in either direction on the bridge or stop or reverse at will, this motion being accomplished by driving the truck-wheels d^4 d^4 on the front girder-rails and the truck-wheels d^5 on the rear rail in the proper direction by means of the customary gears, the two sets of truck-wheels being properly connected so as to run together, as by shafts d^6, of which one is shown in Fig. 1. The trolley is preferably formed with four cross-pieces C′ C′ C^2 C^2 for the convenient housing and journaling in it of the preferred tackle or chain actuating mechanisms, which are mounted in this construction on the trolley. These tackle-actuating mechanisms consist in this case of, first, a duplex winding mechanism, which receives motion from the trolley-shaft S^3, which, as has been said, receives motion from the shaft S^2 and is constantly in motion; second, an auxiliary lifting and lowering device, consisting in this case of a vibrating tackle-beam P, pivoted at p, which carries the chain-sheaves P′, which are pivoted to its free end relatively to the bridge and trolley-projecting end p', and a suitable auxiliary lifting and lowering device for said beam.

Before describing further the auxiliary lifting and lowering device attention is called to the main tackle or chain raising, lowering, and turning mechanisms. This device, which is adapted to act upon a duplex chain-tackle, may be conveniently built up as follows:

Suitably journaled in the cross-pieces C^2 C^2 of the frame of the trolley is a shaft S^4, which has mounted loosely upon it between the cross-pieces C^2 C^2 two mutually independent drums c' c^2, provided with sprocket-surfaces adapted to engage with the links of the tackle-chains H H^2. These drums are secured to or made integral with gears c^3 c^4, which are also mounted on said shaft S^4. Outside of its bearings on the cross-pieces of the trolley the shaft S^4 projects a suitable distance, affording a convenient pivot whereon to journal the inner and forked end of the vibrating beam P. Beneath the shaft S^4, and preferably somewhat in front of it, a shaft S^5 is journaled to all four cross-pieces C′ C′ C^2 C^2, parallel to the shaft S^4, and loosely mounted on its central part are pivot-drums c^5 c^6, corresponding to the winding-drums c' c^2. (c^6 is shown in Fig. 1, c^5 being behind it in a corresponding position.) The function of these pivot-drums is to give a good lap to the chains H H^2 upon the winding-drums c' c^2 aforesaid, and also to pass therefrom fall-bights H′ H^3, which are conveniently passed down within the open center of the bridge B. Each of the drum-gears c^3 c^4 is operatively connected by a system of gears, shafts, and clutches to the continuously-rotating shaft S^3 in a manner to be hereinafter more particularly explained, so that the winding-drums may be rotated in the same direction with equal velocity, thus raising or lowering the load, or one drum may rotate in one direction and the other drum in the other direction, thus rotating the load, or one drum may remain quiet and the other

drum rotate, thus raising and rotating the load at the same time. Means are also interposed to vary the speed as may be desired.

A system of gears capable of performing these motions is seen stripped from its bearings and spread out, so as to clearly show all the modes of connection, clutching, and so on, in Figs. 3, 4, and 5.

Referring specially to Fig. 4, c' c^2 are the winding-drums, and c^3 c^4 are the gears attached thereto, as in Figs. 1 and 2. The gear c^3 meshes with a gear g of much smaller diameter, which gear is fixed to a shaft. (Marked here S^{10}.) This shaft has also fixed to it a gear g' of comparatively large diameter and which in turn meshes with a small gear g^2, fixed on a shaft. (Marked S^{11}.) This shaft S^{11} also carries a large gear g^3, mounted thereon, which, however, may be of less width of face and generally slighter build than the preceding wheel g^2. The gear g^3 further meshes with a spur-wheel g^4, carried on a shaft S^{12}, which shaft also has firmly mounted thereon two gears g^5 g^6 of different diameters, which mesh, respectively, with gears g^8 g^{10}, which are loosely mounted on the shaft S^{13}, but are adapted to be operatively connected to the said shaft by means of a longitudinally-splined clutch K'. These two last-named gears g^8 g^{10} differ in size, the smaller g^{10} gearing with the larger g^6 on the shaft S^{12}, so as to vary the speed, as will be explained hereinafter.

