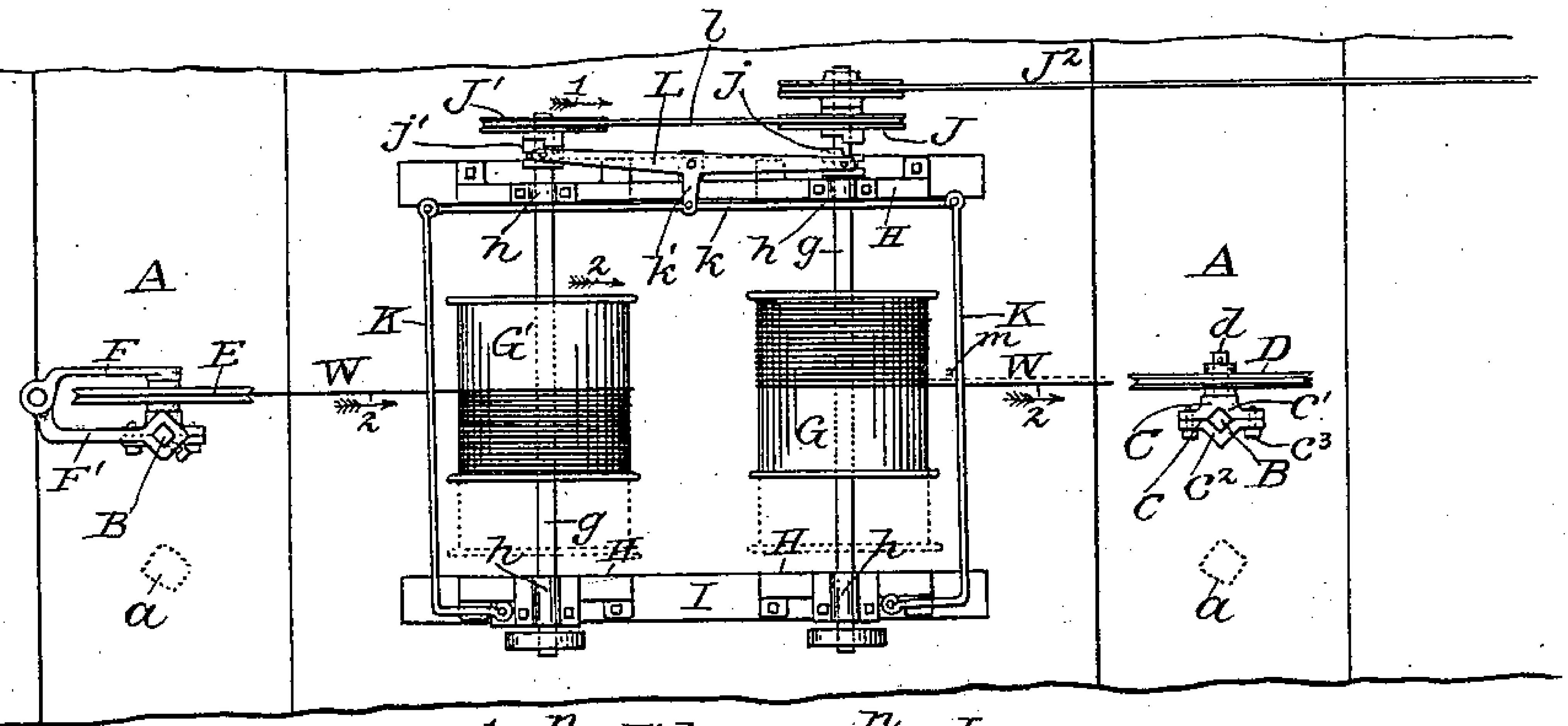
(No Model.)

G. F. CLARK.

APPARATUS FOR SAWING STONE.

No. 558,483. Patented Apr. 21, 1896.

Fig. 2.



