E. G. Lamson,

2 Sheets, Sheet 1.

Stone-Channeling Machine.

No. 68,888. Patented Sep. 17, 1867.

Fig. 1.

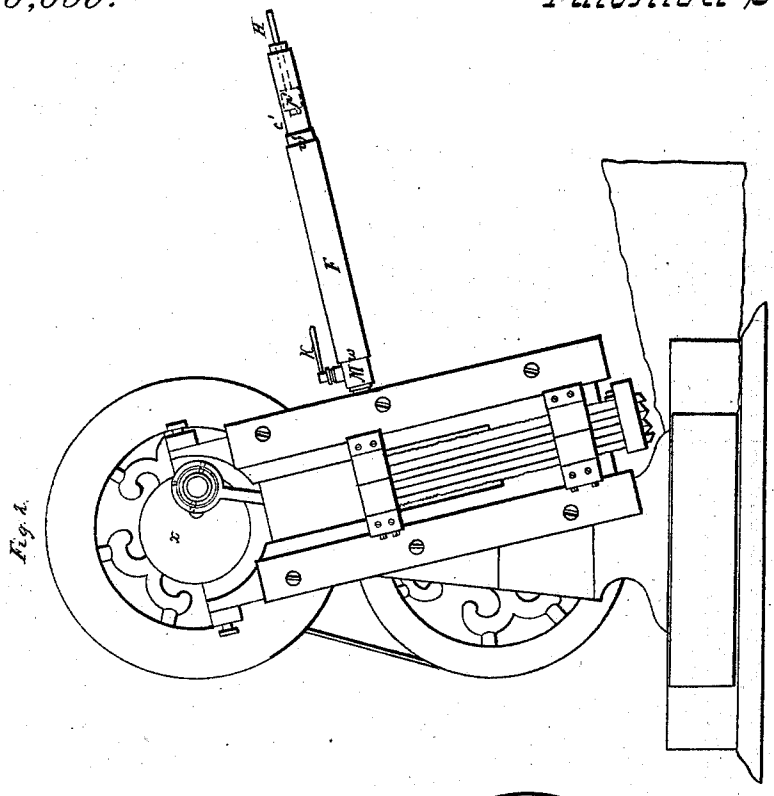
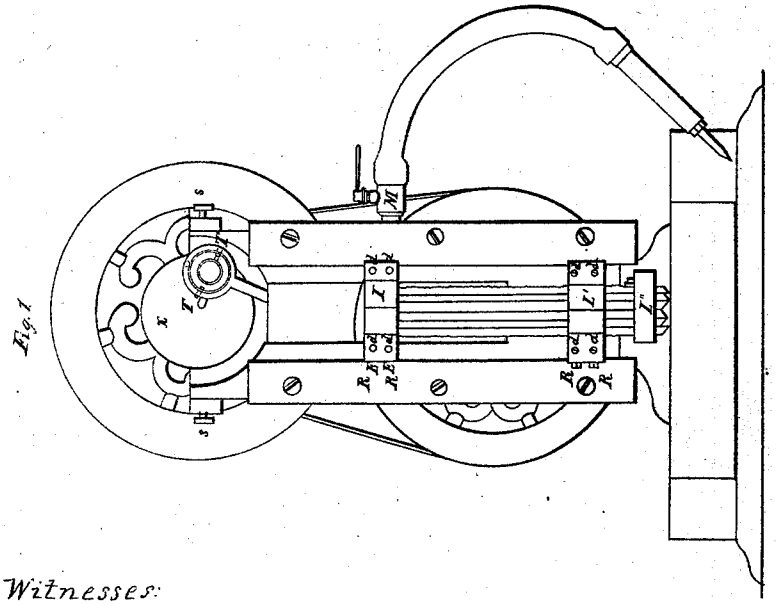


Fig. 2.



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Lewis Wieser

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AM. PHOTO-LITHO. CO. N.Y. (OSBORNE'S PROCESS)

E. G. Lamson.

2 Sheets, Sheet 2.

Stone-Channeling Machine.

