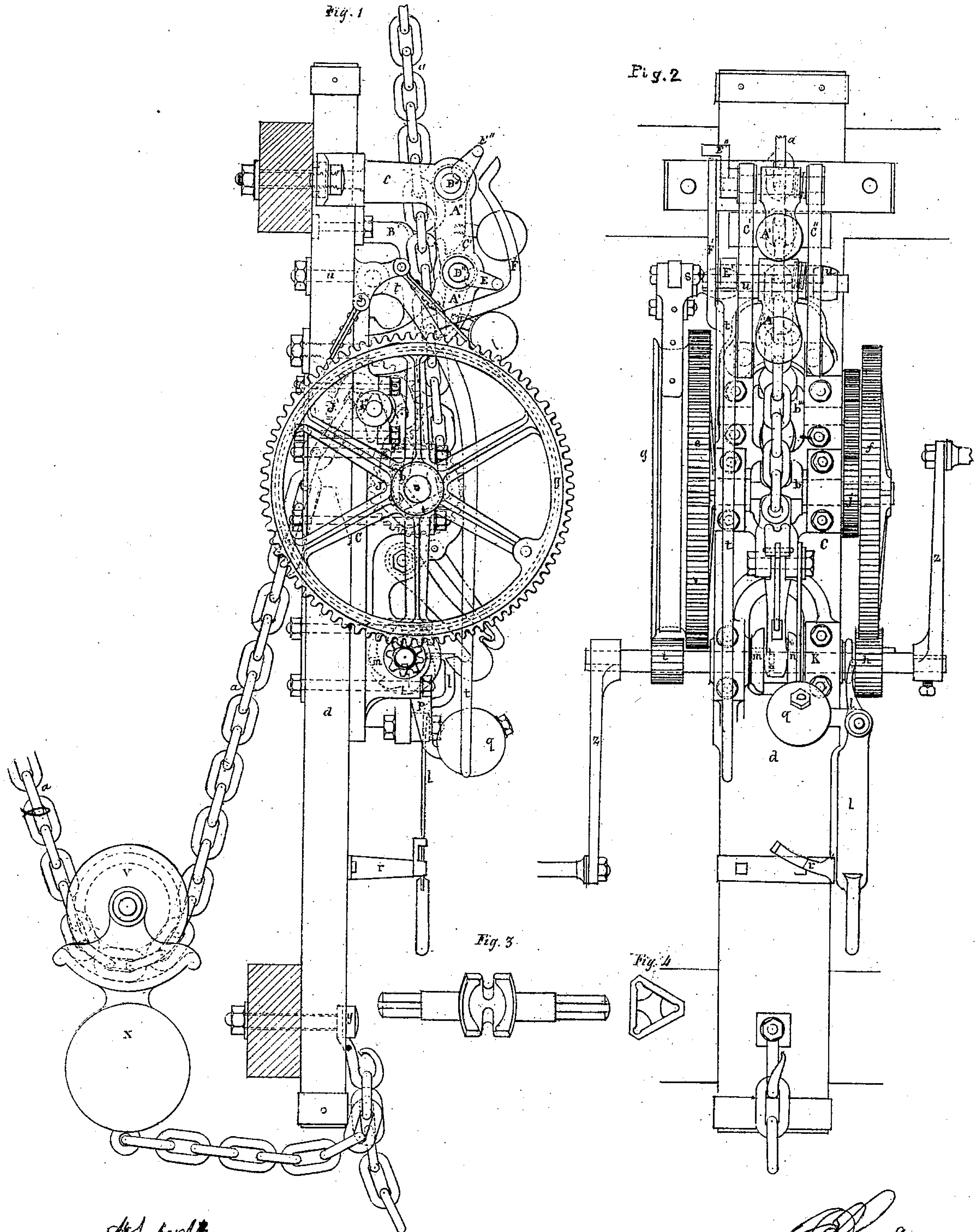
4 Sheets. Sheet 1.

E. H. Bernier,

Elevator.

No. 90,810. Patented June 1, 1869.



E. H. Bernier, 4 Sheets, Sheet. 2.

Elevator.

No. 90,810. Patented June 1, 1869.

