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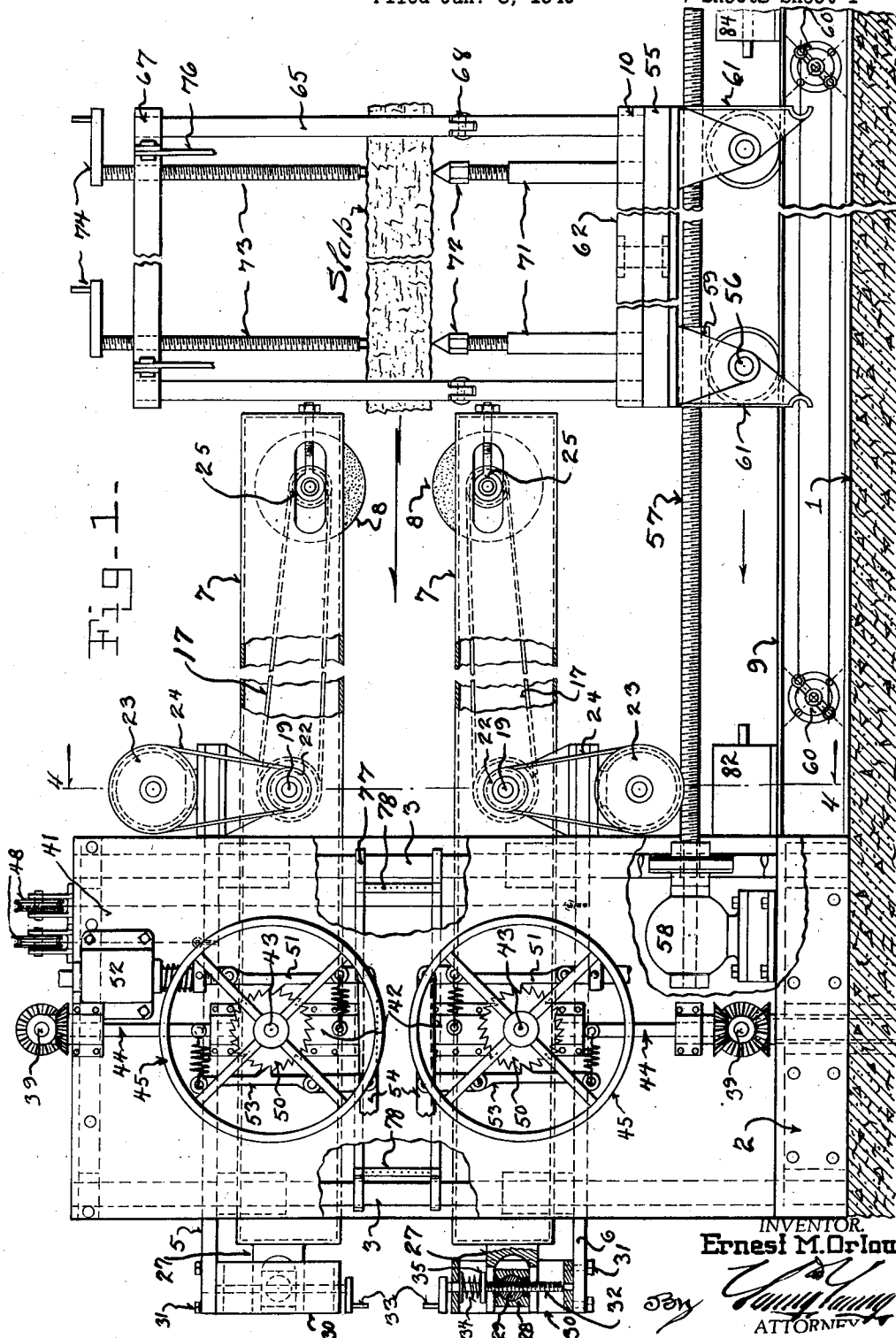
E. M. ORLOW

