2 Sheets—Sheet 1.

G. HOUDAILLE.

MACHINERY FOR RAISING FROM MINES.

No. 185,922. Patented Jan. 2, 1877.

Fig. 1.

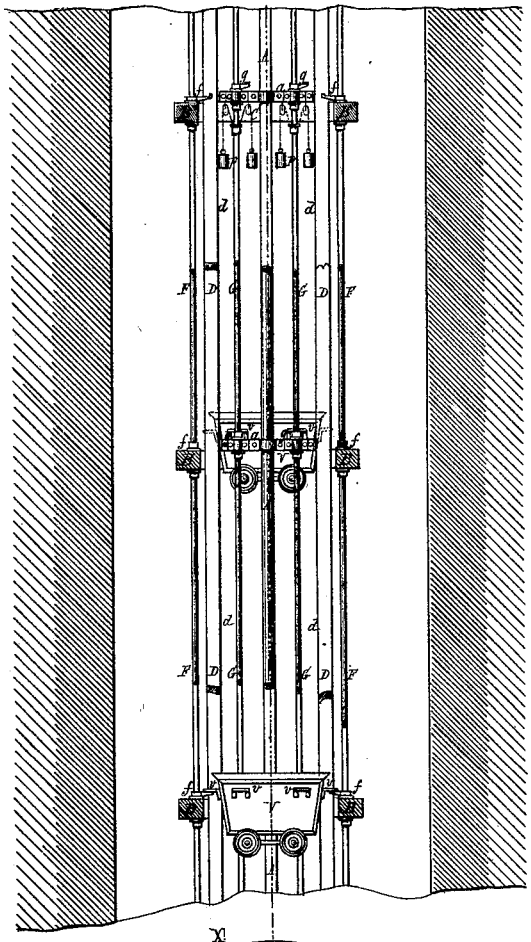


Fig. 3.

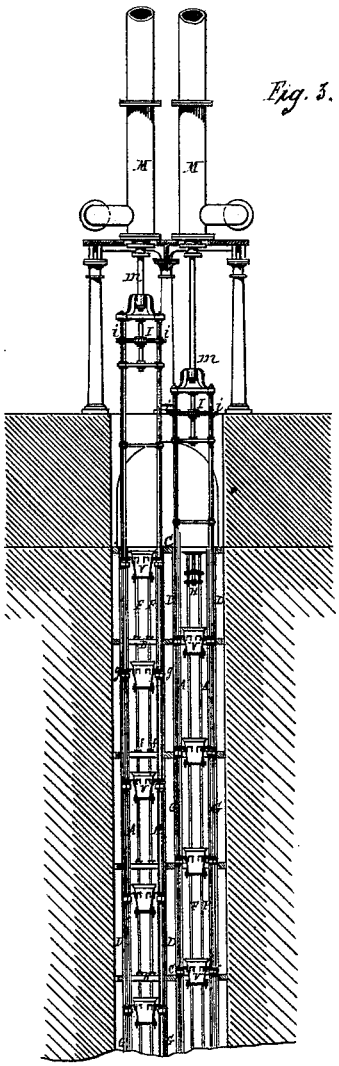


Fig. 2.

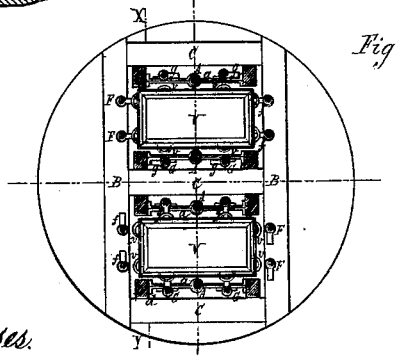


Fig. 4.

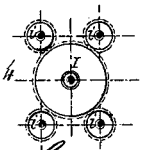
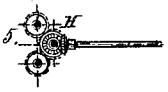


Fig. 5.



Witnesses.

J. W. Shumway

Clara Broughton.

