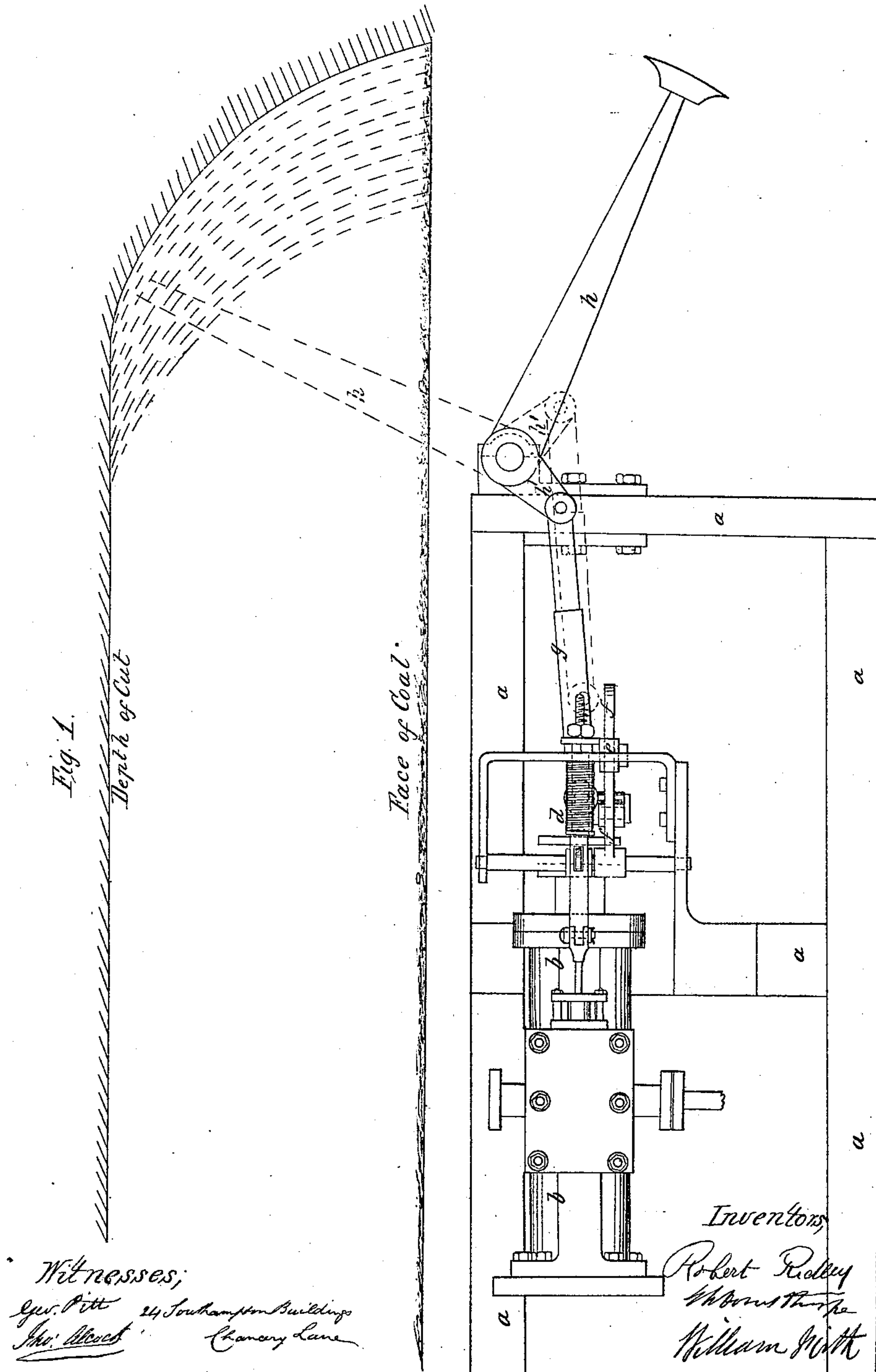


G. E. DONISTHORPE, W. FIRTH & R. RIDLEY.
COAL MINING APPARATUS.

No. 42,724.

Patented May 10, 1864.



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Fig. 2.

