(No Model.)

J. A. CALDWELL.

CRANE.

No. 284,274. Patented Sept. 4, 1883.

Fig. 3.

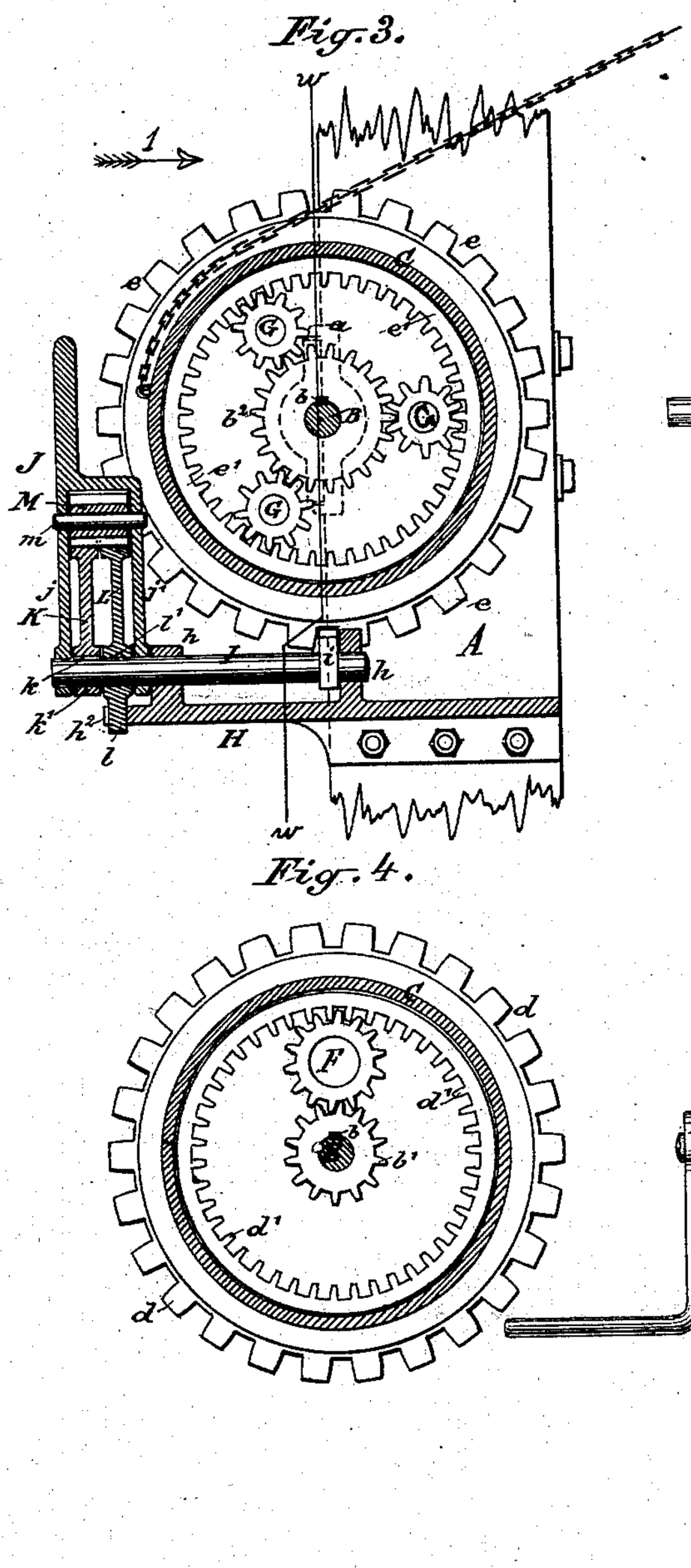


Fig. 4.

Fig. 1.