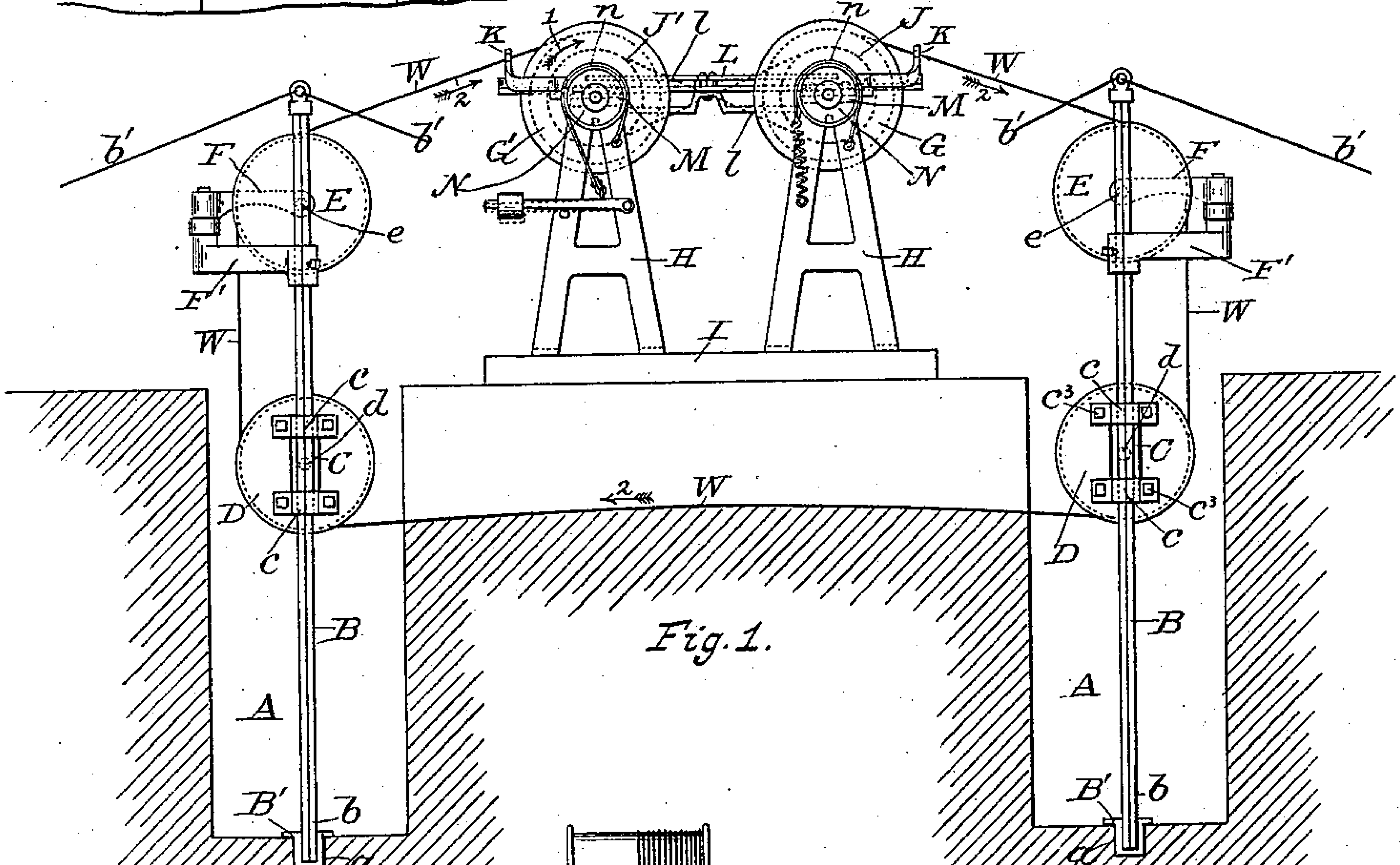