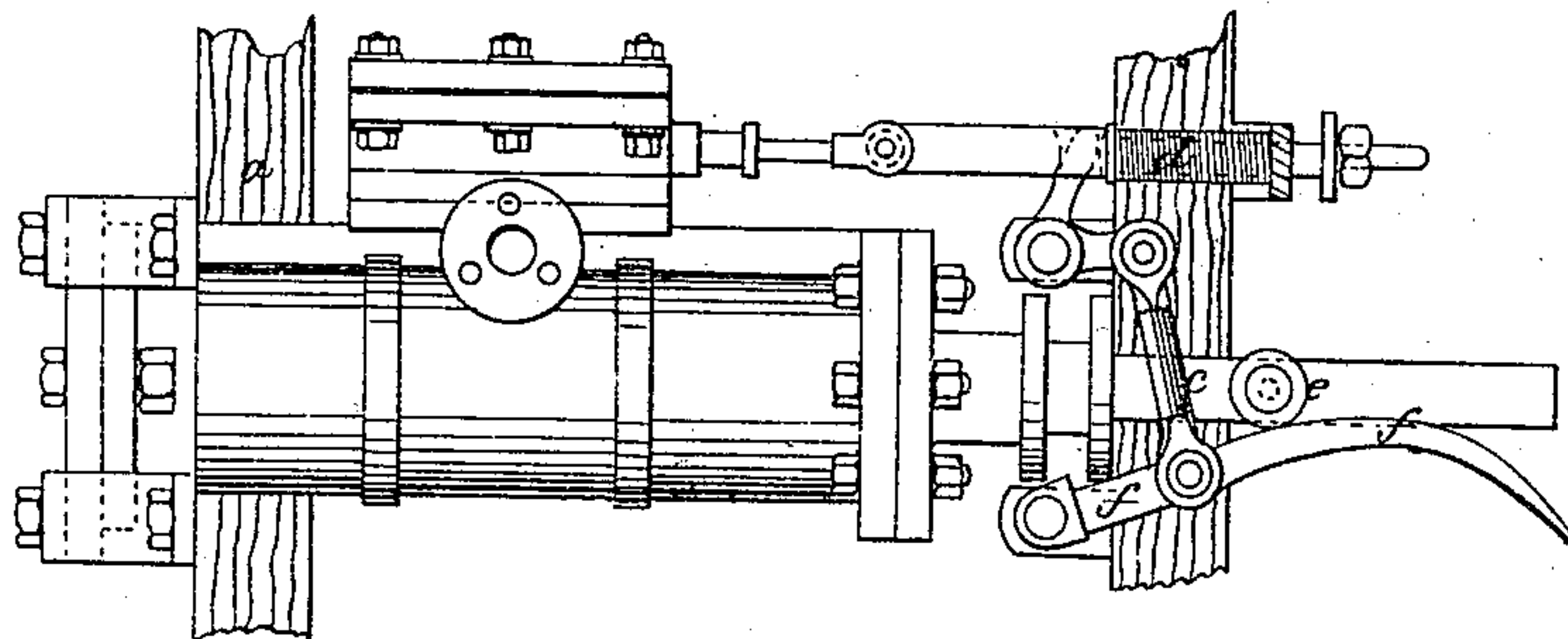


Fig. 5.