Fig: 3 Fig: 4 Fig: 5

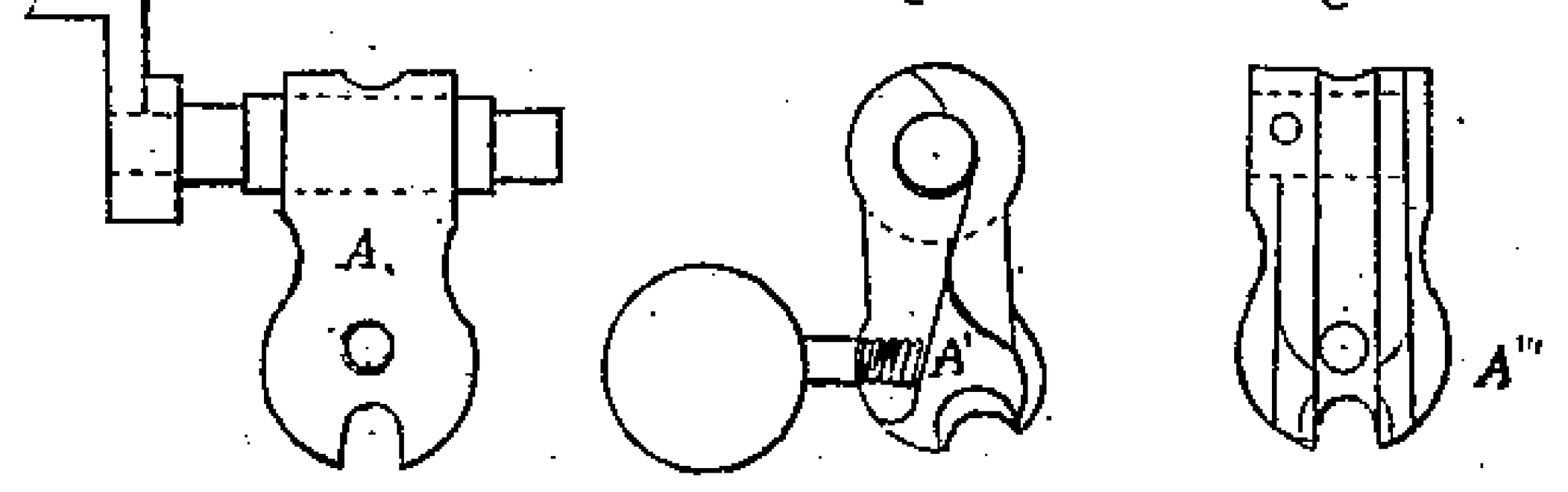


Fig: 2.