Georges Houdaille
Inventor
By Atty
Thos. G. Earle

2 Sheets—Sheet 2.

G. HOUDAILLE.

MACHINERY FOR RAISING FROM MINES.

No. 185,922. Patented Jan. 2, 1877.

fig. 6

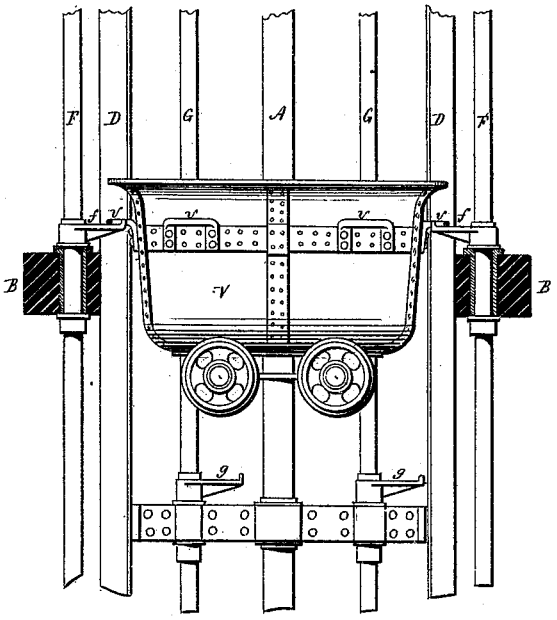
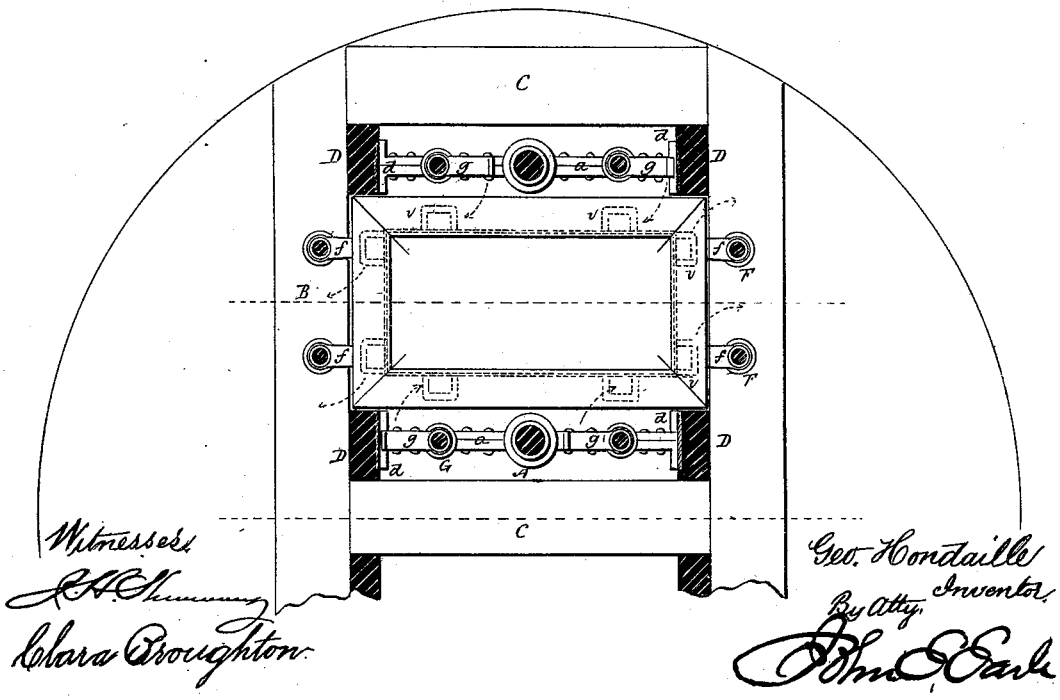


fig. 7



Witnesses:
Edwin Shumway
Edwin Broughton

Geo. Houdaille
Inventor,
By Atty,
Edwin Clark

UNITED STATES PATENT OFFICE

GEORGES HOUDAILLE, OF PARIS, FRANCE.