2,319,154

APPARATUS AND METHOD FOR BREAKING SLABS OF STONE

Filed Jan. 8, 1940

7 Sheets-Sheet 1



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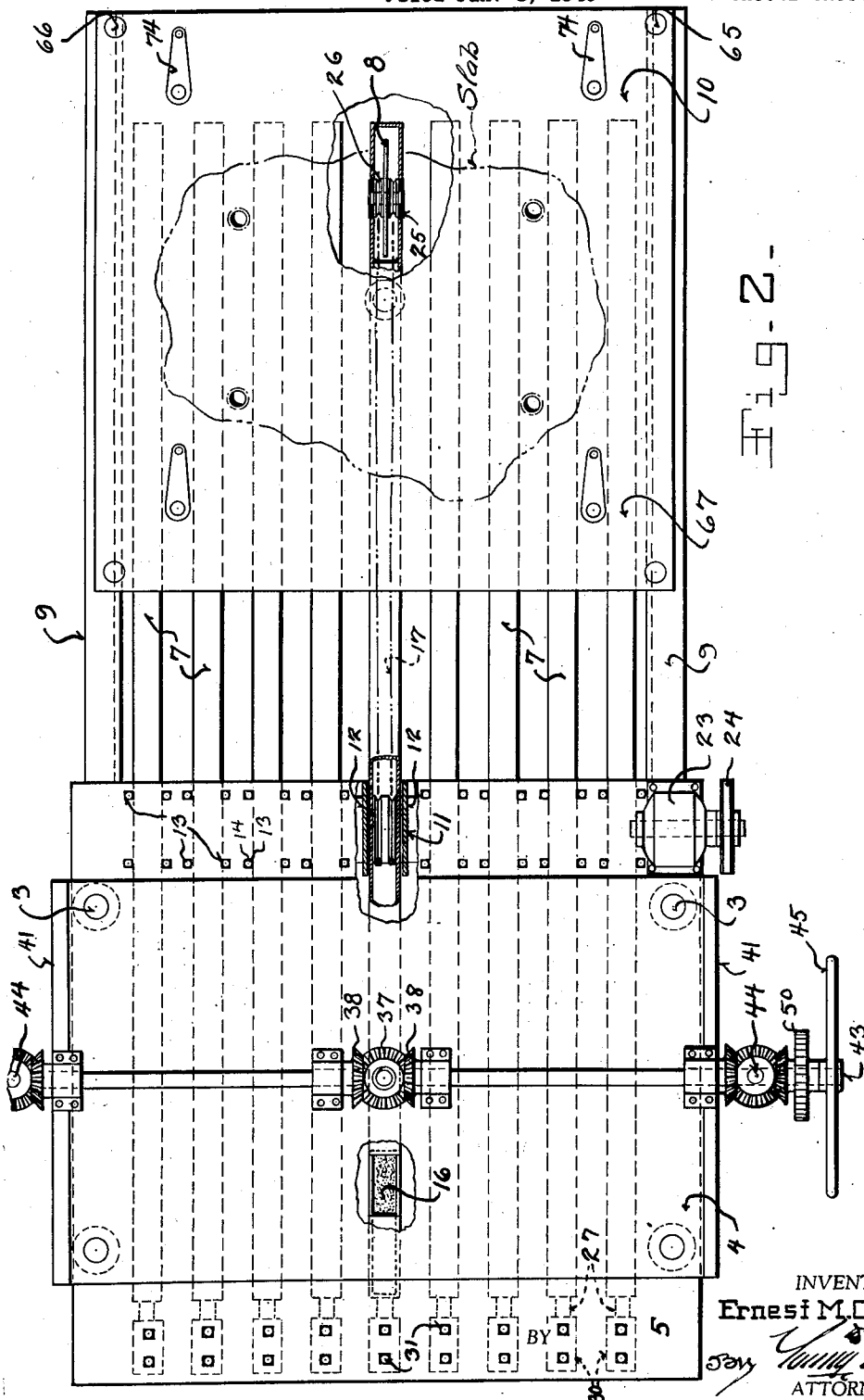
E. M. ORLOW

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7 Sheets-Sheet 2



INVENTOR.
Ernest M. Orlow.
BY *[Signature]*
ATTORNEY.

May 11, 1943.