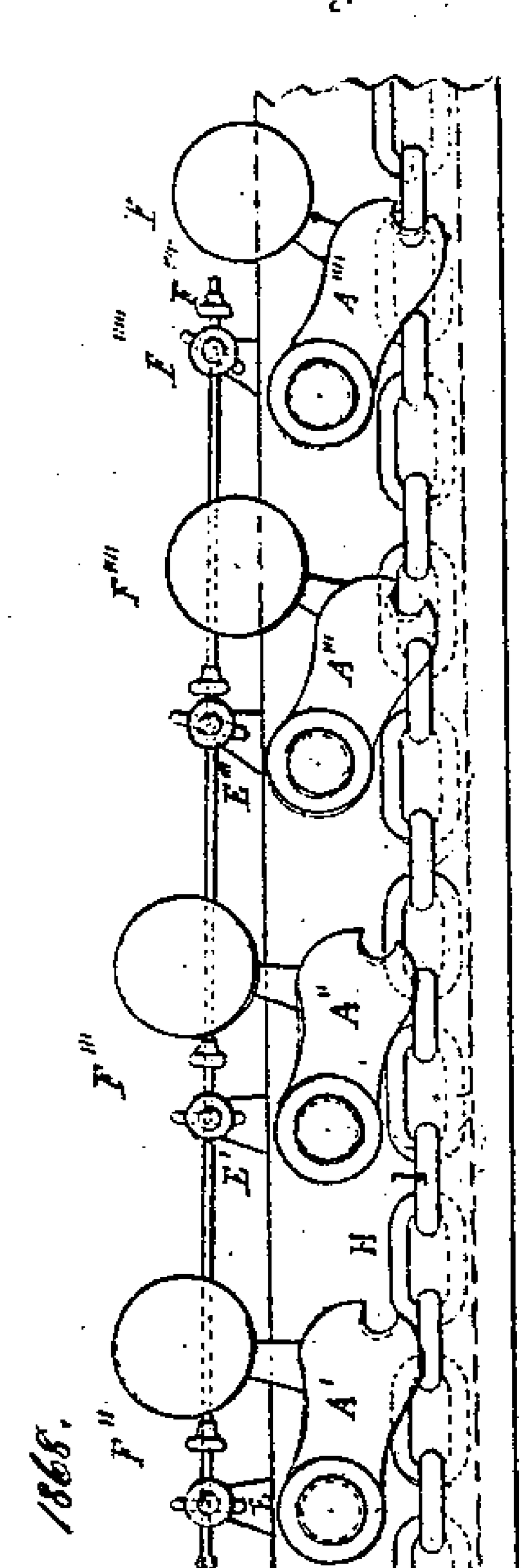
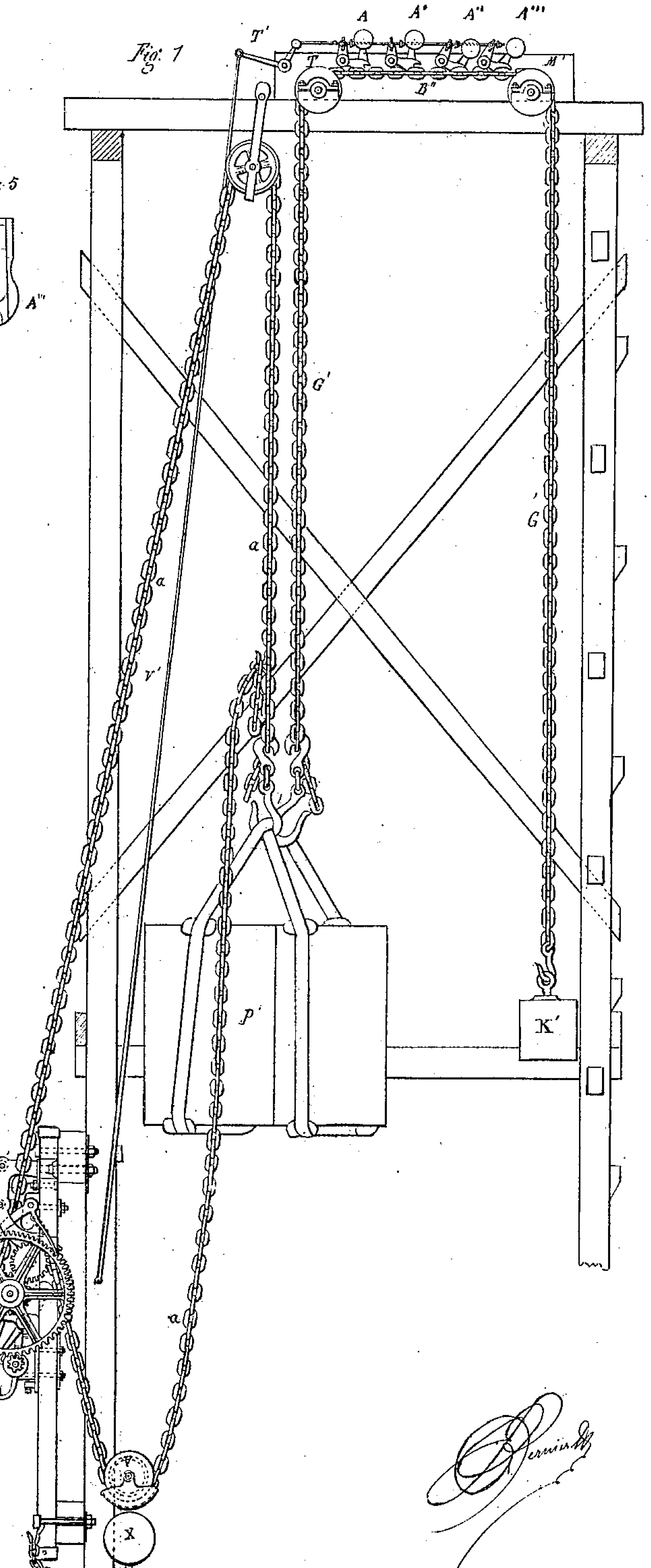