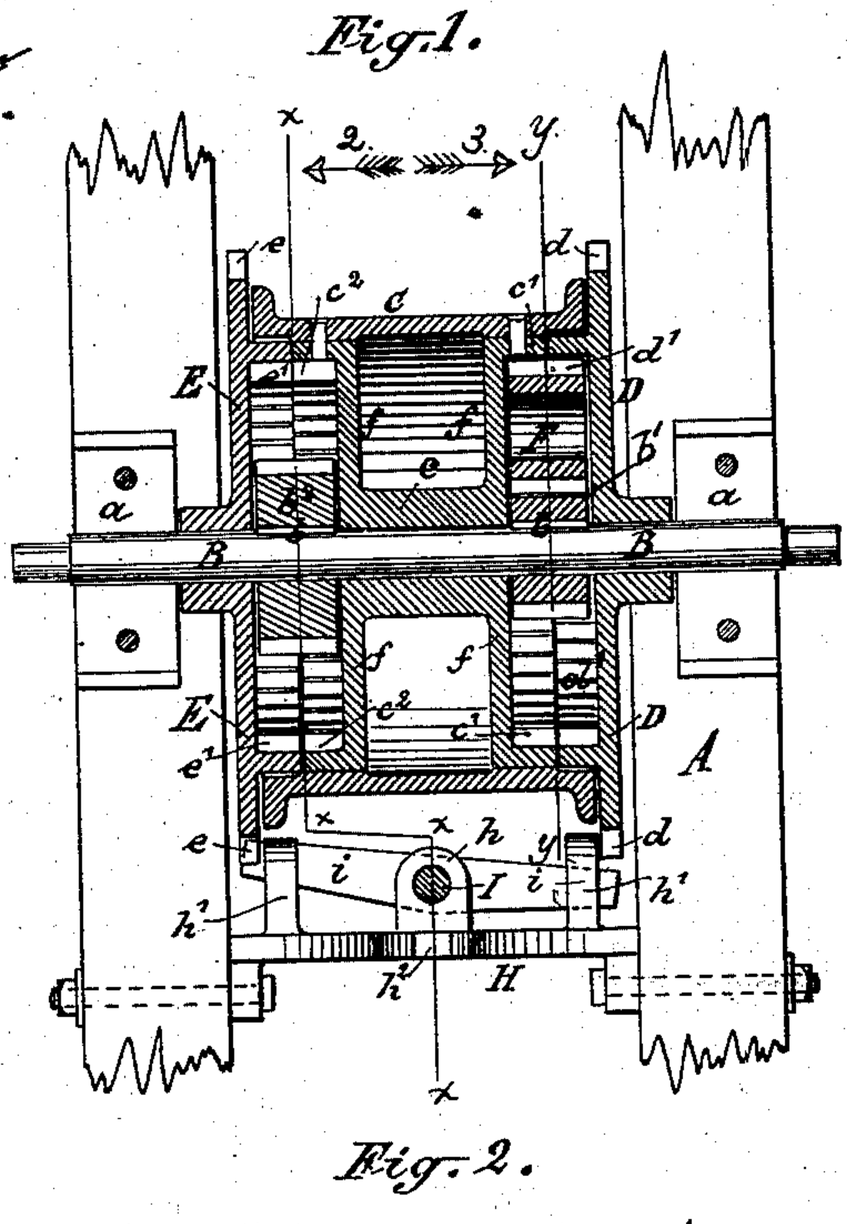
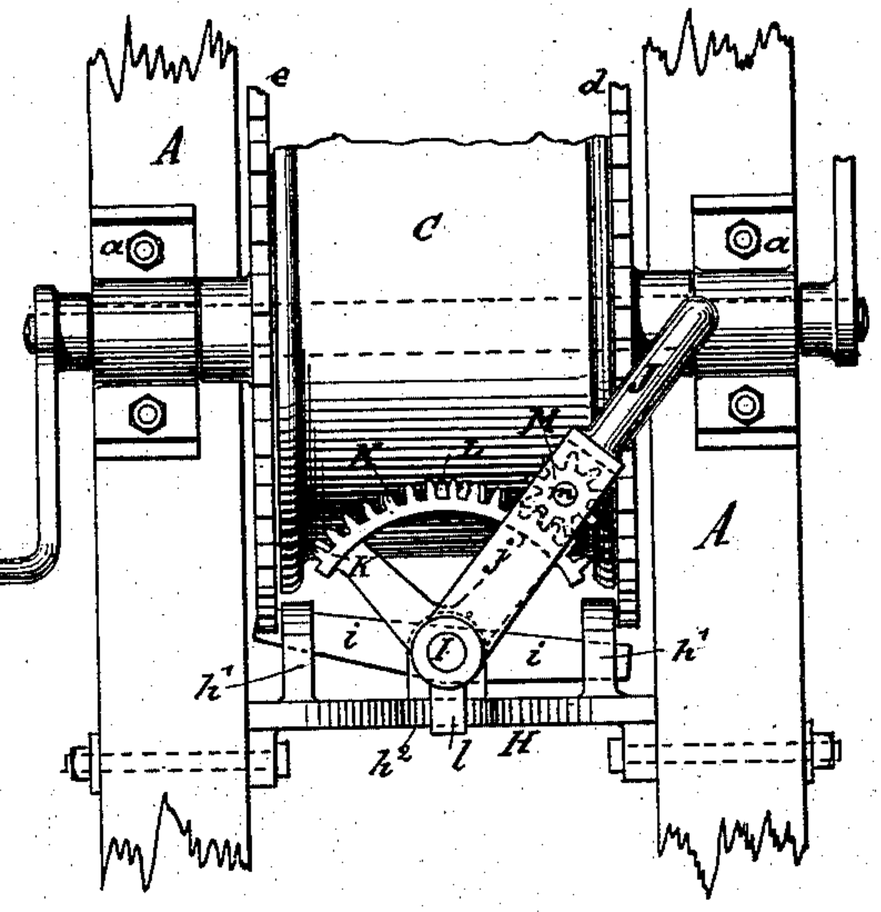