IMPROVEMENT IN MACHINERY FOR RAISING FROM MINES.

Specification forming part of Letters Patent No. **185,922**, dated January 2, 1877; application filed April 13, 1876.

To all whom it may concern:

Be it known that I, GEORGES HOUDAILLE, of Paris, France, engineer, have invented Improved Machinery for Raising from Mines, of which the following is a specification:

The new machinery for raising from mines, which forms the subject of this patent, is based, like the machines formerly tried by Messrs. Mehu and Guibal, on the principle of reciprocating rods, instead of the ordinary ropes of whimseys, for raising, by successive lifts, trucks loaded with coal or ore. This principle has not as yet been satisfactorily applied, on account of the complexity and defective action of the mechanism proposed for attaching the trucks to the reciprocating rods and alternately detaching them at the required times. It is in respect of the means of such attachment that my system is chiefly distinguished from preceding systems intended for the same purpose.

My invention consists, essentially, in the combination of two sets of horizontal hooks, fitted on vertical spindles, which can be turned through an angle of about ninety degrees on the horizontal plane. It is this partial rotation which causes the said hooks to be protruded or withdrawn to take hold of or to let go the trucks by the handles, with which the latter are provided. The hooks of the one set are connected by their spindles with the reciprocating rods, and move up and down with them, whereby they raise the loaded trucks. The hooks of the other set rest stationary on cross-beams, which divide the shaft into stages, and these hooks hold the trucks until the moving hooks re-engage with them and raise them one stage higher, and so on, from stage to stage.

Having thus explained the principle of my invention, I proceed to describe, referring to the accompanying drawings, the arrangement and action of a lifting apparatus according to my system.

Figures 1 and 2 represent, respectively, a vertical section and a sectional plan of a mine-shaft, showing the action of the rods and their hooks upon the trucks. (An enlargement of the same is shown in Figs. 6 and 7.) Fig. 3 (drawn to a reduced scale) is a vertical elevation of the whole lifting-gear, showing the arrangement of the apparatus on the ground-level for giving the rods their reciprocating movement. In this figure the section of the shaft is taken at right angles to that in Fig. 1—that is to say, on the line X Y of Fig. 2—so as to show the two compartments of the shaft. Figs. 4 and 5 are diagrams, showing, in plan, the gear for working the hooks.

The shaft is, as shown, divided into two rectangular compartments—the one for the ascent of the loaded trucks, and the other for the descent of the empty trucks. In each of these compartments two coupled parallel rods, A A, are caused to reciprocate vertically, for the purpose of raising and lowering the trucks. The shaft is divided in its height into stages by means of the cross-beams B B, secured in its walls. The two cross-beams of each stage are framed together by three beams, *c c c*, against which are fixed vertical beams D D, for guiding the trucks, these vertical beams being faced at certain places with plates *d d* for this purpose. The arrangement for the two compartments of the shaft are similar, so that it is necessary to describe only one set of them—as, for instance, those for the ascending compartment.

F are vertical spindles or shafts, arranged in suitable bearings in the beams B, and to which a partial rotation is imparted by a simple horizontal arrangement of gears near the ground-level, as shown in Fig. 5, that figure representing a plan view of one pair of the vertical shafts F. To these shafts F, at each of the beams, an arm or hook, *f*, is securely attached, and so as to turn with the shafts in a horizontal plane, as indicated in Fig. 7. Preferably, two of these vertical shafts are arranged on opposite sides. On the other two sides, and between the vertical beams D, a vertical or lifting rod, A, is arranged, and so as to move freely up and down, carrying cross-heads *a*, the distance from each other equal to the distance between the beams. At each side of these vertical rods there is arranged a vertical spindle or shaft, G, taking their bearings in the cross-heads *a*, and to which a rotary movement is imparted, similar to that described as by the shafts F, and by means of gearing above, consisting of four pinions, *i*,

