No. 662,163. Patented Nov. 20, 1900.

H. C. BEHR.

HOISTING APPARATUS.

(Application filed June 25, 1900.)

(No Model.) 3 Sheets—Sheet 1.

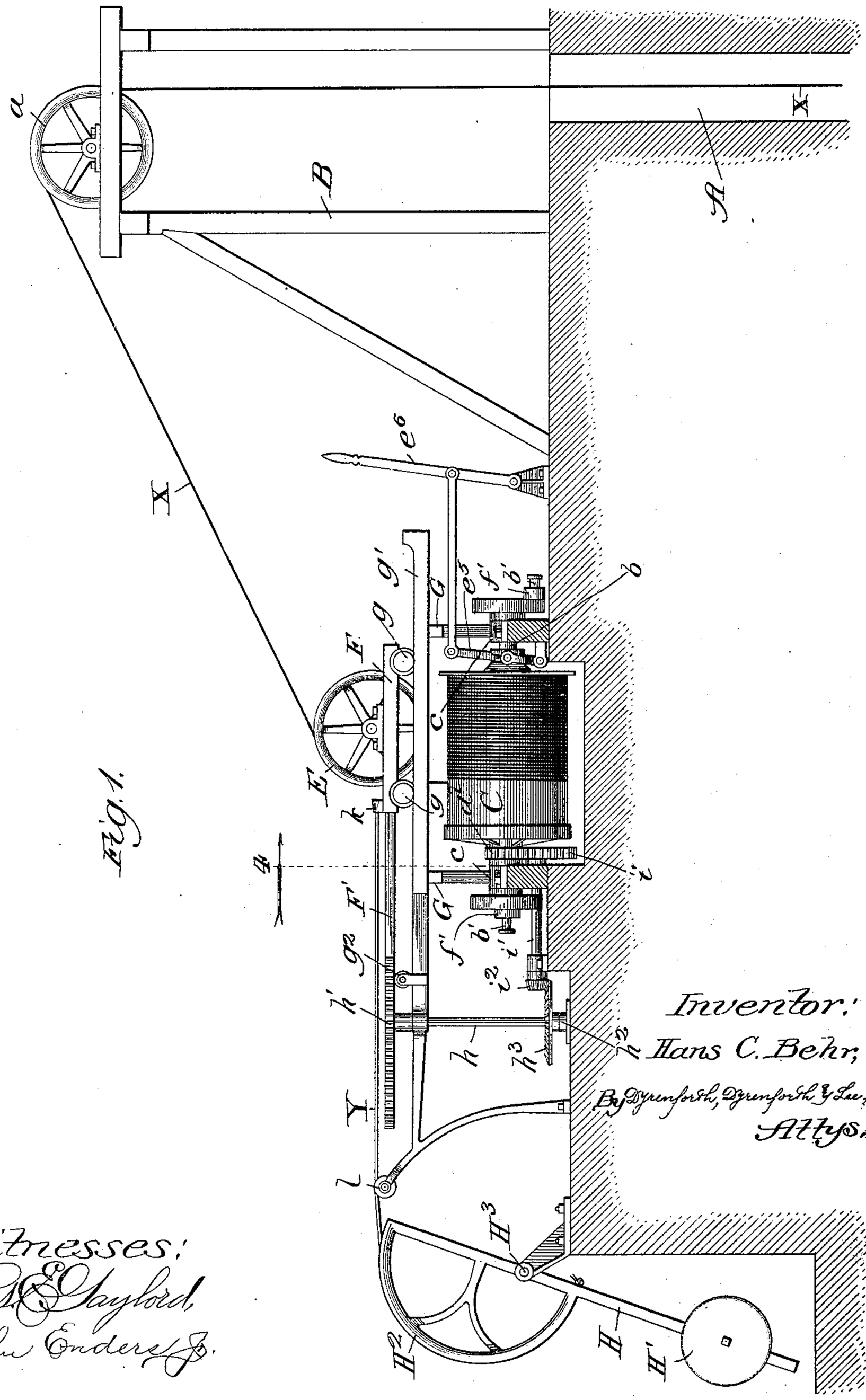

Fig. 1.

Witnesses:
Chas. E. Gaylord,
John Enders Jr.

Inventor:
Hans C. Behr;
By Dyrenforth, Dyrenforth & Lee,
Attys.