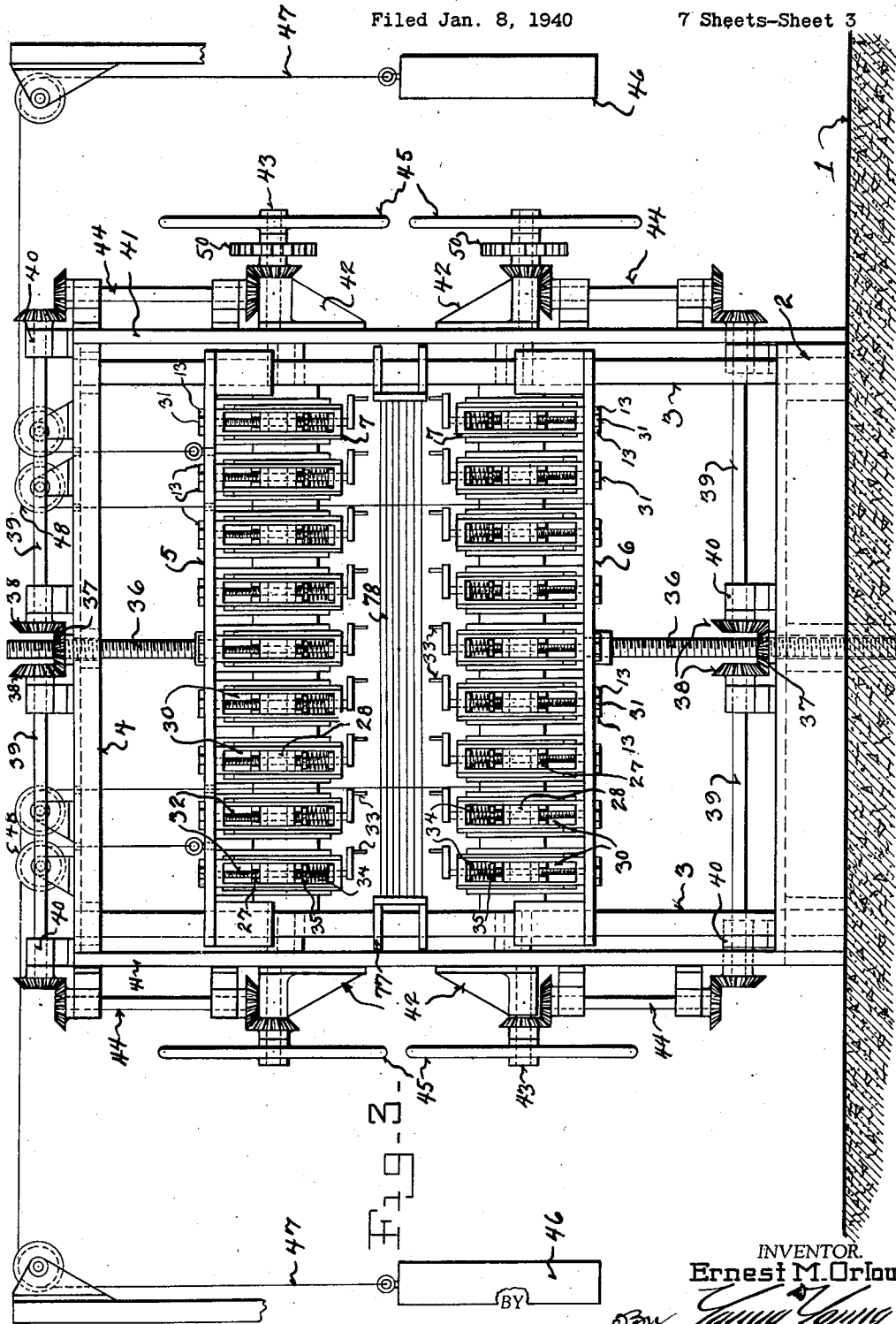
E. M. ORLOW

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APPARATUS AND METHOD FOR BREAKING SLABS OF STONE

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7 Sheets-Sheet 3



INVENTOR
Ernest M. Orlow
BY *Ernest M. Orlow*
ATTORNEY.

May 11, 1943.