Fig. 2.



WITNESSES:

Edward Schofield

Robt. W. Matthews

INVENTOR

John A. Caldwell

BY A. W. Almqvist

ATTORNEY

UNITED STATES PATENT OFFICE.

JOHN A. CALDWELL, OF BAY RIDGE, NEW YORK.

CRANE.

SPECIFICATION forming part of Letters Patent No. 284,274, dated September 4, 1883.

Application filed June 2, 1883. (No model.)

To all whom it may concern:

Be it known that I, JOHN A. CALDWELL, a citizen of Great Britain, and a resident of Bay Ridge, in the county of Kings and State of New York, have invented certain new and useful Improvements in Cranes, of which the following is a specification.

The object of my invention is to provide an improved construction of apparatus for raising and lowering weights, whereby a great weight can be raised by the application of a very small power; and it relates particularly to such hoisting apparatus in which, with slow speed, great power is gained by the combination of two cog-rings having different numbers of teeth, and a pinion arranged to mesh with its teeth into those of the said two cog-rings simultaneously, the teeth of the pinion thus acting as a wedge, so to speak, between the teeth of one of the said cog-rings and those of the other, thus causing them to revolve slowly in opposite directions.

The invention consists in the construction and combination of the various parts, by which a difference in speed and effect is gained and power changed from fast to slow, and vice versa, &c., as will be hereinafter described and claimed.

In the accompanying drawings, Figure 1 represents a sectional elevation of my improved crane, the section being taken on the line *w w* of Fig. 3, and seen in the direction of arrow 1. Fig. 2 is a front elevation of the same. Fig. 3 is a cross-section of the same, taken on the broken line *x x* of Fig. 1, and seen in the direction of arrow 2. Fig. 4 is a similar section of the same, taken on the line *y y* of Fig. 1, and seen in the direction of arrow 3.