On the shaft S^{13} are firmly mounted two other gears, g^7 g^9, as shown. The gear g^9 meshes with a gear g^{13} of equal size, loosely mounted on the continuously-revolving shaft S^3. The gear g^7 meshes with a gear g^{11}, which meshes with a gear g^{12} of a size equal to the gear g^7, loosely mounted on the shaft S^3. The two gears g^{12} g^{13} are collared endwise on the shaft S^3 and adapted to be engaged so as to rotate with such shaft S^3 by means of a clutch K^2. Now, therefore, by throwing the clutch K^2 to right or left it is possible to rotate the shaft S^{13} in the same direction as the shaft S^3 by means of three gear-wheels g^{12} g^{11} g^7, or in the opposite direction to the shaft S^{13} by means of the two gear-wheels g^9 g^{13}, or by holding the clutch out of connection with either gear-wheel g^{12} g^{13} to transmit no motion to the train of gear. The shaft S^{13} will have, however, at all times the same speed as the shaft S^3, whether it revolves in the same or in the opposite direction thereto. To change this speed, however, the clutch K' is operative by throwing into gear with the shaft S^{13} either the gear g^8 or the gear g^{10}, causing the shaft S^{12} with its gears to revolve in one case with approximately the same speed, or in the other case with less speed than the shaft S^{13}. As for the gears on the other side, corresponding gears are numbered the same as those described, with the exception that one hundred is added to the index. These have been shown all as separate gear-wheels, but I have found in practice that the two sets of gears shown driven separately from the shaft S^3 may be identical for some distance, and branch at some convenient intermediate point; but as such branching of these trains is a matter of mere mechanical skill and determined by the exigencies of practical construction rather than by anything else it is not necessary to show any particular manner of construction.

A very convenient mode of causing the winding-drums to run at the same speed in opposite directions is shown in Fig. 4. On the same shaft S^{10} to which the gear-wheel g is secured there is mounted loosely a gear g^{16}, meshing with the gear g^{15}, mounted on the shaft S^{110}. A clutch K^3 is arranged on the shaft S^{10} so as to revolve with but move lengthwise of said shaft, thus connecting at will the shaft S^{10} and the gear g^{16}, so that they will turn together. If, therefore, motion is communicated to both winding-drums through the set of gears g^{10} g', &c., and if the gear g^{16} is caused to turn with the shaft S^{10} by proper manipulation of the clutch K^3, the winding-drums c' c^2 will revolve with the same speed in opposite directions, as the gears g^{15}, g^{100}, g, and g^{16} are all the same size. Also by the proper employment of the clutches K', K^2, K^{101}, K^{102}, and K^3, either of the drums may be driven forward or backward at a variable speed, or one may be driven forward and the other backward, and at any point desired, either can be stopped and driven in the other direction at any desired speed.

Referring now to the driving-tackle, as will be best seen in Fig. 6 this consists of two chains, as H H^2, each preferably made as a continuous loop or endless chain and each passing over the two winding-drums c' c^2, which each have sprockets c^7 for the one chain, H, and sprockets c^8 for the other chain, H^2. The fall-bights H' H^3, respectively, of these chains are allowed to hang, as shown, between the bridge-girders. In the loop of the chains is hung a sling-block H^5, and which is rotated by the chains H' H^2 when one of the winding-drums is moved in one direction and the other in the other direction, and a sling H^6 is arranged to hang from the sling-block H^5 and carries the load, as H^7, which will be turned in the same direction and with a speed proportional to that of the sling H^6. It is of course clearly understood that the train of gears here described is simply a convenient mode of transmitting the desired motion, and it will of course be obvious that numberless modifications may be made without departing from the spirit of my invention; also that while the arrangement of tackle shown is the one I prefer any arrangement involving the principle here shown and claimed is clearly within the scope of the present invention, as it is evident that numerous arrangements of tackle could be made. It will be obvious, however, that during the rotation of the load it may be necessary to raise or lower it. This raising or low-