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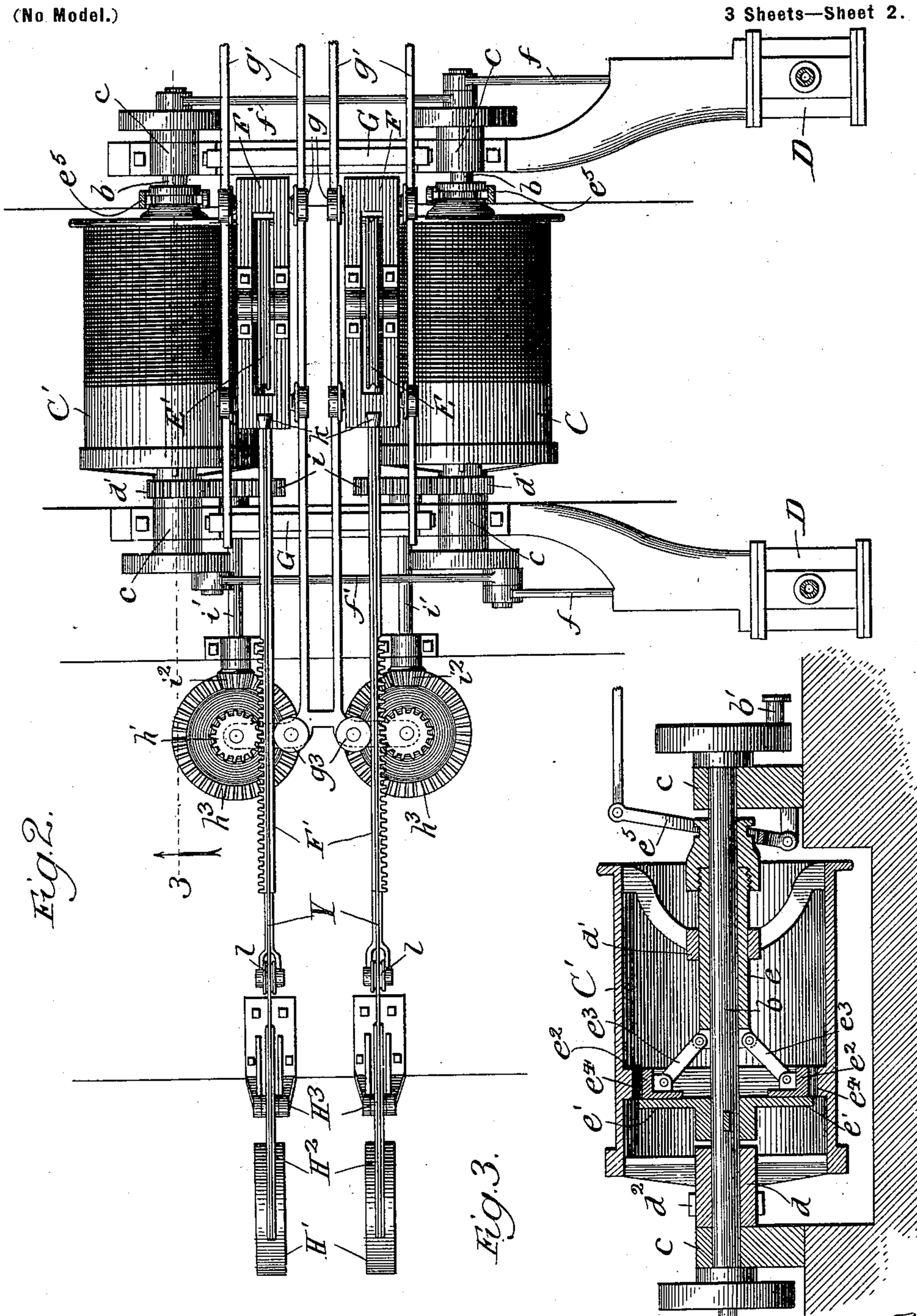

Fig. 2.

Fig. 3.

Witnesses:
Chas. E. Gaylord.
John Enders Jr.

Inventor:
Hans C. Behr,
By Dyrenforth, Dyrenforth & Lee,
Attys.

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(No Model.) 3 Sheets—Sheet 3.