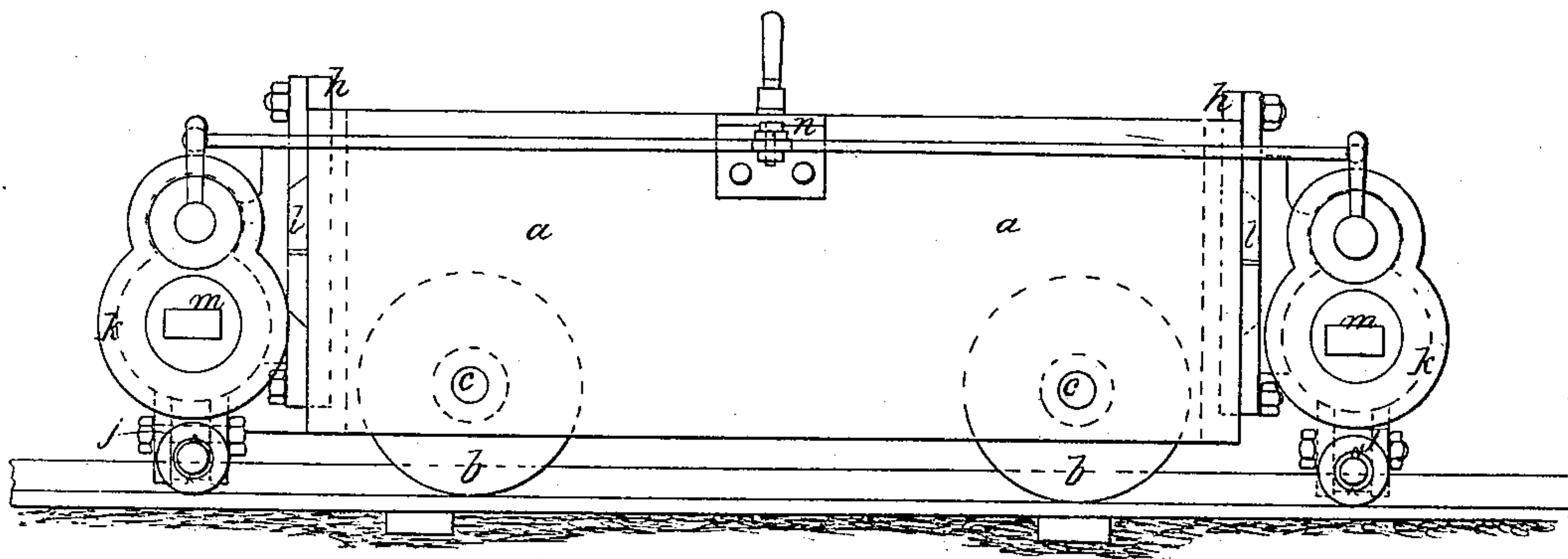
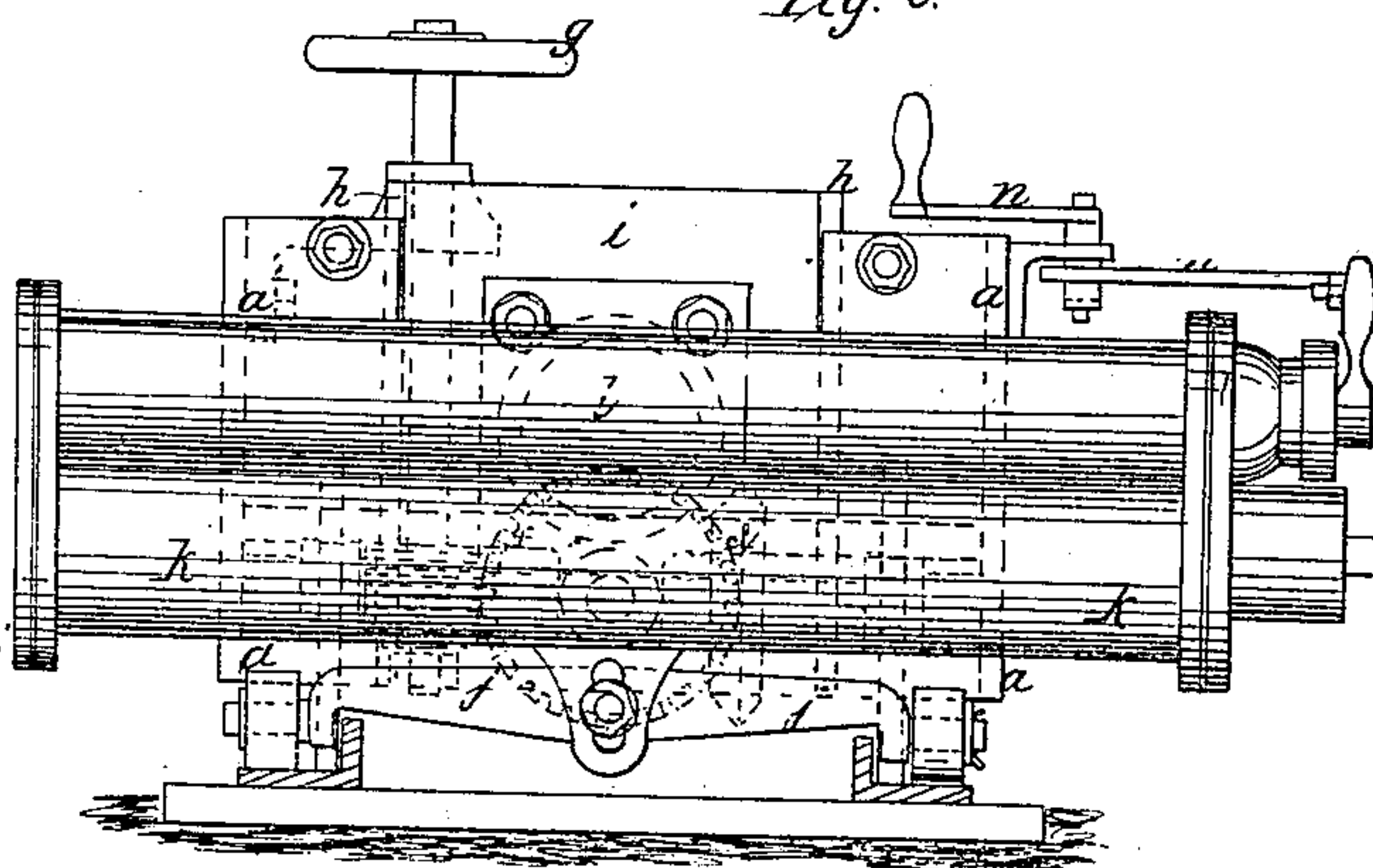