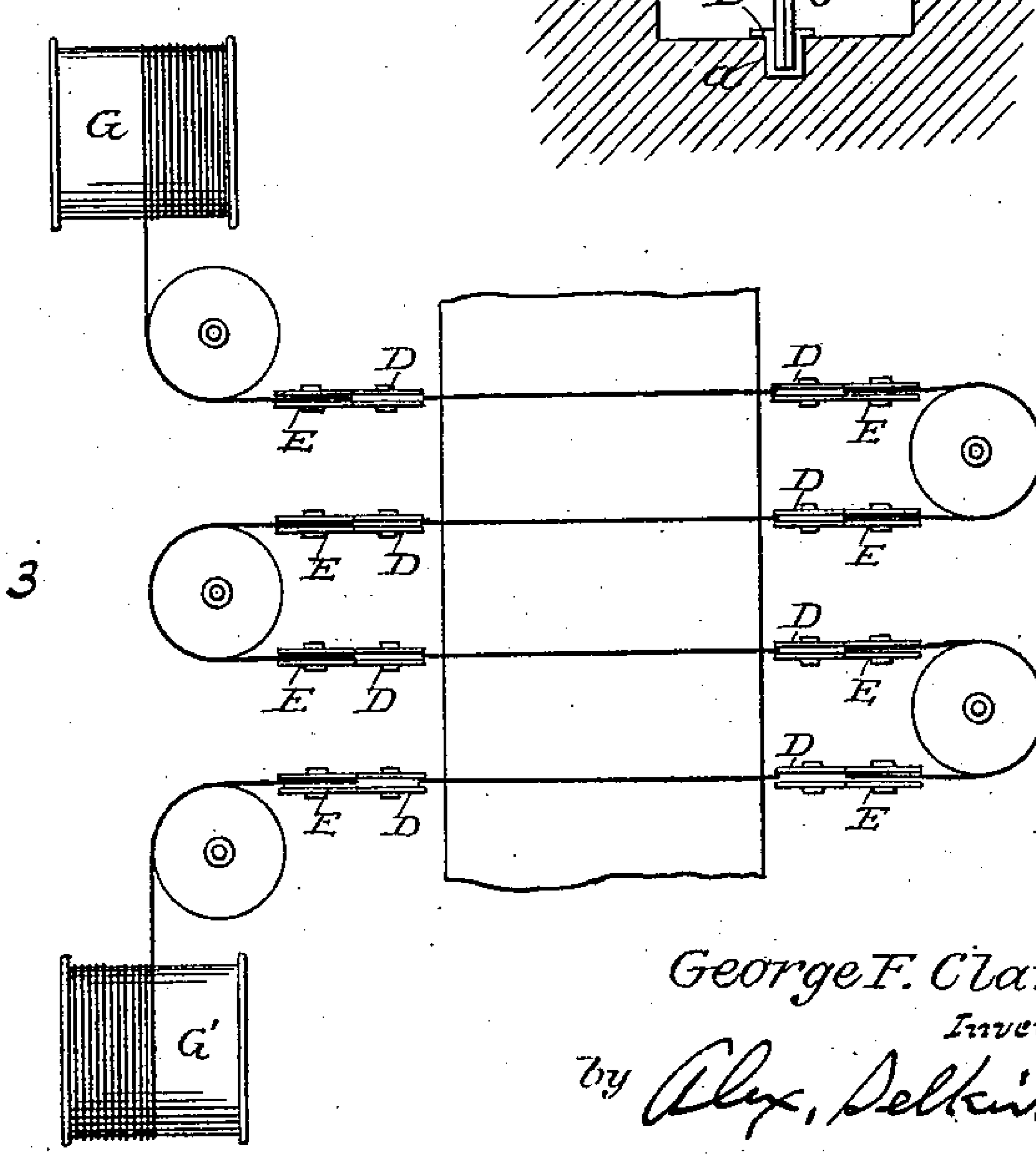