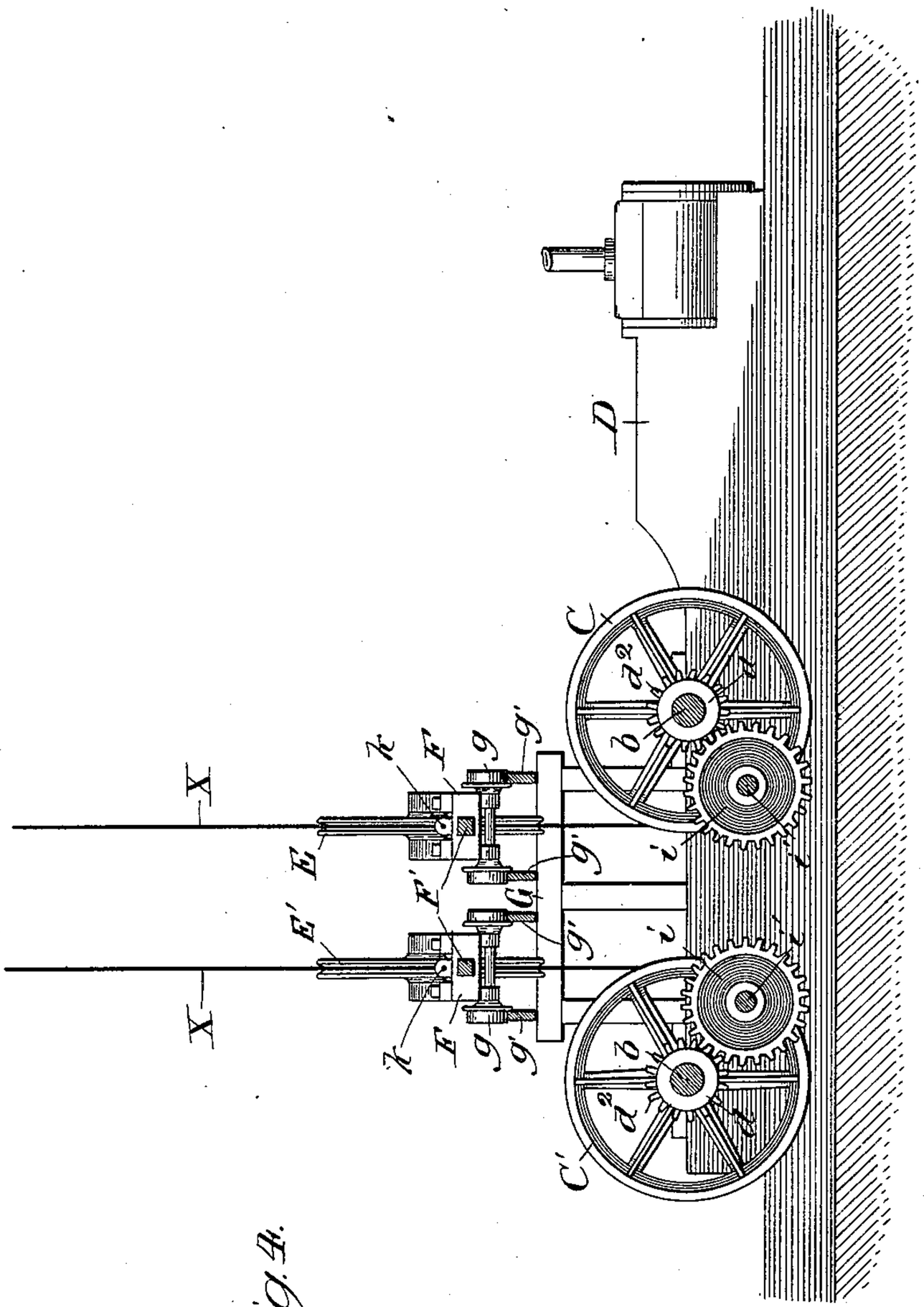

Fig. 4.

Witnesses:
Chas. E. Gaylord.
John Enders Jr.

Inventor,
Hans C. Behr;
By Dyrenforth, Dyrenforth & Lee,
Atty's.

UNITED STATES PATENT OFFICE.

HANS C. BEHR, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR TO THE FRASER & CHALMERS, OF CHICAGO, ILLINOIS.

HOISTING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 662,163, dated November 20, 1900.

Application filed June 25, 1900. Serial No. 21,487. (No model.)

To all whom it may concern:

Be it known that I, HANS C. BEHR, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented a new and useful Improvement in Hoisting Apparatus, of which the following is a specification.