Fig. 6.



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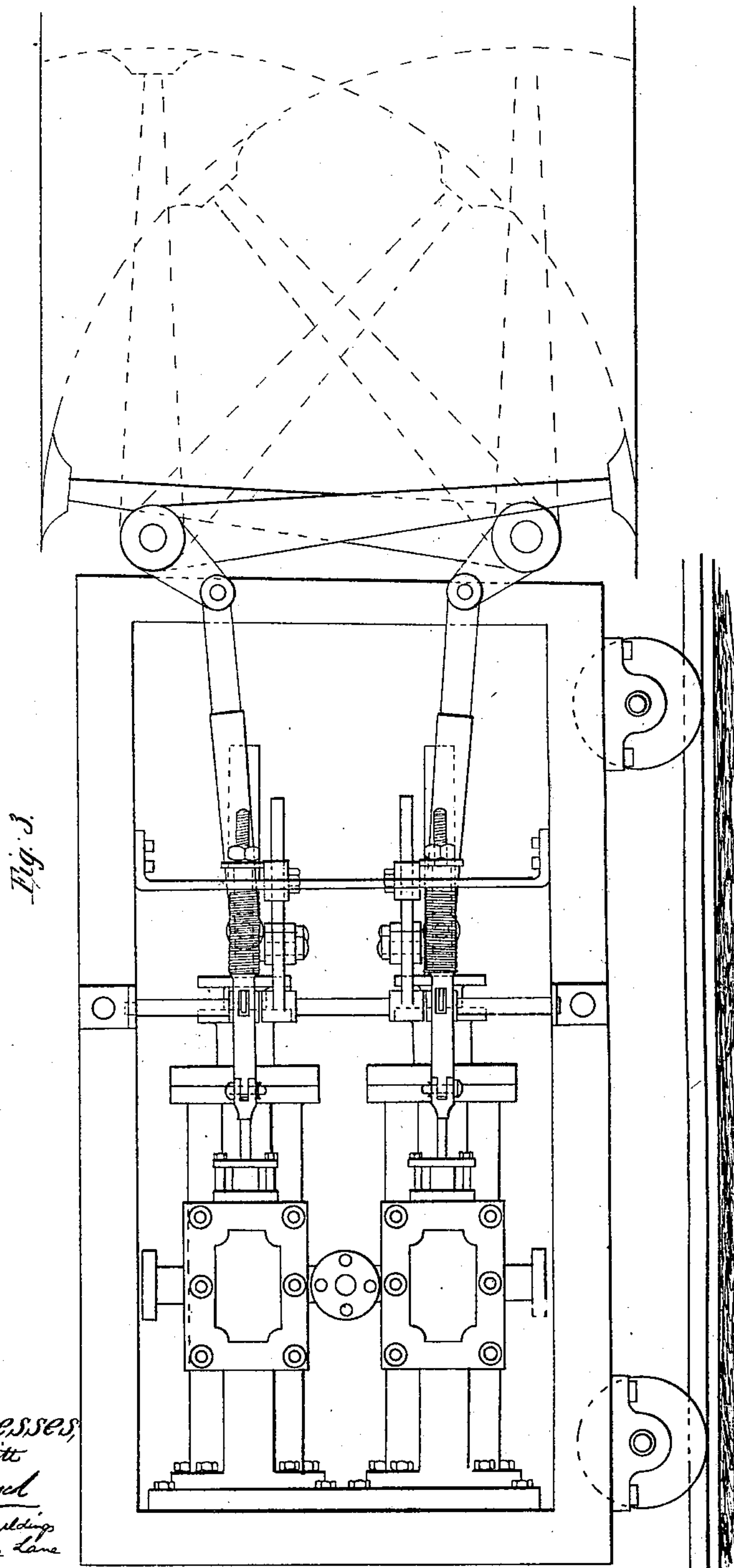