E. M. ORLOW

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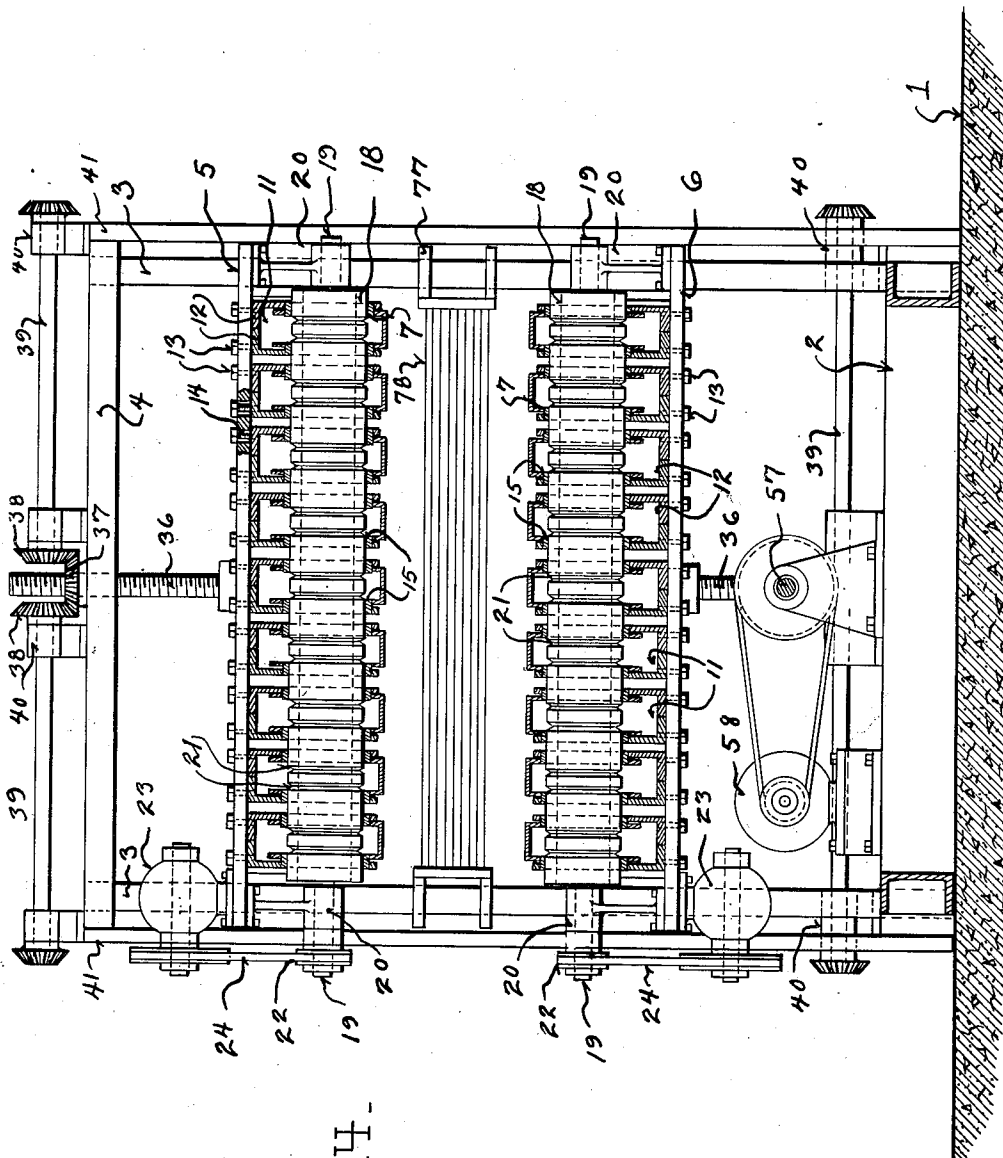


Fig. 4-

BY

INVENTOR.
Ernest M. Orlow.
ATTORNEY.

May 11, 1943.