ering, however, or the primary lifting and lowering device cannot be conveniently used while the load is being evenly rotated. Now, especially in forging operations at a steam-hammer, it is very desirable to both rotate and either lift or lower a forging to a certain extent. In order to effect such a movement, it is only necessary to call into play the secondary lifting or lowering device. This device consists, preferably, in the beam P, pivoted as described, and means for raising and lowering said beam. This means may conveniently be a hydraulic ram, as F, to which water under proper pressure is admitted through a pipe F′, the plunger or piston *f* of which, in the construction shown in Fig. 1, bears against the buffer P^2 and serves to raise the beam P. A spring or springs P^3, adapted to support a very heavy weight, are preferably interposed between the buffer P^2 and the beam P. By admitting water to or permitting it to escape from the hydraulic cylinder the beam P, with the load depending therefrom, will of course be raised or lowered to any desired extent within the limits of the movement of the hydraulic lift. By this arrangement also a forging can be slightly raised and then lowered to the exact point from which it had been raised, which is often very advantageous. To carry the load-tackle to one side of the trolley, I preferably arrange the beam P as shown, pivoting it at *p* and journaling a sheave P′ at the outer end *p′*, preferably at such a distance that the load will not be much, if any, farther forward than the front wheel *b′* of the bridge. By extending the beam P to one side of the trolley so that the chains hang to one side thereof rather than from between the girders B′ B^2, as is usual, it is possible to present a forging much more conveniently to the dies of a steam-hammer.

The device shown in Figs. 6, 7, and 8 is essentially the same in principle as the one already described. Here, however, a cross-girder B^{10} is shown, on which are arranged rails, two r^5 r^5 at the front and one r^6 at the rear. Suitable trucks are arranged to support the trolley C^{10}, whose wheels d^{10} d^{10} are arranged to bear on the rails r^5 r^6. The beam P^{10}, however, is not in this case pivoted on the extensions of the shaft S^4, but on a central bracket C^{11} of the trolley and carries on its free end *p′* the fall-block sheaves P′. Shown in dotted lines in Fig. 7 is the auxiliary lifting apparatus F. F^2 is a hydraulic cylinder; *f*, the piston therein, having a preferably spherical socket *f′* arranged therein. A block-bearing piece f^2 having spherical ends is arranged, as shown, so as to bear at one end in the socket in the hydraulic piston and at the other end in a corresponding socket in the buffer-plate P^{12}, between which and the beam P^{10} are preferably arranged springs P^{11}, as shown. It is evident that in this construction as the beam is not pivoted to the axis of the duplex winding-drum there is a slight endwise movement of the tackle-chains in relation to the pivot of the chain-sheaves whenever the beam P^{10} is moved. This, however, being a trifling matter in comparison to the amount of movement obtained by the use of the hydraulic jack may be neglected.

The crane, though not so shown, is supplied with proper brakes, which may obviously be applied wherever it may be deemed expedient, but I prefer to associate them with the winding-drums, and it may be convenient to disconnect the actuating-train and rely entirely on the brake mechanism for lowering. Such construction being, however, very familiar it is not deemed necessary to show it. The mode of operation is believed to be clear from the description given.

The driver, by proper manipulation of the customary lever in the cage M, throws in the proper gears and by turning the winding-drums together or separately in the same or in opposite directions, in conjunction with the secondary lifting device, can effect a very perfect and exact manipulation of a forging or other load, the lifting and rotating of the load being done by the same tackle, which is of course a great advantage.

In the claims I shall refer to the flexible member which is acted upon by the lifting and lowering mechanism described as a "chain," but I do not wish to be understood as thereby limiting myself specifically to what is technically known as a "chain," as any of the many equivalent devices may of course be used in its place.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a crane, the combination of a chain having a bight in which the load is supported, a primary lifting and lowering device adapted to act on both ends of the chain, and an independent secondary lifting and lowering device also acting on both ends of the chain, substantially as and for the purposes hereinbefore described.

2. In a crane, the combination with a chain having a bight in which the load is supported, of a primary lifting and lowering device adapted to act on both ends of the chain, and an auxiliary lifting and lowering device also acting on both ends of the chain adapted to be worked either independently of or concurrently with said primary lifting and lowering device.

3. In a crane, the combination of a chain having a bight in which the load is supported, one or more primary lifting or lowering devices acting on both ends of the chain, one or more chain-sheaves over which the chain passes and which lie between the primary lifting device and the chain-bight, and a secondary lifting and lowering device acting on the said sheave or sheaves and through them upon the bight of the chain.