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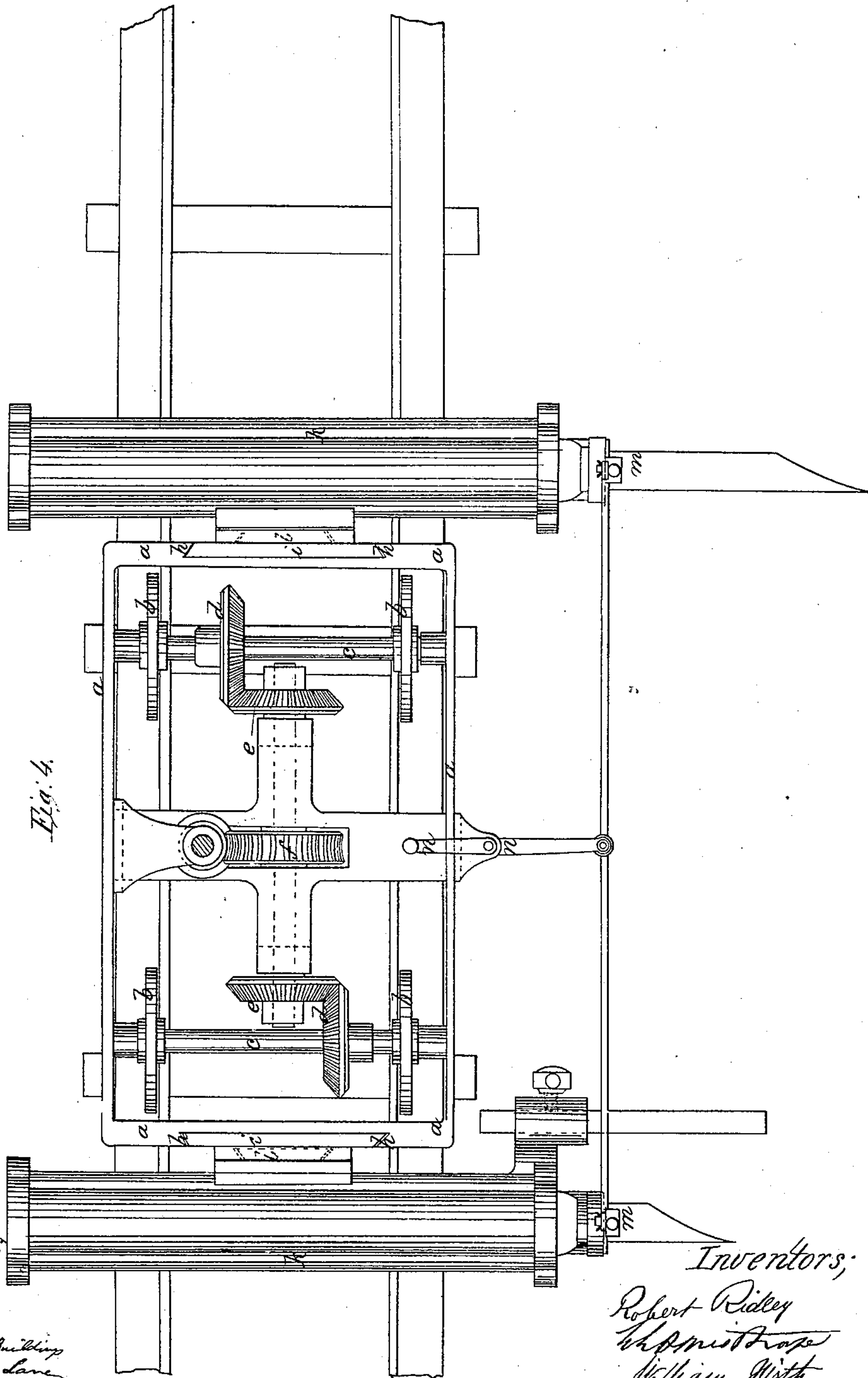


Fig. 4.