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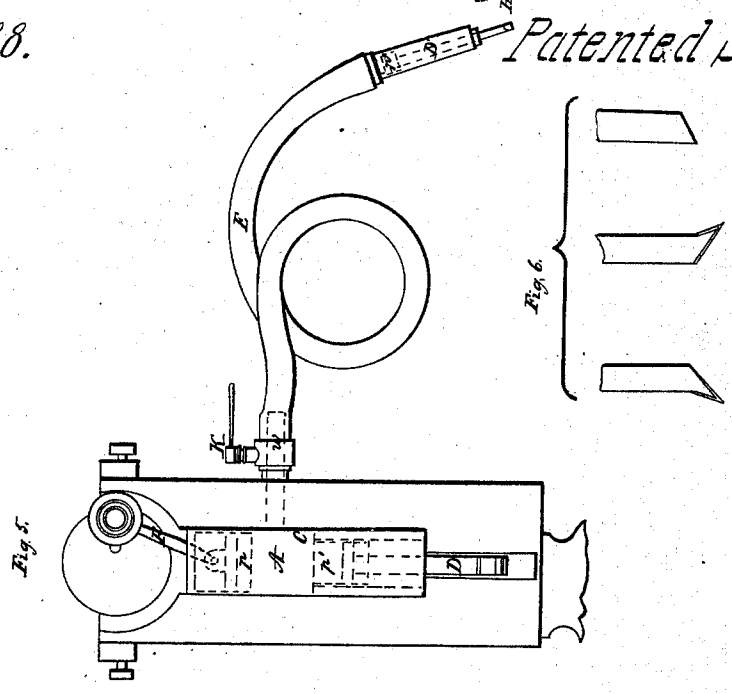

Fig. 5.

Fig. 6.

Fig. 4.

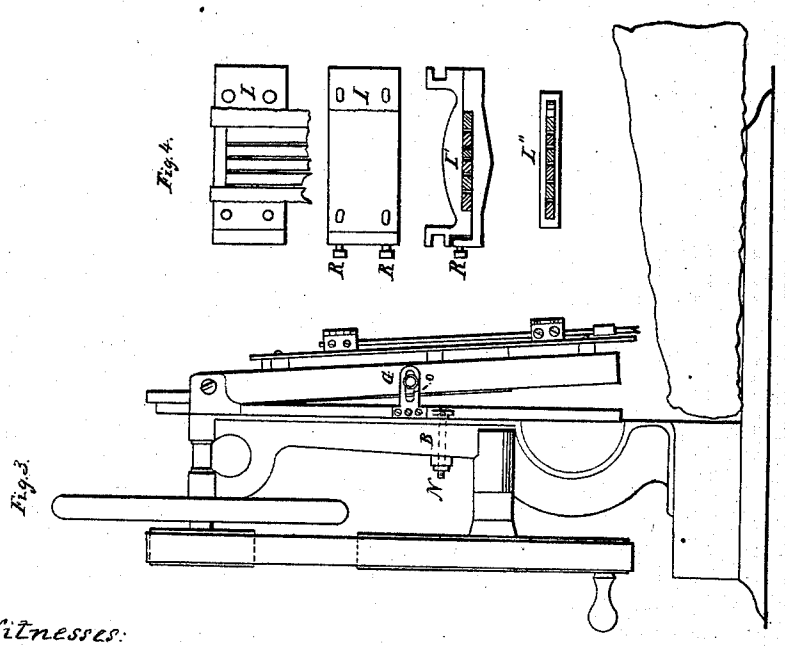

Fig. 3.

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United States Patent Office.

EBENEZER G. LAMSON, OF SHELBURNE FALLS, MASSACHUSETTS.

Letters Patent No. 68,888, *dated September* 17, 1867.

IMPROVEMENT IN OPERATING DRILLS.