with an intermediate gear, I, common to all, as represented in Fig. 4, so that the four shafts G turn together. On these shafts G there are arranged hooks or arms *j*, similar to the hooks *f* on the shafts F, and they turn with the shafts G, in substantially the same manner, and as indicated in broken lines, Fig. 7. The rotary movement of these shafts is intermittent, and this intermittent movement may be produced by any known mechanical movement—as a "tappet." To impart to the vertical rods A a vertical reciprocating movement any suitable motor may be employed; but a very satisfactory arrangement is to place between the motor-engine and the rods A A a hydraulic receiver, which may be, for example, as shown in Fig. 3, a single-acting hydraulic engine. Two hydraulic cylinders, M M, are fixed immediately over the shaft, supported by cast-iron columns, or by a strong wooden framing. The reciprocating rods A A of each compartment of the shaft are fixed to the piston-rods *m m* of those cylinders. The two cylinders may communicate with a single forcing-pump, which gives the necessary pressure for working.

The action of this system is as follows: Each stage of the shaft that is between one set of beams B and the next above should be a little less than the vertical movement of the reciprocating rods A. Suppose a loaded truck, V, to be suspended on the hooks or arms *f* of the shafts F on a lower stage; the shafts G are turned to bring the arms *g* beneath the side handles *v v* on the truck. Then the upward movement of the rods A commences, and by the connection with the trucks through the arms *g* the trucks are raised to the next stage above. In the meantime the shafts F have been turned to turn the hooks *f* out of the path of the ascending truck, and so soon as the ascending truck has been raised one stage—that is, so as to bring the handles *v* on the ends above the plane of the hooks *f*—then the shafts F are returned to bring the hooks *f* beneath the handles *v* on the ends of the truck. Then the vertical rods A descend, leaving the truck supported on the hooks *f*, and in their descent the hooks *g* are turned away, so as to pass below the truck, and when they have reached their lowest position the hooks *g* are again turned inward, and the next hooks above the first that acted will come beneath the side handles *v* on the truck, and on the next ascent the truck will be raised a second stage, and so continuing from stage to stage until it be raised to the top; and while the loaded trucks are ascending in one compartment of the shaft, the empty trucks are descending in the other compartment by a like operation, it only being necessary to rotate the shafts accordingly. Thus the trucks may succeed each other stage by stage.

The rods of the system are composed of several lengths, connected by sockets screwed on their ends, which are made with right and left handed screw-threads. Thus they can be lengthened or shortened, as required, to adjust exactly the positions of the hooks. To render the action of the rods easy and regular, they are balanced at various places by counter-weights *p p*. (See Fig. 1.) Thus, in my system for holding the trucks, a horizontal rotary motion is substituted for the vertical rotary and jointed movement of Mr. Mehu, and for the inclines of Mr. Guibal, thus avoiding clutching arrangements and complications, and so far lessening the risks of fracture and accident.

Instead of employing stationary hooks resting on fixed cross-beams, it may be advantageous, in some cases, to adopt another set of reciprocating rods, working opposite to the first set. This system would have the advantage of increasing the quality of work done, retaining the same speed of movement, and, especially, of detaching the apparatus completely from the walls of the shaft, which is of great importance in soils liable to fall in.

My machinery is partially suited to the shafts of mines having a large production—such as coal-mines; but it may also be of great use in raising ores, and in all cases where numerous loads have to be regularly moved, either vertically or at an inclination.

I desire by the present patent to secure to myself the exclusive property of my new system of raising from mines, founded on the known principle of reciprocating rods; and I claim as constituting the novel and essential features of my invention the following points:

In a hoisting apparatus, the combination of the rotating vertical shafts F, carrying hooks or arms *f*, with vertical reciprocating and rotating shafts G G, carrying similar hooks or arms *g*, the said arms *g* lifting the weight one stage, the said arms *f* receiving and holding the said weight until a second set of arms, *g*, engage the weight and take it therefrom, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

G. HOUDAILLE.

Witnesses:
ARMENGAUD, Jeune,
ROBT. M. HOOPER.