My invention relates to improvements in hoisting machinery of the class employing multiple drums for use in hoisting from two or more adjacent shaft-compartments of a mine. In machines of this character it is preferred to employ round ropes winding in single layers upon the respective drums, for the reason that single-layer winding has been found to be the best for preventing wear and tear of the ropes. In connection with deep mines it is necessary to provide drums possessing large winding-surfaces, produced either by providing them of large diameter or of smaller diameter and correspondingly-increased length. There is an objection to employing drums of very large diameter on account of the necessarily large driving-engines or expensive or otherwise objectionable intermediate gearing they render necessary, and while drums of comparatively small diameter and increased length are preferred to drums of larger diameter for the reasons stated it has always been a matter of difficulty to cause the rope to wind thereon in an even single layer and without such friction at the drum or sheaves as will produce undue wear of the rope.

My object is to provide hoisting apparatus involving two or more hoisting-drums of an improved construction in which the ropes will be caused to wind in a single layer and lay on and pay off smoothly and without wear upon the ropes; and my object is, further, to provide improved counterbalancing mechanism which will relieve the driving mechanism of the rope guide-sheave from the weight or greater part of the weight of the rope extending down the shaft of the mine and its fixed load.

In carrying out my invention I provide two or more hoisting-drums, with their axes parallel and their winding-faces lying in or nearly in the plane of rotation of the pit-head sheaves, over which the ropes are led from the drums on their way to the different shaft-compartments. I also prefer to provide the drum-carrying shafts with double cranks and coupling-rods connecting the shafts, whereby they will be rotated in unison from the same engine. I also provide a separate guide-sheave over each drum, mounted in a carriage geared to the driving mechanism to travel along the drum, causing the guide-sheave to travel at its rope-leading face in a plane vertical and tangential with relation to the drum, whereby in traversing the rope guide-sheaves the ropes will be properly guided onto the drums, while the planes of rotation of the rope guide-sheaves will be the same or nearly the same as those of the corresponding pit-head sheaves.

Referring to the drawings, Figure 1 is a sectional elevation of my improved hoisting mechanism; Fig. 2, an enlarged top plan view of the same constructed with two hoisting-drums and their operating mechanisms; Fig. 3, a still further enlarged longitudinal section through one of the drums, the section being taken on line 3 in Fig. 2; and Fig. 4, an enlarged section taken on line 4 of Fig. 1.

A is one of a pair of shaft-compartments of a mine, deep well, or such like bore of underground work. Over the mouth of the shaft is a gallows-frame B, carrying a pit-head sheave *a*, central over each hoisting-compartment.

C C′ are hoisting-drums, and *b b* are the drum-shafts. The drums may be mounted as shown most clearly in Fig. 3. Each drum-shaft *b* is journaled toward opposite ends in bearings *c* and is provided at each end with a crank *b′*, the cranks being at right angles to each other. The drum at one end is supported by a trunnion *d*, loose upon the shaft, and at its other end is supported by a trunnion *d′*, loosely surrounding a longitudinally-sliding sleeve *e*. In order that the drums may be thrown independently into and out of operation, clutch mechanism is provided between each shaft *b* and its drum, and this clutch mechanism may consist of the bar or disk *e′*, keyed to the shaft, and shoes e^2, sliding against said disk and connected by toggle-links e^3 with the sleeve *e* to be slid into and out of clutching engagement with the friction-face or clutch member e^4 of the

drum. The clutch may be operated by lever mechanism e^5, extending to an operating-handle e^6. Any suitable clutch mechanism may be employed between the shaft and drum, and I do not herein limit my invention to or lay any claim to the construction of the clutch mechanism shown. The shafts are driven from an engine, and in the present connection I show two engine-cylinders D D at opposite ends of the drum, having connecting-rods f, going to the cranks b' of the shaft of the drum C. Coupling-rods f' extend from the cranks of the shaft of the drum C to the cranks on the shaft of the drum C', whereby the shafts are operated in unison from one engine.