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

TO ALL WHOM IT MAY CONCERN:

Be it known that I, EBENEZER G. LAMSON, of Shelburne Falls, in the county of Franklin, in the State of Massachusetts, have invented a new and improved mode of Operating Drills or other tools of a stone-cutting, channelling, quarrying, stamping, hammering, or tunnelling machine, which I design as an improvement to my invention of a stone-cutting machine, for which Letters Patent were issued to me, dated October 2, 1866, and numbered 58,435; and I hereby declare that the following is a full, clear, and exact description of the construction thereof, and the manner of its operation, reference being had to the accompanying drawings, and to the letters of reference marked thereon, making a part of this specification.

Figure 1 is an isometrical front view of the machine constructed for the purpose, and showing the invention embraced therein.

Figure 2 is the same showing the drills swung out longitudinally for the purpose of operating on rock whose surface is in another plane from that on which the machine stands.

Figure 3 is a side view of the machine, showing the drills swung out laterally for the same purpose as in fig. 2, when the rock to be operated upon lies in another direction.

Figure 4 shows the three clamps detached and their mechanisms for confining the drills in gangs.

Figure 5 shows the cylinders without gang and swinging devices, indicating by dotted lines the piston-heads and their respective rods, the rod F being attached to the eccentric, and the rods D and D′ being for the purpose of attaching either a gang or a single drill, for the purpose of gadding or otherwise as the case may require.

Figure 6 shows cutting edges of the gang.

Similar letters of reference, where they occur in different figures, indicate like parts of the machine in all the drawings; the rod D′ being to be used as an attachment or as a single drill, as shown in H.

When, by operating machinery, I drive a drill or other heavy cutting, breaking, or abrading instrument against rock with sufficient force and velocity to work away the stone rapidly, the blows delivered produce tremendous concussion or jarring, which, in the absence of an elastic or flexible instrument intervening between the driving and striking mechanisms, soon shakes the operating machinery to pieces, and renders it inoperative and useless. In the present invention I propose to remedy this mischief by interposing these between such an instrument that at the instant the striking machinery delivers a blow, at that very same instant the driving machinery shall be isolated or practicallly disconnected therefrom. This will, of course, prevent the concussion communicating from the one to the other.

In my aforesaid former invention I interposed for this purpose a bow-spring of steel. I now propose to make an improvement on the character of this interposing spring; and my present improvement consists in using the elasticity of air, as and for this interposing spring, in lieu of the elasticity or flexibility of metal.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation.

By means of and between piston-heads p and p' or p and p'', packed air-tight, I confine the stratum of air A, fig. 5, so that when, by cam-crank, crank-wheel, piston-rod direct, or by other familiar forms of machinery, I push the head p forward I compress the stratum of air A, which, compressing, drives the piston-head p' or p' forward, and when I reverse the motion and draw p backward I rarefy or create a partial vacuum in A, and the pressure of the atmosphere on the outside acting freely against the opposite side of p' or p'' forces the same back to its original position. It is thus that I create the reciprocal motion of the striking machinery. When I operate with p' I lock p'', and *vice versa*, and I operate the one or the other, or both, according to the direction in which I wish to deliver the blows. At every stroke of the piston p it will be seen by inspection that the air in A is alternately compressed and rarefied in its relation to the weight or density of the outside atmosphere. During one half of the time, therefore, or while the air in A is in a state of rarefaction, the driving and the striking machinery are practically disconnected from each other by the intervening distance between p and p' or p''. So I adjust my machinery and operate it with such velocity as to insure the delivery of the blows during the time of this disconnection, thereby entirely relieving the machinery from concussion as afore said. Moreover, as the cylinders inside must, of course, correspond with the diameters of the piston-head