4. In a crane, the combination with a chain of two mechanisms, as the winding-drums *c′*

c^2 for lengthening and shortening the bight inside of the chain, said mechanism forming a duplex lifting and lowering device, and means, as a beam and chain-sheaves carried on the end thereof for carrying the load into a position otherwise than directly below the lifting mechanism.

5. In a crane, the combination with a trolley of a duplex mechanism for raising and lowering a bight in a chain, and means, as a beam and chain-sheaves carried on the end thereof for carrying the load at one side of the trolley-bridge.

6. In a crane, the combination with a chain having a depending bight, of two mechanisms, as the winding-drums c' c^2 for lengthening and shortening the bight inside of the chain, said mechanism forming a duplex lifting and lowering device, means, as a pivoted beam and chain-sheaves journaled thereon for carrying the bight of the chain and the load in a position otherwise than directly below the lifting mechanism, and an auxiliary lifting and lowering device for moving the beam on its pivot and changing the elevation of the chain-bight independently of the duplex lifting and lowering mechanism aforesaid.

7. In a crane, the combination with a trolley of a duplex mechanism for raising and lowering a bight in a chain, means as a pivoted beam and chain-sheaves journaled thereon for carrying the load at one side of the trolley and an auxiliary lifting and lowering mechanism acting on the beam aforesaid for changing the elevation of the chain-bight independently of the duplex lifting and lowering mechanism aforesaid.

8. The combination in a crane of a main driving-shaft, two independent driving mechanisms, means operated from the main driving-shaft and adapted to rotate the independent driving mechanisms, means as suitable clutches adapted to cause the two driving mechanisms to severally rotate in either the same or in opposite directions, and an endless chain arranged to be operated by the driving mechanism.

9. The combination in a crane, of the main driving-shaft, two independent driving mechanisms, means such as proper gears and clutches adapted to drive the independent driving mechanisms from the main shaft either in the same or in opposite directions, a chain operated by the driving mechanisms, a sling-block arranged in the bight of the chain, and a sling arranged to carry the load.

10. The combination in a crane of a bridge, a movable trolley adapted to move longitudinally along the bridge, a beam carried by the trolley and projecting laterally and substantially horizontally beyond the bridge and provided at its free end with a chain sheave or sheaves, a chain adapted to pass over said sheave or sheaves and mechanism on the trolley for raising and lowering the bight of said chain.

11. The combination in a crane of a movable trolley, a shaft secured to said trolley, a substantially horizontal beam journaled at one end on said shaft and provided on its free end with a chain sheave or sheaves, a chain adapted to pass over said sheave or sheaves mechanism for raising and lowering said chain and means for lifting the free end of the beam mounted on the trolley and affording an auxiliary lifting and lowering device.

12. In a crane the combination with a movable trolley of two independent and independently-actuable windlasses, a chain engaging said windlasses in the manner of a bight, a fulcrum attached to said trolley, a substantially horizontal tilting beam operatively engaged to said fulcrum and provided with chain-sheaves for said chain and a hydraulic jack attached to said trolley and operating the substantially horizontal tilting beam through a certain angular range of action substantially as and for the purposes hereinbefore described.

13. The combination in a crane of a trolley and duplex winding mechanism mounted thereon, a chain operated by the winding mechanism, a sling-block hung in the bight of the chain and a sling hung thereon substantially as specified.

14. In a crane the combination with load-supporting chains and winding mechanism therefor, of a laterally-extending substantially horizontal beam for carrying two load-supporting chains and a spring-buffer support for said beam lying beneath the same.

15. In a traveling crane the combination with a supporting-bridge of a trolley adapted to run on said supporting-bridge, winding mechanisms carried on the trolley, a substantially horizontal beam extending transversely to the line of movement of the trolley and adapted to carry the load to one side of the bridge, and a spring-buffer support for said beam situated between it and said trolley.

16. In a crane the combination with main lifting and lowering mechanism for a load, of a substantially horizontal pivoted beam extending laterally and adapted to support the load, a secondary lifting and lowering device for said load lying beneath and adapted to support the substantially horizontal beam at a suitable distance from its pivot and a spring-buffer between the secondary lifting and lowering device and the pivoted beam.

FREDERICK W. TAYLOR.

Witnesses:
MARTIN EICHE,
G. L. DAVIS.