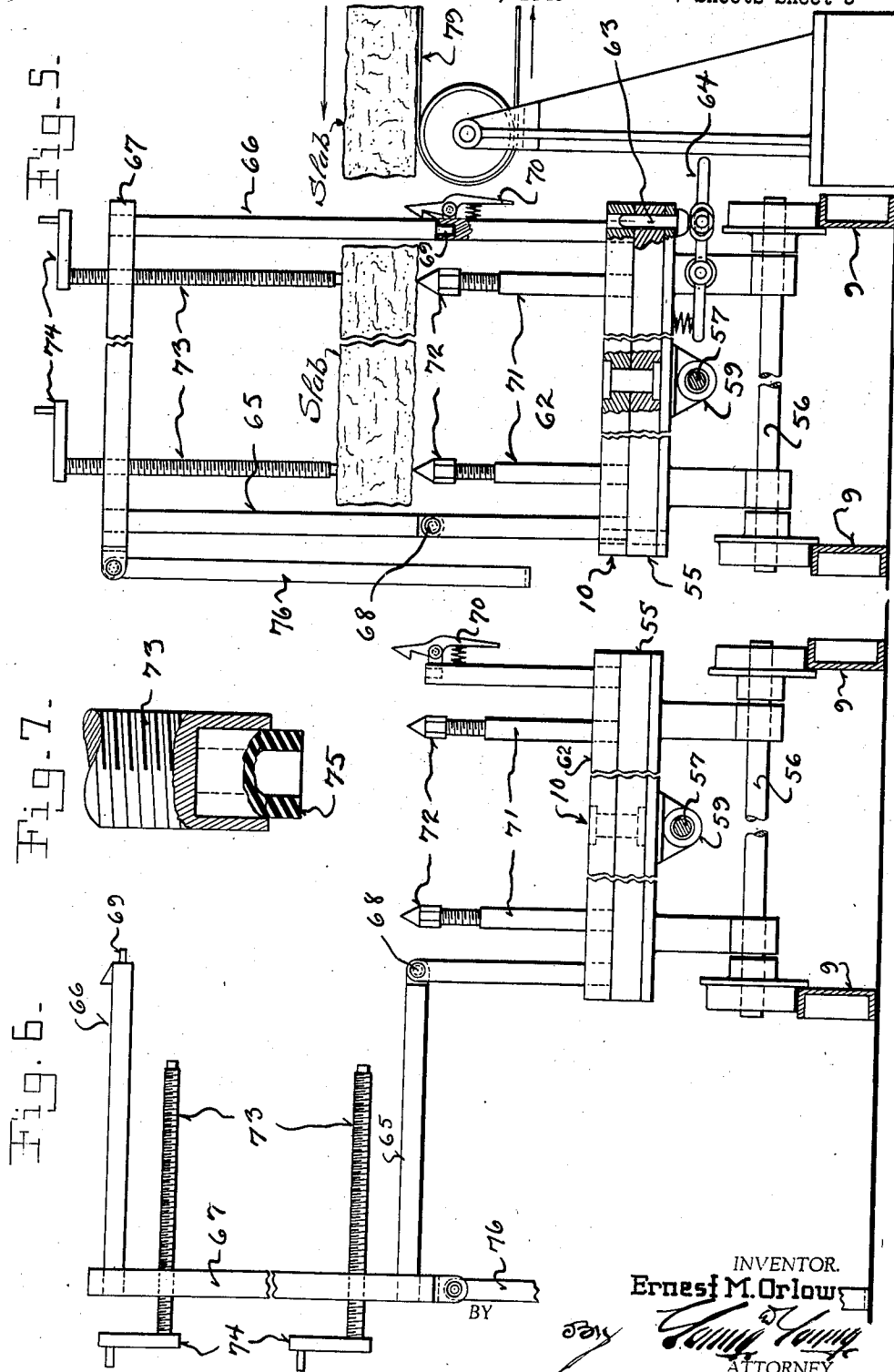
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APPARATUS AND METHOD FOR BREAKING SLABS OF STONE