Above the drums C C' in planes tangential, or nearly tangential, thereto are the guide-sheaves E E', which divert the ropes X to the drums, said ropes being the hoisting-ropes leading up from the shaft-compartments over the pit-head sheaves a down to the guide-sheaves E E'. Each guide-sheave is mounted upon a carriage F, having wheels or rollers g, which travel upon tracks g' on a frame G, extending horizontally and longitudinally over the adjacent side portions of the drums. Each carriage F carries a horizontally-extending rack F'. Each rack is engaged by a pinion h' on the upper end of a vertical shaft h, journaled at its lower end in a bearing h^2 and at its upper end in the frame G. The rack may rest upon a guide-wheel g^2 on the frame and is held in engagement with the pinion h' by a horizontal guide-wheel g^3. Motion is given to the carriages from the respective drums through any suitable gearing between the pinions h' and drums, and the gearing for this purpose shown in the drawings comprises gear-teeth d^2 upon the trunnions d, engaging gears i upon shafts i', carrying beveled pinions i^2, engaging beveled gears h^3 on the shafts h. The gears between the drums and carriages are such that the guide-sheaves will be moved longitudinally of the drums a distance corresponding approximately with the width of the rope X, employed in each revolution of the drum. The relation between the drums is such that as one is winding up a rope the other is causing its rope to pay out. The strain upon a carriage F under the pull of the rope X naturally increases as the rope lengthens in descending the shaft and decreases as the rope shortens in rising out of the shaft. It is very desirable that this strain shall be equalized as far as possible, and thereby relieve the operating mechanism from all strain except that exerted by the ore or other load to be raised from the shaft. The counterbalancing mechanism for the rope which I prefer to employ consists of a variable lever H, provided on its long arm with an adjustable weight H' and having a short arm H^2 in the arc of a circle eccentric with relation to the pivot or fulcrum H^3 of the lever. A rope or cable Y is fastened at one end to the carriage at k and extends over a guide-wheel l on the frame G and over the curved face of the short arm H^2 of the lever. Thus as the carriage moves away from the lever H it tends to swing the weighted end H' toward the horizontal plane, and at the same time its engagement with the short arm of the lever moves gradually nearer the fulcrum H^3. The resistance or counter pull of the lever upon the carriage thus increases as the rope X pays out from the drum and diminishes as the rope is laid onto the drum to counterbalance more or less nearly the increasing and diminishing pull of the rope X.

While I have shown my improvements in connection with two parallel cylindrical drums, they are applicable with equal benefit to frusto-conical drums. When the latter are employed, the tracks g' may extend at an angle to each other corresponding with the angles of the winding-faces of the drums, whereby the guide-sheaves will move at their rope-leading faces in planes tangential, or nearly so, with relation to the drums, while rotating in planes corresponding with those of the pit-head sheaves to prevent wear upon the ropes, and while I have shown but two drums additional drums may be provided for additional shaft-compartments and all may be operated from the same engine through additional connecting or coupling rods. If desired, the drum-shafts may have but a single crank at one end or a double crank at one end instead of one at each end, as shown, and the engine would be provided accordingly.

While I prefer to construct my improvements throughout as shown and described, they may be variously modified as to details of construction without departing from the spirit of my invention as defined by the claims.

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

1. In a hoisting apparatus, the combination with a pit-head sheave, of a hoisting-drum, a shaft on which the drum is mounted having its axis parallel or approximately so to the plane of said pit-head sheave, a track above the drum extending parallel with the rope-leading face thereof, a carriage on the track, a rope guide-sheave on the carriage extending approximately in the plane of the pit-head sheave, and rack-and-pinion propelling mechanism for the carriage actuated from the drum to move the rope guide-sheave at its rope-leading face in a plane approximately tangential with relation to the rope-leading face of the drum.

2. In a hoisting apparatus, the combination with the pit-head sheaves, of parallel drum-shafts coupled together to work in unison, drums on the shafts provided with toothed trunnions, engaging and releasing clutch mechanism between the shafts and their drums, tracks above the drums, carriages on said tracks, rope guide-sheaves on the carriages extending approximately in the planes of their companion pit-head sheaves, and rack-and-pinion propelling mechanism for each

carriage actuated from the trunnions of the respective drums to move the rope guide-sheaves at their rope-leading faces in vertical planes approximately tangential with relation to the rope-leading faces of the respective drums.

3. In a hoisting apparatus, the combination with a hoisting-drum, a rope guide-sheave movable along the drum and a traveling carriage on which said sheave is mounted, of variable-lever rope-counterbalancing mechanism connected with the carriage and operating to increase resistance to movement of the carriage as the rope pays out from the drum and decrease said resistance as the rope is wound upon the drum, substantially as and for the purpose set forth.

4. In a hoisting apparatus, the combination with a hoisting-drum, a rope guide-sheave movable along the drum and a traveling carriage on which said sheave is mounted, of variable rope-counterbalancing mechanism comprising a lever, fulcrumed between its ends to swing in a vertical plane, having a weighted arm and a curved arm describing an arc eccentric with the fulcrum, and a rope connecting the carriage with the curved surface of said arm and fastened to the lever, substantially as and for the purpose set forth.

HANS C. BEHR.

In presence of—
D. W. LEE,
A. D. BACCI.