Like letters of reference indicate like parts in the several figures.

A represents timbers or a portion of the frame-work, to which are attached bearings *a*, in which bearings is mounted the shaft B of my hoisting apparatus, which is operated by winches (or pulleys) attached at the ends of the said shaft.

C is the hoisting-drum or chain-drum, which, by its hub *c*, is mounted to revolve loosely upon the shaft B. Cast together in one piece with the hub *c* are circular disks *f*, having continuous flanges upon their edges and cogs upon the inside of the said flanges, thus forming internally-geared wheels $c' c^2$, to and around the outside of which is secured the circumferential casting of the drum C, as shown in Fig. 1. The gear-wheels $c' c^2$ have both the same number of teeth—say forty-two teeth. Adjacent to the gear-wheels $c' c^2$ are similar toothed flanges, $d' e'$, cast upon the circular disks D E, respectively, which disks, by their hubs, are mounted to revolve loosely upon the shaft B, and the said disks D E have upon their outer circumference teeth or notches to form stop-wheels *d e*, for the purpose as will presently appear. The parts, when put together as in Fig. 1, are kept in their relative positions by the fact that the hubs of the disks D E fill the space between the bearings *a*. Upon the shaft B is fastened, by a key, *b*, the pinion b', which, by means of an intermediate idler, F, is constantly in gear with the wheels $d' c'$, the teeth of the said idler F meshing into the teeth of the said two wheels simultaneously. Upon the shaft B is also keyed a pinion, b^2, which, by means of three intermediate idlers, G, is kept in constant gear with the teeth of the wheels c^2 and e', the teeth of the said idlers G meshing into the teeth of the said two wheels $c^2 e'$ simultaneously. It is evident that if the disks D E are allowed to rotate with the shaft no effect is gained for hoisting purposes; but if one of them be stopped and retained stationary the teeth of its cog-ring will act as the fulcra upon which to move the drum-wheel by means of the pinion and idler, and thus the weight may be raised. Let us now suppose that the disk E is left free to revolve with the shaft B, and the disk D is held by some outside means and prevented from turning, and, further, let the wheel d' have forty-three teeth and the pinion b' be one-third of the diameter of the wheel d'. It is evident, then, that the pinion b' will make three revolutions while the idler F makes one convolution around the center of the shaft B, and as the wheel c' has forty-two teeth the difference in movement between the wheel c' and d' for one convolution of the idler F will be only the space of one tooth. It will thus take $3 \times 42 = 126$ revolutions of the shaft B and pinion b' to cause one revolution of the drum C.

The effect being inversely proportional to the velocity, the gain is thus 126 to 1. We will now suppose that the disk D be allowed to move freely with the shaft, and that the disk E be locked, so as to prevent it from turning, and that the wheel e' has forty-five teeth, and the pinion b^2 is one-half of the diameter of the wheel e'. It will then be clear that the shaft B and the pinion b^2 will make two revolutions while the three idlers will have made only one convolution each around the center of the shaft B. The wheel c^2 having forty-two teeth, and the wheel e' having forty-five teeth, as aforesaid, it only takes one-third of one convolution of the idlers G to advance the drum the space of one tooth, and consequently, as two revolutions of the pinion b^2 cause a movement through the space of three teeth, and $42 \div 3 = 14$, we have the effect gained on that side of the machine equal to $2 \times 14 = 28$, or twenty-eight turns to one, or a gain of 28 to 1. Now, in order to utilize the difference between the gains of power obtained at the opposite sides of the drum, it is only necessary to provide suitable means for alternately stopping or retarding the motion of the flanges D E. For this purpose I have designed the following shifting apparatus: In bearings *h* upon a bracket, H, secured in any suitable manner to the frame or timbers A, as shown in Fig. 1, is mounted a shaft, I, upon which shaft is secured a lever, *i*, extending on opposite sides of the shaft and arranged to engage with its ends into one or the other of the notches *d* and *e* of the flanges D E, respectively, by the rocking of the shaft I. Upon the front end of the shaft I are fitted, by their bored hubs k' l', two cog-segments, K L, having different numbers of teeth, the segment L being thus fitted upon the shaft, but kept from turning with the latter by having a tail or projection, *l*, entered in a notch, h^2, in the frame H, and the other segment, K, being secured by a key, *k*, upon the shaft, so as to always move with the latter.