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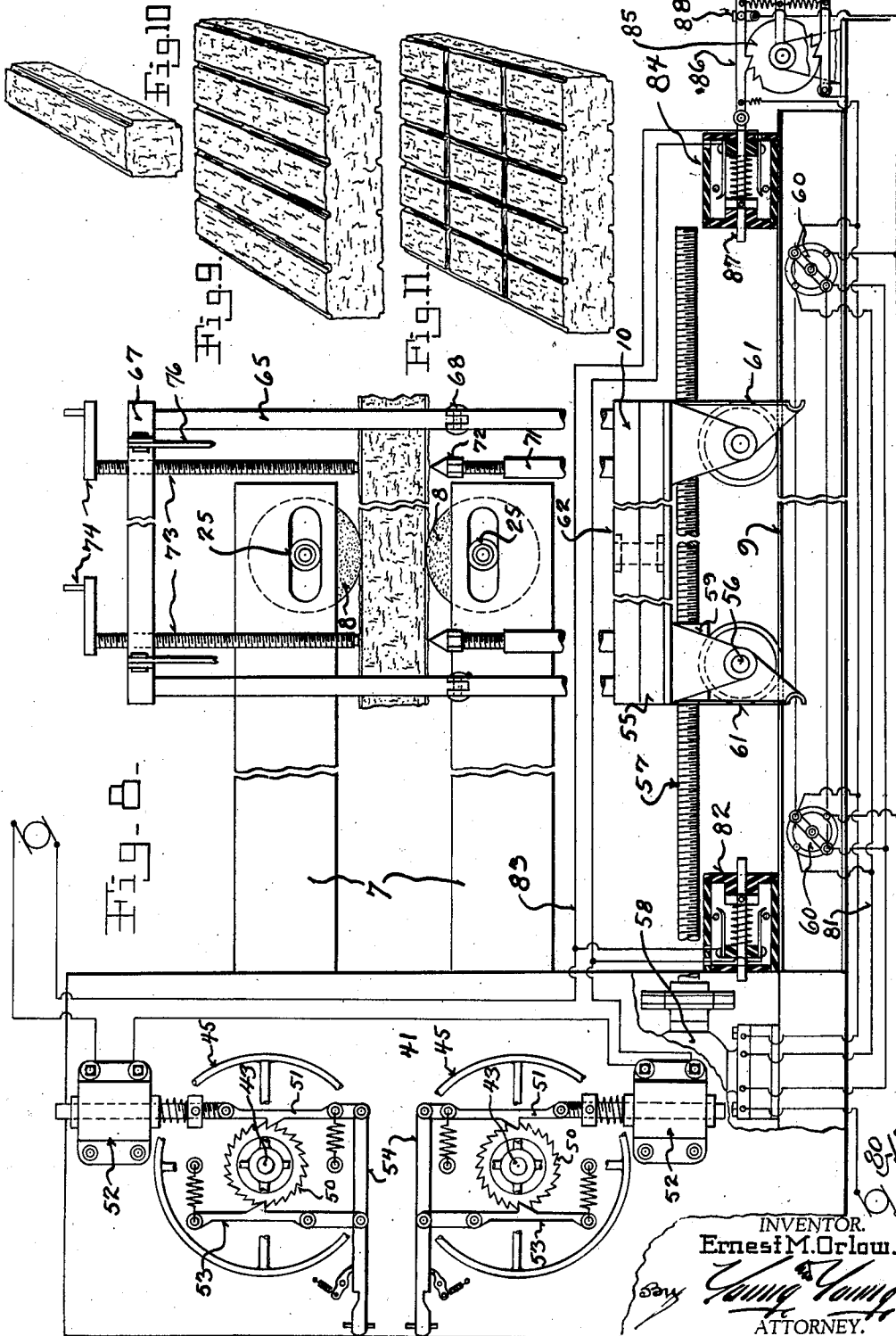
E. M. ORLOW

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APPARATUS AND METHOD FOR BREAKING SLABS OF STONE

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INVENTOR.
Ernest M. Orlow.
ATTORNEY.

May 11, 1943.

E. M. ORLOW

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APPARATUS AND METHOD FOR BREAKING SLABS OF STONE

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Fig. 12.