Fig: 1

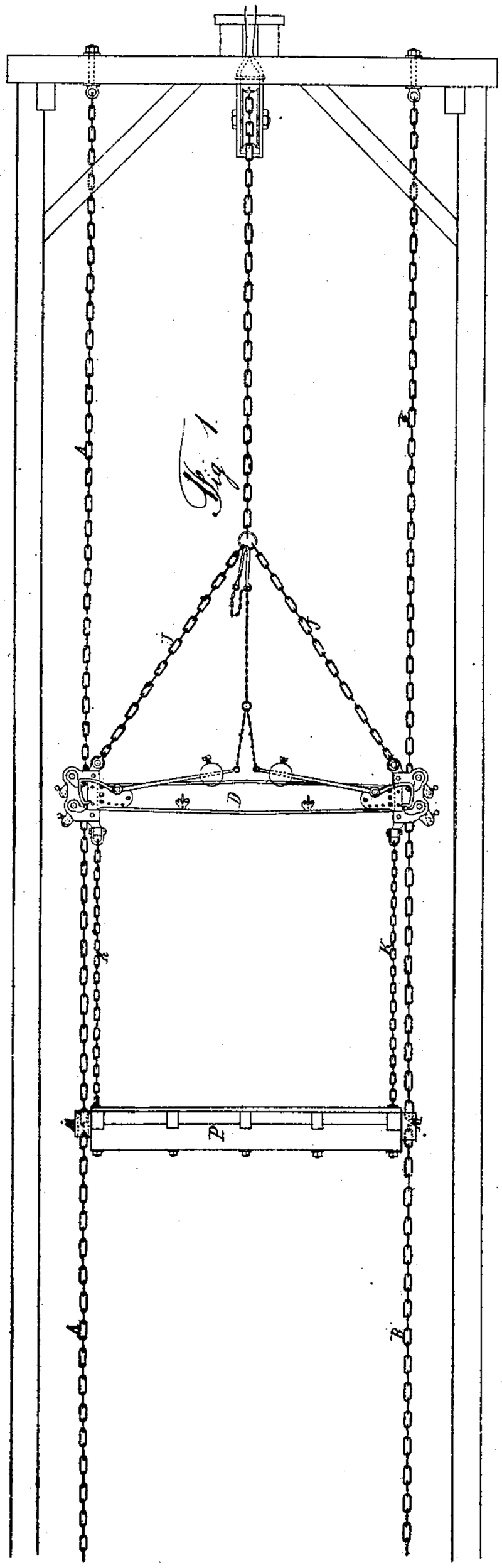


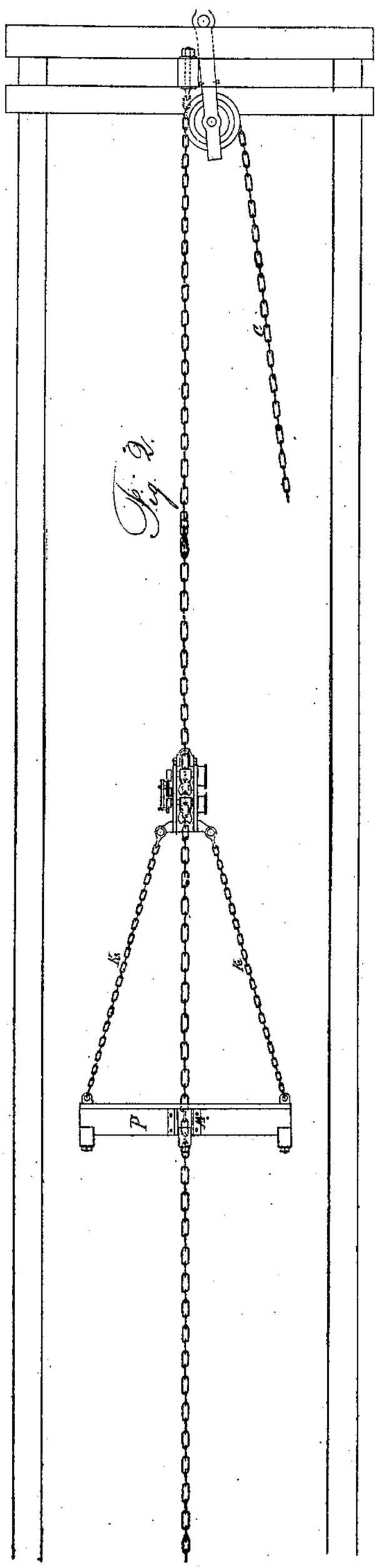
E. H. Bernier,

4 Sheets, Sheet. 3.

Elevator.

No. 90,810. Patented June 1. 1869.





Witnesses:

H. Dufour

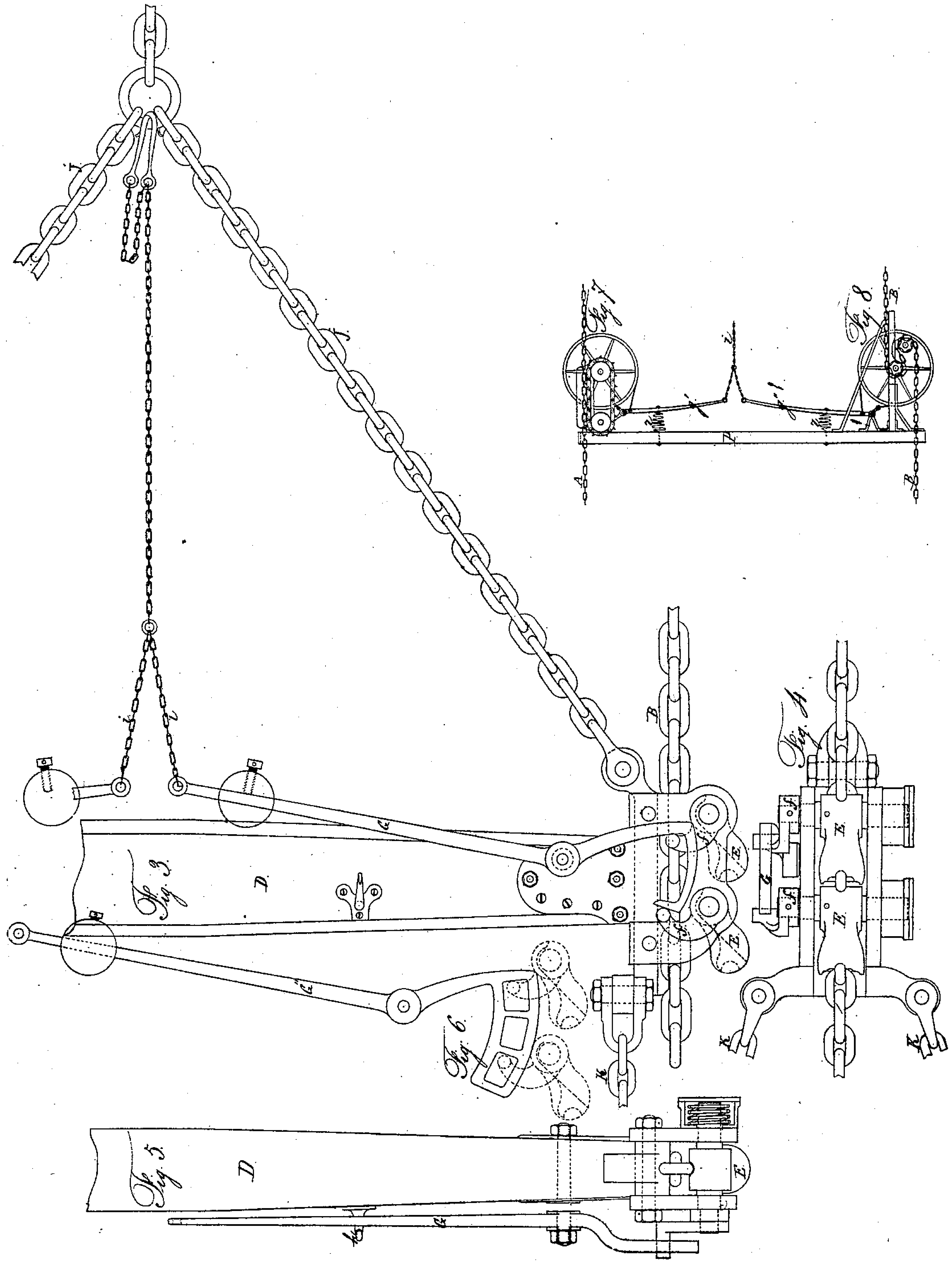
E. H. Bernier

E. H. Bernier,

4 Sheets. Sheet 4

Elevator.

No. 90,810. Patented June 1. 1869.



N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

United States Patent Office.

EUGÈNE HENRI BERNIER, OF PARIS, FRANCE.

Letters Patent No. 90,810, *dated June* 1, 1869.

IMPROVEMENT IN HOISTING-APPARATUS.

The Schedule referred to in these Letters Patent and making part of the same.

To all to whom these presents shall come:

Be it known that I, EUGÈNE HENRI BERNIER, of Paris, in the Empire of France, civil engineer, have invented certain Improvements in Winches and Safety-Apparatus for Raising and Lowering Bodies, parts of such improvements being applicable to raising and lowering persons and loads in mines; and that the following is a full, clear, and exact description of the principle or character which distinguishes it from all other things before known, and of the usual manner of making, modifying, and using the same.

The first part of my improvements consists in the application, to winches or crabs, with a single nut, of three new parts, which are—

First, a second nut similar to the first.

Secondly, a safety stretching-guide.

Thirdly, a double self-acting apparatus, for holding the load in case of accident or wrong working.

The adherence of the chain on the single nut gives rise to considerable friction on the cast-iron frame, from which it results that the chain has a tendency to get displaced, and that the deep bites impair the chain, wear out the frame, and put the nut out of shape; besides, the chain is delivered from the winch or crab with shocks, and in an irregular manner.

To obviate these defects, I roll the chain round two similar nuts, turning in opposite directions, and driven, one by the other, by the intermediate agency of two pinions of the same diameter.

The double nut has the advantage of having seven links of the chain instead of three, on which the action is distributed, and consequently produces a greater regularity in the movement and economy of motive-power, as the rolling friction of the nuts is very slight in comparison with the sliding friction for which it is substituted.

To avoid ruptures, which are of frequent occurrence, through the violent return of the chain into the nut when loads are let down at a great speed, or from any other cause, and to prevent the chain, by reason of the rapid descent of the load, from being presented in kinks or crosswise, I have invented a simple arrangement, which I call safety stretching-guide, for forcing the chain, whatever its speed, to keep always in the same direction, and to pass, slightly stretched, and straight, into the winch or crab.

The use of this stretching-guide placed at the foot of the winch, and composed of a grooved pulley, V, mounted freely above a suspender-weight, X, is especially necessary in winches or crabs not provided with the self-acting apparatus, preventing any fall of the load, whatever may be the wrong working. The use, however, of the safety stretching-guide, contributes to the superiority of the action, even in winches provided with the self-acting safety-apparatus.

The double self-acting apparatus may also be applied in combination with other apparatus for raising bodies than to my improved winch, and may also be applied separate from the winch by acting on a separate safety-chain, which can be applied for raising weights in the building-trade, or as a safety-apparatus above shafts of mines, and in all cases where additional safety is deemed necessary, its application being universal as a means of safety to prevent the fall of loads.

Description of the Drawings.

In sheet 1—

Figure 1 is a side elevation of the winch or crab.

Figure 2, front elevation of the same.

Figure 3, front view of the principal triangular nut.

Figure 4, sectional view of the same.

In sheet 2—

Figure 1 shows the winch complete, with safety-chain mounted on a timber frame.

Figure 2, details of the four catches mounted on the safety-chain.

Figures 3, 4, and 5, views of the safety-apparatus.

In figs. 1 and 2, sheet 1, the iron calibred chain *a* is rolled round two triangular nuts, *b b‴*, mounted on a cast-iron frame, C, firmly bolted on a timber piece, *d*.

The motive-nut is forged of one single piece with its axle which carries two large cog-wheels, *e f*, of different diameters.

On one of these wheels, *e*, is cast the pulley *g* of the brake, which serves to retard or stop the descent movement, either when the driving-pinion is cogged with its wheel, or when the nuts and the wheels are independent of the pinions and crank-arms by the uncogging of the two pinions *h i*.