respectively, I make these same piston-heads of different measurements, which measurements I vary according as I wish to secure the desired momentum or force of the blows struck and the rapidity of delivering them; for by inspection it will be seen that the less the diameter of p or p' the longer must be the stroke in the cylinders in which they play, and the longer the stroke in a given time the greater will be their respective velocity, and consequently the greater their momentum or heavier the blow struck. Hence by regulating the speed of the driving machinery, and by varying the respective diameters of the piston-heads, I am able to regulate my blows and to give them any desirable rapidity and force. And since I have one-half of the time of each revolution of the driving machinery wherein to deliver blows without danger from concussion, I have not the slightest difficulty to make the requisite adjustment for speed ever so great and for blows ever so heavy—principles of incalculable value in applying machinery for tunnelling and otherwise working in and on stone. Hitherto all machines for such purposes have been restricted to low speed and light blows for want of suitable devices wherewith to prevent breaking; and, further, machines for tunnelling and quarrying purposes especially must be able to work in and on rock the plane of whose surface is other than that on which the machine stands; and particularly for tunnelling, the machine must be able to strike in every direction, laterally, longitudinally, up and down. The layers of marble and of grindstone-rock are not ordinarily horizontal, and are frequently so inclined that it would not be possible for a grooving or gadding-machine to stand upon their surfaces, while it is required to cut these layers at right angles. My invention, therefore, further enables me to swing the striking machinery at any angle longitudinally, as seen in fig. 2, or I can swing it laterally, as seen in fig. 3, and cut under or obliquely, as the case may require.

For the longitudinal swing I hang the whole striking mechanism on the shaft of the eccentric X, and by means of the groove V, described as an arc on the centre of the shaft of eccentric X, I am able, by the screw-bolt B and nut N, to fasten it at any desired angle; the head of bolt B playing in the groove V. S S, in fig. 1, shows the axis for swinging out laterally the striking machinery for side or under cuts, and for the purpose of cutting grooves which shall be parallel to the longitudinal feed movement of the machine attached to my stone-cutting machine, and fed forward and backward on the track, according to my invention patented in No. 58,435. T T, in fig. 1, shows the axis of the joint at the upper end of the rod of piston-head p to contribute to this same lateral swing, while G G, in fig. 3, show the heads of the guide-pins for this same purpose. One of the guide-slots O, in which G plays, may be seen in fig. 3. E and F show hose and pipe respectively. And for still greater variety in cutting in different directions I attach the arm M to the cylinder C, and by means of the screw and socket, at W and W', I attach cylinder C', which holds p'', and so am able to operate a single drill, H, for gadding, blasting, and otherwise, and I may screw in either a hose or pipe, E or F, and work the drill at the end thereof, when required to operate it at a distance from the machine. It is evident that the number of such arms which may be so attached and operated at the same time is only limited by the capacity of the cylinder. The joint W may also be used as an air or pit-cock to regulate the quantity of air contained in the stratum A, or for this same purpose I may use the stop-cock K, designed also to regulate or to stop the gadder H, which gadder, in operation, may be rotated by the free action of hose, or by screw-joint W, or by other familiar rotating appliance in the hand of the operator or otherwise; and I may use, for the purpose of making the vacuum in A more perfect in reversing the movement of p', a self-acting check-valve opening outward near the terminus of the stroke forward of the piston p, in order for the escape of the compressed air as soon as p' passes by the same, but closing by outward pressure of atmosphere, whenever p begins its reverse movement, and I may use a similar valve opening inward upon the orifice of the pipe F, where it enters C', and so confine a stratum of air between said valve and p'' as an "air-cushion," so called, to prevent p'' giving a blow when forced backward too forcibly, by atmospheric pressure, in its reverse movement; and whenever such arrangement may be necessary for heavy work or otherwise, to perfect the same, I make an air communication between cylinder C' and pipe F opening forward of the "air-cushion," and behind said valve, but closing whenever p'' passes the same, and remaining closed by the edge of piston p'' until the air through the said valve forces p'' forward beyond the opening into C' of the said communication.