Fig. 1.

Fig. 3



Witnesses.

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APPARATUS FOR SAWING STONE.

SPECIFICATION forming part of Letters Patent No. 558,483, dated April 21, 1896.

Application filed June 12, 1895. Serial No. 552,505. (No model.)

To all whom it may concern:

Be it known that I, GEORGE F. CLARK, a citizen of the United States, residing at Albany, in the county of Albany and State of New York, have invented certain new and useful Improvements in Apparatus for Sawing Stone, of which the following is a specification, reference being had herein to the accompanying drawings.

This invention relates to certain new and useful improvements in apparatus for sawing stone, marble, &c., and while it is designed, primarily, for use at the quarry for sawing stone and cross-cutting the same in the quarry, yet it is well adapted for use in sawing stone into slabs after it has been removed from the quarry.

My invention has for its object, among others, to provide a cheap, simple, and efficient means for applying a strip of wire or twisted wires, or two or more such strips, to a stone for coaction with sand, crushed stone, small grains of chilled iron or steel, or other like hard substances and water for cutting stone, and for automatically causing the strip or strips of wire or twisted wires, of length of two thousand or more or less feet, as preferred, to travel at a suitable speed in one direction and then automatically reverse the direction of travel of the strip and run it with similar speed and at the same time cause the wire to descend as the stone is cut; also, to provide a simple means for moving the strips lengthwise their whole length at a similar speed and for keeping the strip or strips taut while running in either direction, and, further, to provide simple means for carrying the strip or strips of wire or twisted wires, while running in either direction, downwardly and in a perpendicular line of direction until the bottom of the intended cut is reached. These objects of my invention may be obtained by employment of the means illustrated in the accompanying drawings, which form a part of this specification, in which—

Figure 1 is a side elevation of my apparatus in position for operation in a quarry. Fig. 2 is a top plan of the same, and Fig. 3 is a plan view illustrating several cuts being made by a singe strip.

Similar letters of reference refer to like parts in the several figures.

In carrying my invention into practice I preferably employ an apparatus of the form of construction shown, that being the form which I at present consider preferable for operation in a quarry. Yet it may be varied in respect to some of its parts and within certain limits without departing from the spirit of my invention.

By any suitable means I first form in the quarry, preferably, two parallel channels A, sunken to a depth a little greater than that intended the stone is to be cut to by the strip of wire or twisted wires. These channels A may be at any suitable distance apart, say from twenty to one hundred feet, or more or less, as may be advantageous or preferred, and are preferably from three or four feet, or more or less, in width as may be found to be advantageous for free access to the bottom of the channels for any purpose, and especially for removal of the mud resulting from the sawing of the stone. I next form in the stone, at the bottom of the said channels A, holes *a a* at such distances apart as may be equal to the width of the stones to be cut by a single strip of wire, or by two or more strips of wire operated simultaneously, each making a single cut, or by the use of a single strip having several turns for cutting several cuts. These holes *a a* in each channel may be made of diameter corresponding with that of the foot ends of the vertical shafts B and are sunken to a depth of only a few inches and receive the foot ends of said shafts B, which are to guide the brackets, carrying the wire-depressing wheels, that the latter may be suitably guided in their vertical descent as the stone is being cut. These shafts B are each placed in perpendicular position with its foot end *b* in hole *a* or in a socket B′ in a slightly larger hole, and its upper end held by any suitable means from moving out of perpendicular, and preferably by guys *b′ b′*. Although these vertical shafts B may be of round or other forms, yet I at present prefer to make them of square form that they may hold the brackets C from swiveling on them, and although the lower ends of said shafts may be directly seated in said holes *a* or in a socket B′, as above stated, yet they may be otherwise held from moving by any suitable means.

The brackets C C are placed in position on the shafts B, and are preferably provided with a pair of vertical sleeves c c, which nicely fit said shafts and are free to move vertically in either direction on the same to any preferred distance, and although said sleeves may be solid, yet I prefer to make them sectional and secure said sections, as c' c^2, together by suitable nut-head screws c^3, as shown. In Fig. 2 the upper guiding-wheel E, at one side, is omitted for showing the plan view of depressing-wheel D below. These brackets C are each provided with a pintle d, projected in direction of the channel A with its axial line at right angles to the axial line of the sleeves c. On each of these pintles d is mounted a wire-depressing wheel D of suitable diameter and having in its circumferential face a V-shaped groove for receiving and holding the wire strip W they are to depress while cutting the stone. These wheels are free to revolve in either direction on their respective pintles d. The upper end of each vertical shaft B is provided with a wire-guiding wheel E, (one of which is shown in Fig. 2), revolving on pintle e. This pintle e is preferably secured to a suitable bracket F, which is pivoted to an arm F', rigidly secured to and projected outwardly from the upper ends of said shafts B. These wire-guiding wheels E, being thus secured to the respective shafts B, are free to swing horizontally in either direction as the feed or delivery of the running strip of wire W may require.