The axle of the motive-nut also carries a small wheel, *j*, which communicates motion to the second nut *b‴*, by another wheel, *j′*, similar to the wheel of the motive-nut.

The driving-shaft K, mounted on the cast-iron frame C, which carries the nuts, is provided with two pinions, *h* and *i*, one of which, *i*, fixed and forged with the shaft, drives the brake-wheel *e*, giving the greatest strength and small speed.

On this shaft, movable in the longitudinal direction, which allows of its being displaced at will, is mounted slideways the other pinion *h*, which gives motion to the wheel *f*, for lighter loads, and acting at a great speed.

This latter movable pinion is kept in its cogged or uncogged position by the fork *l*, which does not prevent it from turning with its shaft, by which it is drawn by means of a key fixed on the shaft and slideways in the groove of the pinion.

A small ratchet-wheel, *m*, mounted slideways, in the same manner as this latter pinion, on the movable

shaft, serves to retain the motive-wheels by the intermediate action of the cogged pinion, and this ratchet, as well as the pinions and crank-arms *z z'*, ceases to act when the mechanism is set to lower at a great speed, which must always take place when the hook of the chain, having reached a certain height, is lowered in order to reduce the time of the operation and avoid turning back the crank-arm. I effect this by means of the brake.

The shaft of the driving-pinions has two circular grooves, *n o*, the use of which consists in receiving the key *p*, loaded with a weight, *q*.

This key is inserted in the groove *n*, if it is desired to uncog the pinion *i*, for the small speed, and to cog or not the movable pinion *h*. It is engaged, on the contrary, in the groove *o*, if it is desired to uncog the movable pinion *h*, and cog the fixed pinion *i*. The key with a counterweight is lifted by hand to let the shaft which is pushed with the other hand slide longitudinally to put it in the required position, which being effected, the key is dropped and forthwith engaged in the corresponding groove.

The fork *l*, of the movable pinion, carries a flat lever, acting as a spring, and which can be kept in one or other of the two positions which are regulated by the support *r*, which serves as a stop to it.

The axle of the brake carrying the hinges *s s*, of the ring and the lever *t*, oscillates in two iron supports, *u u*, bolted on the wooden part *d* of the winch or crab.

To put on the brake, the lever *t* is drawn towards the operator, and the brake is released by itself as soon as this lever is dropped.

The action of the safety stretching-guide serves to keep the chain *a* stretched in the direction which it should always occupy to properly work.

This chain carries at one end the hook of the load, and the other end is united by a hook, having the form of an **S**, above the hook of the load, to form an endless chain.

This stretching-guide is suspended by a chain, at a few inches above the ground, to the foot of the winch or crab.

It is composed of a grooved pulley, V, turning on the axle fixed in the cap or top of the cast-iron weight X, underneath which is a small chain, one end of which is attached to this weight by a strong screw-ring, and the other end is fixed to the winch by the bolt *y*, which carries a hook, over which one of the links of this chain is passed.

The machinery mounted in the upper part of the winch, consists of a double self-acting parachute, serving to prevent the fall of loads in case of accidents which might happen to the winch in consequence of wrong working or other cause.

This system of self-acting parachute consists of two strong forged-iron catches, A' A'', formed in such a manner as to be able to be engaged in the intervals of the links of the chain, so as to retain the chain in case of any involuntary back movement.

The chain is thus caught by one or the other of the catches, and is held between the clenched catch and the grooved buffer, or chain-guide, B', firmly fixed on the winch or crab. The two catches A' A'' oscillate freely on the chain when the load is going up. They are fixed on axles, the pivots of which are mounted on the two large forged-iron supports C' C'', which are firmly fixed to the winch by screw-nuts.

On the left side of the winch, near the brake, the axles of the catches D' D'' carry each a small lever, E' E'', for receiving the abutment of the elbowed branch F', of the lever of the brake *t*, so that when the brake is worked, the catches of the parachute may be raised to allow the recoil of the chain when it is desired to effect the descent either of the load, of the hook, or of the chain.

As soon as the brake ceases working, the catches of the parachute fall on the chain ready to work.

The standards C' C'', and the buffer B', represented of forged iron, may be made of a single cast-iron piece well strengthened in all its parts.

Application of my System of Self-Acting Parachute to a Safety-Chain.

Fig. 1, sheet 2, represents a winch with a safety-chain, G', mounted on timber-work.

In this application a safety-chain may be combined with an apparatus for raising, of any kind, such as a crane, windlass, horse-mills, crabs, capstans, or any other like apparatus, either with a chain, a rope, or otherwise.

The object of the self-acting parachute is to keep the load in the air in case of the breaking of the raising-apparatus, or of its rope or chain.

The parachute with its safety-chain may be applied in a great many cases; for instance, when loads or persons are to be raised in the shafts of collieries or other shafts, or in the raising of heavy or precious materials, such as marbles, statues, columns, and other articles in the construction of monuments; it may also be applied to raising on inclined planes.