To hold drills in gangs, delivering blows with great force and rapidity, I must hold them in place with corresponding power. My clamps, for this purpose, are seen in L, L', and L'' in fig. 1. L and L' furnish also the grooves or guides for the reciprocating motion of the gang, while L'' clasps the drills near the lower end of the same for the purpose of holding them firmly together. L and L' are shown detached in fig. 4. The two outside drills are serrated on their respective outside edges to correspond with like serrations in the inside of L and L', and are made to hold tightly by the set-screws R R R R, as seen in fig. 1, while $d\ d\ d\ d\ d\ d\ d\ d$, seen in fig. 1, show heads of screws to hold the corresponding parts of the clamps respectively together, the parts thereof next to the heads of the screws being provided with elongated holes to accommodate the action of the set-screws. The clamp L is made whole at its top, thus interposing a positive prevention to the drills being driven from their position by the recoil in delivering blows. I use shims to preserve appropriate lengths to the drills. The two outside drills may be made without cutting edges, and used merely as side clamps, with their serrations, if desired. These side drills, therefore, are made to pass through the upper clamp. The clamp L'', serving to hold the drills together, is made in one piece, having one of its inside edges serrated, while it is constructed to do its office work by means of two wedge-keys driven inversely to each other, the inside one being also serrated to correspond to the serrations of the outside drills, as aforesaid.

Drills for cutting channels should be so arranged that the edge of each particular one shall cut the rock independently of every other one, and should also be arranged in pairs, one half cutting when the machine moves forward, and the corresponding half cutting when it moves backward; my drills therefore are so arranged. I show six (6) in number, three cutting when the machine moves forward, and the corresponding three when moving backward. The edges of my two forward drills respectively cut longitudinally with the channels to

preserve its width, the third one transversely thereto to cut out the intermediate lands. If, on account of the hardness of the rock, or the width of the channel, or otherwise, the third edge is not able to do its office work fully I interpose one or more to aid. The edges I bevel after the manner of framing-chisels, the bevelled side being opposite to the rock to be cut, and the longitudinal cutting edges, when made perfect, are constructed on the line of the hypothenuse of a right-angled triangle, whose perpendicular may be measured by the distance that the chisels settle into the rock when struck, and whose base may be measured by the width of the chisel itself. This inclination, the lowest part thereof being behind when the drills are operated, will necessitate cutting the whole length of the edge.

When I drive the edges of drills into rock, and especially into grindstone-rock, the corners of the edges are speedily ground off, and all the quicker in proportion as the channel is deeper, which channel is frequently required to be at the depth of some feet. The arrangement of the cutting edges of my drills, as aforesaid, does in part remedy the evil, as I thereby protect to a considerable extent the corners of these cutting edges, they coming in contact but very little if any with the sides of the channel cut. Now, in order to remedy this evil fully, and withal to sharpen the whole line of the cutting edge, I make still another conformation of these cutting chisels, to wit, I construct the sides thereof opposite to the bevel a little dishing, somewhat after the manner of the upper edge of a grass-scythe, so that the wear occasioned by rubbing against the grindstone or other rock, when the drill is in operation, shall keep the chisel sharp. I thereby obviate the necessity of removing the drills every few minutes to grind them, which, in the case of cutting grindstone-rock especially is such an inconvenience as hitherto to render machines for channelling it worthless.

What I claim as my invention, and desire to obtain by Letters Patent, is—

1. The air-spring, substantially as and for the purpose described.
2. The device whereby I regulate at pleasure the momentum of the blow struck, by regulating the speed of the driving machinery, the greater the speed the harder the blow, substantially as and for the purpose described.
3. The device whereby I cause the piston-head, carrying the striking mechanism, to operate in a different direction from the piston-head attached to the driving mechanism, substantially as described.
4. The mechanism for swinging out the drills longitudinally, substantially as and for the purpose described.
5. The mechanism for swinging out the drills laterally, substantially as and for the purposes described.
6. The mechanism for confining the drills in gangs, substantially as and for the purposes described.
7. The form and disposition of the cutting edges of the drills, substantially as and for the purpose described.

EBENEZER G. LAMSON.

Witnesses:

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