I also provide one or more pairs of coacting strip-wire-carrying drums as, G G', of any suitable diameter and length and calculated to receive from five hundred to five thousand feet, or more or less, of wire of either single or twisted strands, as may be found to be advantageous for use for cutting stone. The drawings show but one pair of these drums G G', yet by duplication of these drums on the same shafts, or by arrangement of the drums of each pair on different shafts, or by turning the wire several times between each drum of a pair, as shown in Fig. 3, several stones may be cut at a time. These drums G G' of each pair operate alternately, one as a take-up drum and the other as a paying-out drum, until the wire strip W becomes transferred in its full length from the latter drum to the former, when a reversal of the direction of revolution of these drums causes the paying-out drum to operate as a take-up drum and the other as the paying-out drum. These drums G G' are each mounted on a shaft g and are so fixed thereto as to revolve with it, and when they are in the form of a spool, as shown in Fig. 2, I prefer to so arrange said drums on their respective shafts that they may move lengthwise in either direction on the same, as may be deemed advantageous for winding up or paying out the strip W. These drums are shown to be flanged for guarding the outer end coils of the wire strip when coiled in one or more layers in place on the drums. The shafts g are supported in proper bearings h from any suitable framework H, secured to any substantial platform I, and are preferably of length between their bearings h h about equal to twice the length of the said drums when the latter are to be allowed to move lengthwise on their shafts. Mounted loosely on these shafts g are band or sprocket wheels J J' with clutches j j' of any suitable known construction between each shaft and the wheel thereon, and any suitable lever-mechanism, as L, for operating said clutches simultaneously in opposite directions may be employed for throwing the respective clutches alternately into and out of engagement with their respective coacting wheels J J' at the times reversals of revolutions of the drums are to be effected. Although these lever mechanisms L may be operated by an attendant, yet I preferably provide automatic means for so changing the direction of revolutions of said drums. These loosely-mounted wheels J J' are geared or connected together by endless chain or other belt l, so that when clutch j' is in engagement with wheel J' on shaft of drum G' and clutch j is out of engagement with wheel J on shaft of drum G the revolving of the wheel J' will be in direction of arrow 1, causing the drum G to wind up the wire strip W in direction of arrow 2 at the same time it is drawing the wire strip off from drum G, after running through the stone, as illustrated in Fig. 2.

A reversal of the movement of the lever mechanism L for moving the said clutches may be effected by any suitable known mechanism, yet at present I prefer to employ a slotted lever K, opposite each drum and pivoted each by one of its ends to the framework supporting said drums, with its opposite end connected by suitable connecting-rod k to an angularly-arranged arm k' of the lever L, in connection with a stop-piece m of any suitable form secured to the wire strip W at a short distance from its fixed end at each drum, as indicated by dotted lines in Fig. 2, whereby when the wire has been nearly fully drawn off from the paying-out drum, as drum G, said stop-piece pulls against lever K by the draft of the take-up drum, as G', and moves said lever outwardly to a short distance, and through connection-rod k and arm k' moves the lever L in proper direction for throwing the clutch j' out of engagement with the clutch of wheel J', actuating drum G' and throwing clutch j into engagement with wheel J, actuating drum G, when wheel J' will be loose on the shaft of drum G', while the driving-belt or endless cable l actuates wheel J, held by clutch j with the shaft of drum G, which now becomes the take-up drum, and revolves the same in direction reverse to that indicated by arrow 2, when said drum G, winding up the wire strip, draws it off from drum G, while drawing it through the stone for cutting the same until nearly the whole length of the wire strip has been rapidly drawn through the stone in direction reverse to that indicated by arrows 2 until the stop-piece m on the strip connected with drum G′ operates and shifts the lever K opposite said drum and shifts the lever L through its connection-rod for reversal of the clutches j j' for changing the direction of the revolution of said drums and thereby the direction of the wire strip W. Power may be communicated to one of the said wheels J or J′ through a suitable wheel, as J^2, driven by an endless belt or cable from any source of power. (Not shown.)