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UNITED STATES PATENT OFFICE.

GEORGE EDMUND DONISTHORPE, WILLIAM FIRTH, AND ROBERT RIDLEY,
OF LEEDS, ENGLAND.

IMPROVEMENT IN COAL-MINING APPARATUS.

Specification forming part of Letters Patent No. 42,724, dated May 10, 1864.

To all whom it may concern:

Be it known that we, GEORGE EDMUND DONISTHORPE and WILLIAM FIRTH, of Leeds, in the county of York, merchants, and ROBERT RIDLEY, of Leeds, aforesaid, engineer, subjects of the Queen of Great Britain, have invented or discovered new and useful Improvements in Machinery and Apparatus for Working Coal and other Mines; and we, the said GEORGE EDMUND DONISTHORPE, WILLIAM FIRTH, and ROBERT RIDLEY, do hereby declare the nature of the said invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement thereof, that is to say—

This invention has for its object improvements in machinery and apparatus for working coal and other mines.

In the working of some mines, particularly coal mines, it is required to make longitudinal horizontal grooves, and also vertical or upright grooves, communicating with each other, so as to divide the upright face of the work into sections bounded on the two sides, and at the lower or upper, or both lower and upper, parts with grooves of such depth or extent as is desired for determining the sizes of the sections which shall be removed by blasting or otherwise from the upright surface which is being worked, and such horizontal and upright grooves have heretofore for the most part been made by hand-labor, using picks with handles, though it has been proposed to mount similar picks on carriages moved on rail or tram ways, and to give motion to such picks by the reaction of springs wound up by manual or other power, and reciprocating cutters or picks, the stems of which slide horizontally in guides mounted transversely on carriages arranged to move on rails or tram ways have also before been proposed to be used, the sliding stems of the picks or cutting-tools being actuated by manual labor; and it has also been proposed to use compressed-air engines in giving motion to drills for drilling holes into the coal or stone or mineral at intervals, in order to facilitate the working of mines, and in other cases in giving motion to rotating tools suitably constructed to break and pulverize the upright face of the end of a drift or tunnel.

Now, our invention consists in combining, as

hereinafter described, compressed-air engines with picks and cutting-tools, such as are hereinafter explained, which are mounted on carriages moved on and guided by rail or tram ways, such picks or cutting-tools being arranged to cut longitudinal, horizontal and also upright grooves to the desired depth or extent into the upright face of the work, and thus to divide the work into rectangular sections, each section being bounded by grooves on three or four sides. For these purposes a carriage mounted on wheels suitable for being moved on a rail or tram way, which is laid down parallel with the upright surface of the work, is employed, on which is placed a compressed-air engine which is constantly in connection by a suitable pipe with machinery at a distance arranged in a suitable manner to keep up a constant supply of compressed air to the compressed-air engine on the carriage before mentioned, and a flexible length of pipe is used between the compressed-air engine and the fixed air-pipe in order to allow of the carriage moving a distance along the work. On the carriage is applied any desired number of picks on lever-handles moving on axes, the lever-handles being by preference cranked levers, so that at one end the pick is applied, and at the other end the lever is acted on directly, or is attached by a connecting rod or rods to the piston rod or rods of the compressed-air engine; hence as the carriage is moved at intervals along the face of the work horizontal longitudinal grooves are made in the upright face of the work by repeated blows of one or more picks moving on an upright axis, and, in order to make the necessary upright grooves, one or more picks is or are applied to the carriage, and it or they receive motion in a similar manner from the compressed-air engine.