Although the parachute may work with a chain with equal links, and rather long, I have represented in the arrangement shown at figs. 1, and 2, sheet 2, a safety-chain, the links of which, edgeways, H', are longer than the links flatways, I', to give more strength and more play to the catches A' A'' A''' A'''', in the intervals of the links.

The iron chain G', of large calibre, is fastened to the load P', at one end, by means of a hook or other means, and is drawn away at the other end by means of the counterweight K'. It can freely follow the load in passing in the safety-apparatus mounted on the upper part of the timber-work.

The frame of the safety-apparatus carries two grooved pulleys, L' M', to send back the chain at its entrance and at its egress.

This frame carries four stop-catches, A' A'' A''' A'''', arranged so that the thread of the chain G' is so subdivided that each catch is lowered alternately on the links edgeways, to be ready to keep back the flat link which has just passed. By this arrangement of four catches, the stop is almost instantaneous, as one or other of the catches is always completely fitted into the chain, and the least recoil is sufficient to make it bridle.

In this arrangement, if the chain *a*, which raises the load P', happened to break, all the load would lie upon the safety-chain G', and, in consequence, would cease to rise until the repaired chain is replaced.

To effect the descent either of the load or of the hooks, and raise the counterweight K', it is necessary to raise the four catches from the safety-chain to allow the free recoil of this chain.

For this purpose, each catch carries a small lever, E' E'' E''' E'''', at the end of which is a rather large hole, in which passes a small rod provided with four buttons, F'' F''' F'''' F'''''

The end of this rod corresponds to a small elbowed lever, T', which carries, at the end of the other branch, a small cord, or chain, V'.

By drawing this cord, all the catches are slightly raised simultaneously, and it is merely necessary to release this cord, which rises a few inches, to let the catches descend on the safety-chain, when it is desired to lift the load.

My improvements consist, secondly, of the arrangements of safety-apparatus, shown in sheets 3 and 4, and especially applicable to raising and lowering persons and loads in mines.

In this arrangement, however, the safety-apparatus is movable, and travels with the weight in its ascent or descent, and the chains on which it acts are fixed.

I employ one or several fixed safety guide-chains, connected at their upper part, and, if required, permanently fixed at their lower extremities. In this case, a cross-piece and a platform, or recipient of any kind, serving to raise the materials, or persons, is provided with as many supporting stop-catches as there are safety-chains in the apparatus.

These frames, which may be made indiscriminately to carry one or several catches, according as required to divide the space between two links of the chain, travel with their stop-catches in ascents and descents.

During the ascents, the stop-catches may be let down on the safety-chains, and act upon them with slight friction, producing, by their passage on the chain, slight oscillations.

Besides a small counterweight fixed on each stop-catch, a spring is fixed either on its axis, or on the catch itself, to assist in insuring the catching of the catch on the chain, although, if required, the spring, or the small counterweight suffices.

The safety-apparatus may be used in two different ways during ascents, either by keeping the catches raised, and not oscillating on the chains, as shown in the accompanying drawing, or by letting down the levers holding the catches, when the catches will oscillate on the links. In this case, the catches take at once into the safety-chains at the least slackening of the suspension-tackle, arising either from a wrong working of the raising-apparatus, or the breaking of its cable, and the weight remains suspended. In the first case, when the catches are raised only, the rupture of the chain allows of the apparatus instantaneously stopping, any wrong working in the raising-apparatus producing no effect on the safety-apparatus, as a slackening of the suspension is required.

Security is so much more complete from the stop being always instantaneous, no speed, proceeding from the commencement of a fall, being able to accelerate the descent of the load, as the fall can only be, at the maximum, very little, varying according to the number of catches employed to subdivide the link of the chain.

The stopping-catches should be forcibly held raised during the descents, so that they cannot hook into the chains.

Sheet 3 shows the most simple mode of keeping the catches raised, by rendering them part of the suspension-tackle. By means of a small chain, I raise the large levers, which prevent the catches from acting. This chain is kept fast by the suspension-chain, but in case of the rupture of the cable, the chain, being no longer held, allows the levers to fall, and the catches immediately clutch the safety-chains. The large levers may also each have at their extremities, on the same side as the chains, a small counterweight, or spring, to force them to fall suddenly. The cranked part of each of the large levers, serving to work the small levers of the catches, may be placed so as to force the catches to rise when the large levers are raised, and to force the catches to clutch when the large levers fall back with an excess of play, the difference of which leaves an interval sufficient for the oscillating movement of the catches on the chain, if they are required to act during the ascent.

To obtain this result, it is merely necessary to regulate the position of the large levers by the elongation or shortening of the hook-chains adapted to the suspension-chain.

In my improved construction of safety-apparatus, with fixed chains, I have the double advantage of preventing falls of the weights, and also of having, by means of the tightened chains, a good guide for preventing any deviation of the weights, for the frames of the catches work in grooves on the chains, and hold fast either the cross-bar, the platform, or recipient, and the tub, in a regular and rigid position on a level.

I have, besides, the advantage of stopping the platform of the safety-apparatus at any part of its play, and leave it at rest, which allows of loading or unloading the platform or recipient without its moving or swinging.