The wire-strip-carrying drums may be provided with any suitable brakes M for reaction against the pulling strain on the drums when operating as paying-out drums, and thereby hold the wire strip W taut when running through the stone and being transferred from the one drum to the other. These brakes are preferably made in the form of a flexible strap bearing on the periphery of a brake-wheel N, secured to an end portion of each shaft of said drums. These flexible straps (marked n) are preferably of metal, having one end secured to a stationary piece and bent on the face of said brake-wheel with the opposite end drawn downwardly by a weight, weighted lever, spring, or other substitute, as shown in Fig. 1.

Although any suitable strip of wire may be used for cutting the stone, yet I prefer to use a strip of length from one-half of a mile to a mile long and composed of two or three strands twisted together and of suitable diameter as from one-quarter to three-eighths of an inch. This wire I prefer to run at a speed of about seven or eight hundred feet per minute, and in contact with the stone and with a mixture of a suitable hard cutting substance and water in the groove cut in the stone, until the whole length of the wire is run through the stone and off from one drum and on the other. Then by reversal of the direction of revolution of the drums the wire will be run in its full length and at like speed in the opposite direction, the cutting mixture of cutting substance—sand, crushed stone, or chilled iron or steel, and water—being introduced into the groove, when the cut will be made in direction reverse to that of the former. In all cases while the wire strip is running in these directions alternately the depressing-wheels D D, by their weight and weight of their brackets C C, free to move downwardly on the upright shafts B, operate to carry the wire strip W downwardly as fast as the stone is cut. The repeated reversals of the run of the wire, the speed of the same, and weight of the said depressing-wheels, together with the mixture of water and stone-cutting substance, operate to rapidly cut the stone to the depth preferred, and by forming the wire strip W of twisted strands of wire, which I preferably employ, the cutting mixture will be largely held in the spiral channels between the twisted strands and be drawn by the same through the groove formed in the stone, to continue the rapid cutting of the same. By operating this long strip of wire lengthwise and alternately in opposite directions the cut of the stone is made to be about uniformly the same, instead of faster at the side from which said wire travels and slower at the side toward which the wire moves as in the case of the use of endless wires as heretofore employed for cutting stone. This great length of the wire strip itself operates to preserve the wire in good condition for effective service for a longer time than when the wire is used in the form of an endless one and made to run continuously in one direction as heretofore.

In the practice of this invention any preferred number of wires may be operated, as above described, at the same time in the quarry for cutting a number of blocks lengthwise, and then by shifting this apparatus these long blocks may be cut transversely to divide them into smaller ones to be detached from the uncut stone beneath by process of horizontal drilling and wedging, or other methods practiced in quarries.

By providing the drums with several grooves from one to two inches or more or less apart from centers for receiving each a wire strip, and providing such grooves with side walls of from ten to fifteen inches in depth with width between about corresponding with the diameter of the wire of the strip, the wire strips may each be wound coil upon coil in each groove in the take-up drum and be unwound coil from coil in each groove in the paying-out drum, and by reversal of movements of said drums cause a number of wire strips of great length to be run alternately in reversed directions lengthwise, as above described, for cutting stones into slabs or thin pieces of any preferred thickness, and with great rapidity.

In case the wire W is provided with permanently-secured stone-cutting devices the mixture of the granular stone-cutting substances and water may be omitted.