J is a handle, which is formed in one piece with a U-shaped bracket, *j* j', having bored hubs, by which it is pivoted upon the shaft I, in the manner shown in Fig. 3, so as to inclose the two segments K L.

M is a pinion pivoted in gear with the two segments K L upon a pin, *m*, which is secured to the bracket *j* j', as shown in Fig. 3, so that when the handle J is oscillated upon the shaft I the said pinion M, in traversing the surface of the segments K L simultaneously, will shift the position of the same laterally, according to the difference in the numbers of teeth. The said difference is only great enough to insure that the one end of the lever *i* will always be in contact with the stops *d* *e*, respectively, of the disks E D, while the other is out of such contact.

It is evident that when it is desired to throw one side of the machine in gear and the opposite side out of gear, it is only necessary to move the hand-lever J in position to interlock the lever *i* with that side of the machine which is intended to be thrown into gear. It is evident that any construction of the handle J other than that described will act just as efficiently, so long as one of the segments K L is secured upon the shaft I and the other segment kept stationary, and the pinion M, pivoted to the handle, is kept in gear with both segments. It is also evident, from the construction described, that it is not necessary to provide any special means for retaining the handle J in any position, as the friction due to the differential gear and the small difference between the numbers of teeth on the segments is amply sufficient to retain it in any position desired, as against any power for which the crane may be used.

The shaft B may be stationary, (and serve only to support the crane,) and the drum, pinions, and disks mounted on a sleeve revolving upon the said stationary shaft, in which case, of course, the winches or pulleys should be attached to the ends of the said sleeve, which latter, consequently, would then serve all intents and purposes of the shaft B.

The racks K L may be made straight instead of segmental, so long as one of them is kept stationary and the other secured to the shaft I or to an equivalent stopping-bar, the movement of the bar effected by the rotation of the pinion M being rectilinear instead of circular, as when segments are used.

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

1. In a crane or hoisting apparatus, the combination, with a revoluble shaft and with two wheels having different numbers of teeth and mounted to turn upon the said shaft, of a pinion secured upon the said shaft and an intermediate wheel or idler gearing into the said pinion and into the aforesaid two wheels having different numbers of teeth, means being provided to prevent one of the latter wheels from revolving with the said shaft.

2. The combination of the revoluble shaft B, the pinions b' and b^2, secured upon the said shaft, the drum C, free to turn upon the said shaft, and provided with the internally-toothed gears d' and e', arranged to revolve upon the said shaft, and having different numbers of teeth from those of the gears c' and c^2, respectively, the intermediate wheels, F and G, convolving with the said pinions b' and b^2, respectively, and means for alternately stopping the motion of the gears d' and e', the gearing between the pinions b' b^2 and their respective gear-connections being proportioned to effect a difference in speed, substantially as and for the purpose set forth.

3. In a crane or hoisting apparatus dependent for its operation at a variation of speed upon the alternate retention at rest of two movable parts, D E, having suitable stops, *d* *e*, the combination, with such movable parts and with a retainer, *i*, arranged to engage with the said stops, of the rock-shaft I, the two racks

K L, having different numbers of teeth for equal lengths on the racks, one rack being stationary and the other movable with the said rock-shaft, and the pinion M, movable in gear with both of the said racks or segments simultaneously, substantially as and for the purpose set forth.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 10th day of May, 1883.

JOHN A. CALDWELL.

Witnesses:
A. W. ALMQVIST,
ROBT. W. MATTHEWS.