Figure 1 is a plan of apparatus constructed according to our invention. *a a* is the frame of the carriage. It is mounted on wheels, and is arranged with apparatus to move it forward and lock it in any desired position. This apparatus, however, is not shown in this drawing, but will be fully described in reference to Fig. 4. *b* is a cylinder fixed on the carriage, and *c* is the piston-rod thereof. The admission of the air to the cylinder is regulated by a slide-valve, on the rod of which is a spring, *d*, which tends constantly to force the valve to one end

of its stroke—viz., to that which will cause the piston to return after having caused the pick to strike a blow. In returning, a roller, *e*, on the head of the piston-rod strikes the lever *f*, and by so doing moves the valve, and so sets it as first to check the return of the piston and then again to force it outward to cause the pick to strike another blow, and as the piston-rod moves outward it will leave the lever *f*, and the valve is then carried back by its spring, and thus the reciprocating motion will be continued. These parts are clearly shown at Fig. 2, which is a side view of the cylinder and parts in connection therewith. *g* is a connecting-rod connecting the piston-rod with the crank-arm *h'* on the axis of the pick *h*. This axis is carried by the frame *a*, and the motion communicated to it will cause the pick to strike into the coal or mineral. A single blow of the pick will not cause it to cut to the depth required, but each time after the carriage has been moved forward a distance the pick is caused to make several blows in succession at the same place until it descends to the depth required. The pick may be arranged to work up and down a short distance upon its axis, in order to cause it to cut a groove wider than the width of the pick.

When the apparatus is required to produce vertical grooves, the picks are carried on horizontal axes, and we prefer for cutting the vertical grooves to employ two cylinders and two picks, the one working upward and the other downward, as is shown at Fig. 3, which is a side view of the arrangement. One pick serves to remove the corner which the other would otherwise leave. The two picks are not put to work at the same time, as they would interfere the one with the other. In place of using picks on lever-handles turning on axes, reciprocating picks or cutting-tools may be applied to the carriage, and they or their stems be slid and guided to and fro in suitable bearings, and be connected directly or by suitable connecting-rods to the piston rod or rods of a compressed-air engine applied to the carriage, provision being made for raising and lowering the bearings of those cutting-tools which produce the upright grooves. By these means the work may be divided into sections by grooves by the aid of compressed air and cutters combined, and arranged as herein explained, with great advantage.

Fig. 4 is a plan, Fig. 5 a side elevation, and Fig. 6 a front elevation, of apparatus arranged in this manner. *a* is the frame of the carriage. It is mounted on wheels *b b*, carried by the axes *c*. *d d* are beveled wheels fixed on the axes and gearing with other beveled wheels, *e e*, on the axes of which is a worm-wheel, *f*, and this works with a worm capable of being turned by the hand-wheel *g*, and thus the carriage is moved forward as required, and the same apparatus serves to lock the carriage and retain it securely wherever it may be placed, even should the road be inclined. The above description applies also to the appa-

ratus shown at Fig. 1. The carriage has two cylinders in connection with it, one at each end, (or it may have one cylinder only,) and to carry them the ends of the carriage are furnished with V-guides *h*, in which slides *i* work, and these are supported by the bar *j*, pin-jointed to it. The ends of the bar have small rollers on them, which run on the tram. The cylinder *k* is mounted on the slide, it being carried by a center-pin or axis *l*. These arrangements are made in order that any inequalities in the line of tram-road may not injuriously affect the action of the apparatus. *m m* are the rods of the pistons, which work in the cylinders *k*. They are made rectangular, in order that the stuffing-box may serve as a guide to prevent the piston-rod turning. The head of the piston-rod is furnished with a wedge-shaped tool suitable for cutting the coal or mineral. Compressed air is admitted to the cylinders to produce the required reciprocating action of the tools by means of cylindrical valves, (such as are well understood,) and by turning these in one direction the air is admitted behind the pistons to throw them forward to make a blow, and by turning the valves in the contrary direction the air is admitted in advance of the pistons to bring them back, while at the same time the air behind the piston is allowed to escape freely. This motion is given to the valves by means of the hand-lever *n*, the mode of action of which is clearly shown. The air to work the apparatus we prefer to compress at the mouth of the pit by means of an air-pump worked by the engine, and we lead the air into the pit by means of iron pipes. These have union pieces fixed on them at intervals, in order that a flexible pipe may be attached to convey the air to the cylinder.

Having thus described the nature of our invention and the manner of performing the same, we would have it understood that we do not confine ourselves to the exact details described, nor do we claim any of the mechanical parts separately; but

What we claim is—

1. The combined arrangement of mechanism herein explained with reference to Figs. 1 and 2 of the drawings, whereby picks with lever-handles are actuated by compressed-air engines mounted on and carried by the same carriage as the picks.
2. The combined arrangement of mechanism herein explained with reference to Figs. 4 and 5 of the drawings, whereby cutters are connected with and moved to and fro by the piston-rods of air-engines mounted on carriages, as herein described.

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