What I claim is—

1. In an apparatus for sawing stone, the combination with a strip of wire calculated to be drawn alternately in reversed directions lengthwise in contact with the stone to be cut, two vertical shafts at suitable distances apart and having their lower ends secured from moving and at points on a plane below the line of the horizontal plane to which the stone is to be cut, brackets calculated to move in either direction on said vertical shafts, wire-depressing wheels mounted on spindles which are carried by said brackets and are calculated to superimpose weight on the portions of the wire strip moving in contact with the stone, of two revolving wire-carrying drums, each receiving an end of the wire strip and capable of having their directions of revolutions reversed, and calculated respectively to take up and pay out the wire, brakes calculated to check the free revolution of the respective drums while paying out the wire, and driving mechanism calculated to revolve

either drum for winding on the wire while being drawn through the stone and unwinding it from the other drum, substantially as and for the purposes set forth.

2. In an apparatus for sawing stone, the combination with a strip of wire calculated to be drawn alternately in reversed directions in contact with the stone to be cut, two vertical shafts at suitable distances apart and having their lower ends secured from moving and at points on a plane below the line of the horizontal plane to which the stone is to be cut, brackets calculated to move in either direction on said vertical shafts, and wire-depressing wheels mounted on spindles which are carried by said brackets and are calculated to superimpose weight on the portion of the wire moving in contact with the stone being cut, of two revolving wire-carrying drums connected each with an end of the wire strip and capable of having their direction of revolution reversed and respectively calculated to take up and pay out the wire, wire-guiding wheels between each drum and its wire-depressing wheel, brakes for checking the revolution of the paying-out drum and driving mechanism for revolving either drum, as may be required, for winding on it the wire strip, substantially as and for the purposes set forth.

3. In an apparatus for sawing stone, the combination with a strip of wire calculated to be drawn alternately in reversed directions in contact with the stone to be cut, two vertical shafts at suitable distance apart and having their lower ends secured from moving and at points on a plane below the line of the horizontal plane to which the stone is to be cut, brackets calculated to move in either direction on said vertical shafts, wire-depressing wheels mounted on spindles which are carried by said brackets and are calculated to superimpose weight on the wire moving in contact with the stone, of two revolving wire-carrying drums receiving respectively an end of the wire strip and capable of reversal of direction of revolution and also capable of endwise movements in either direction, brakes calculated to check the free revolution of the respective drums while operating to pay out the wire, driving mechanism calculated to revolve either drum for winding on the wire, and clutches, between the driving mechanism of the drums and the shafts on which the said drums are mounted, for changing the direction of the revolution of the latter and thereby reversing the direction of lengthwise movement of the wire strip, substantially as and for the purposes set forth.

4. In an apparatus for sawing stone, the combination with a strip of wire calculated to be drawn alternately in reversed directions in contact with the stone to be cut, two vertical shafts at suitable distance apart and having their lower ends secured from moving and at points on a plane below the line of the horizontal plane to which the stone is to be cut, brackets calculated to move in either direction on said vertical shafts, wire-depressing wheels mounted on spindles which are carried by said brackets and are calculated to superimpose weight on the portion of the wire moving in contact with the stone, of two wire-carrying drums, each receiving and holding with an end of the wire strip and capable of having their direction of revolution reversed and also capable of longitudinal movement in either direction, brakes calculated to check the free revolution of the respective drums when paying out the wire, a driving-wheel loosely mounted on each of the shafts of said drums and geared together by a drive chain or belt, a clutch between each said loose driving-wheel and the shaft it is mounted on, and a lever mechanism for operating said clutches simultaneously for effecting reversals of revolutions of said wire-carrying drums at times for changing the direction of lengthwise movement of the wire strip through the stone, substantially as and for the purposes set forth.

5. In a stone-sawing apparatus employing a wire strip for cutting the stone and two drums calculated to move the wire lengthwise and alternately in reversed directions, the combination with said wire strip and said drums, of brakes calculated to check the free revolution of the respective drums when paying out the wire, a driving-wheel loosely mounted on each of the shafts of said drums and geared together by a drive chain or belt, a clutch between each said loose driving-wheel and the shaft it is mounted on, stop-pieces secured to the wire at near the points of its connection with the respective drums, slotted levers K connecting-rods k and arms k' and lever L all between said clutches and drums, substantially as and for the purposes set forth.

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Witnesses:

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