Besides these guides, obtained by means of the frames of the stop-catches, according to the arrangement of the suspension-tackle adopted, I can fix, either above or underneath the catch-frames, metal guides, through which the chains pass.

The annexed drawing, sheet 4, shows in detail the construction of a platform provided with two guides, one for each safety-chain.

In the arrangement shown in sheet 3, the safety-apparatus is mounted on the suspension cross-piece, and not on the platform; if, however, three or four chains were employed, no deviation in the position of the platform would take place, and the safety-apparatus could be fixed directly on the platform, or on the cage, and the suspension-tackle be simplified and occupy less height.

If only one chain is employed in the safety-apparatus, it must be placed in the centre, close to the chain, or cable of the winch. If there are two, three, or four chains, I make them as much smaller as there is a larger number of chains, since they contribute together to support the whole load, and I symmetrically arrange them on opposite sides, or at the four angles. The arrangement of four fixed chains, mounted at the centre of the four sides, or at the four angles, is the best and the most convenient for working the loads.

In my improved arrangement of safety-apparatus, obtained in all cases by a catch and spring-work on a fixed movable chain, two conditions must be complied with to produce a regular working, *videlicet*, the obtaining, first, the greatest possible distance between the flat links; secondly, the shortest length possible between the tops of the links of the chain.

In the first case, the catches will have an action as much more certain in proportion as the distance between the links on which they should act is great; and in the second case, the possible recoil of the load will be so much less in proportion as the beforesaid distance between the tops of the links of the chain is shorter.

To attain this double result, I have invented a form of chain composed of long and very short links alternately. In working, the short links will be on their flat sides, and will serve for the butting-place of the catches. These short links, being separated by a long link, the catches will act with much greater certainty, and in spite of the length of this link, I do not materially increase the beforesaid distance, although I increase the distance between the flat links.

In sheet 3, figs. 1 and 2 show front and side elevations of an arrangement of two fixed chains, A and B.

C, chain of the winch.

D, cross-piece, provided with two pieces of framing, each carrying two stop-catches of case-hardened iron.

E E E E, in figs. 3, 4, and 5, sheet 4, are stop-catches, seen in their raised position.

f f f f, small levers fixed on the axes of the catches.

G G″, large cranked levers serving to move the small levers *f f*, to raise the catches.

h h, small hooks for supporting the levers G G″, when the catches E E are hooked on the chains A and B.

i i, small hook-chains to fix the position of the cranked levers G G″, either when it is desired to raise

the stop-catches to descend, or when it is wished to lower the stop-catches on the chains, in order that they may act in them automatically in raising the load.

j j, suspension-chains, uniting the chain of the winch and the two heads of the cross-piece D.

K K K K, chains of the platform P.

M M, guides fixed on the platform, through which pass the fixed chains A and B, for guiding the weights.

Figs. 3, 4, and 5, sheet 4, details of the safety-apparatus on a larger scale.

The same letters of reference in all the figures represent similar parts.

Figure 6, large crank-lever G″, to serve, in case it were required, to force, by means of this lever, the catches to clutch in falling back. This lever would also serve for raising the catches in a similar way to the nearly similar lever G, which it would replace.

Figures 7 and 8, sheet 4, show two means of stopping the chains by the self-tightening action of the brake.

One of these means, fig. 7, sheet 4, consists of two pinions, formed from an endless chain forming a rack. On one of the two pinions a brake-pulley is placed. In this arrangement, the safety-chain A remains straight and vertical in its whole length.

The other means, fig. 8, sheet 4, consists in the employment of two pinions with a double-notched nut, around which the safety-chain B rolls, and on one of the two nuts is a brake-pulley.

In the two modes, figs. 7 and 8, the brakes are loosened by the suspension-chains *i* of the brake-levers, but should a rupture of the chain of the winch take place, the brakes would act directly from the force of the springs *r r*, acting on the small levers *g′ g″*.

Having now described the nature of my invention, and the manner of carrying the same into effect,

What I claim, is—

1. An apparatus for raising and lowering weights, consisting of a frame, C, having mounted thereon the hoisting-gear, constructed as described; a self-acting safety-device, consisting of the stop-catches A′ A″ A‴ A⁗, and the parts connected therewith for operating the same, constructed as described; a guide-stretcher, for the hoisting-chain *a*, composed of the grooved pulley V and a suspended weight, X, and the safety-chain G′, provided with a counterweight, K′, all constructed, arranged, and operating substantially as herein shown and described.

2. The self-acting safety-apparatus, consisting of the stop-catches A′ A″ A‴ A⁗, and the parts connected therewith for operating the same, all constructed, arranged, and operating substantially as herein shown, as set forth.

3. The stretching-guide for the hoisting-chain *a*, consisting of the grooved pulley V and the suspended weight X, constructed and operating substantially as described.

In testimony whereof, I, the said EUGÈNE HENRI BERNIER, have hereto set my hand and affixed my seal, this 23d day of August, 1867.

E. H. BERNIER. [L. S.]

Witnesses:

H. DUFRENÉ,

F. H. GOUPAIRLL.