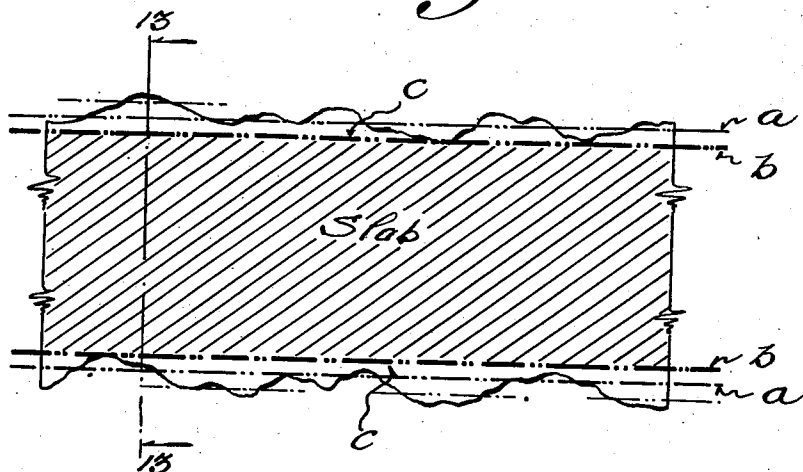
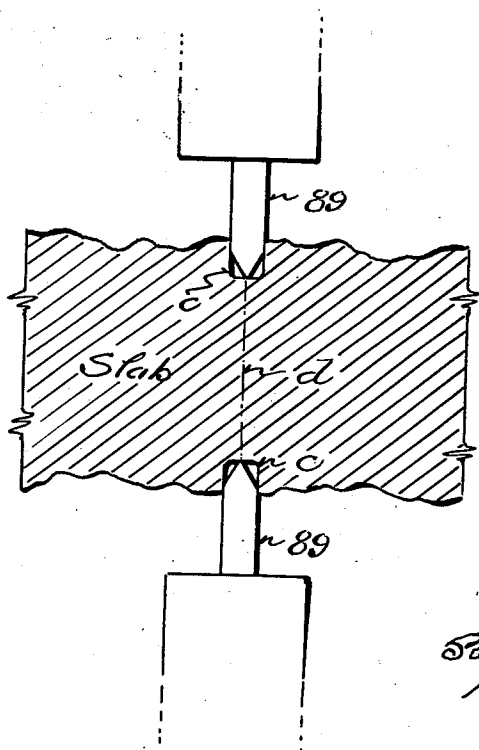


Fig. 13.



Inventor

Ernest M. Orlow.

By *Young Young*
Attorneys

UNITED STATES PATENT OFFICE

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APPARATUS AND METHOD FOR BREAKING
SLABS OF STONE

Ernest M. Orlow, Lannon, Wis.

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8 Claims. (Cl. 125—23)

This invention pertains generally to the breaking of stone, and more particularly slabs of stone found in stratified deposits, and having irregular surfaces.

Numerous attempts have been made to produce machines for breaking stone of the foregoing character into blocks of predetermined size and shape, but as far as is known, these have proved to be impractical because of the slow rate of production and the high cost of operation, combined with considerable inaccuracy in the resultant break.

Consequently, slab stone, commonly known as "Lannon" stone, and characterized by a high percentage of magnesia, and great density, is at present manually broken with hand tools, in a slow, expensive, and inaccurate manner, at little or no profit to the producer.

It is, therefore, the primary object of the present invention to provide a novel method and apparatus by which slabs of stone may be evenly and accurately broken into blocks of predetermined shape and size, at minimum cost.

Incidental to the foregoing, a more specific object of the invention resides in the novel method of severing stone slabs into blocks of predetermined size and shape consisting of, first rutting opposite faces of the slab in the same transverse plane to provide continuous flat seats for reception of a pair of spaced breaker blades, and thereafter applying impact to one of the blades.

More specifically, the novel method contemplated by the invention consists in, reciprocating a stone slab between alined abrasive discs to progressively rut the high spots on opposite faces of the slab until a smooth bed is obtained, next placing the slab between a pair of blades engaged in the opposite ruts, and then subjecting one of the blades to a heavy impact to cause a substantially even, regular fracture between the ruts.

Another object of the invention resides in the provision of apparatus for rutting the opposite irregular faces of a slab of stone in the same plane, to produce flat seats or beds for reception of a pair of blades to which impact is applied, with resultant accurate breaking between the ruts.

A further object of the invention is to provide a machine comprising spaced alined abrasive discs, between which a slab of stone is fed to rut the opposite faces of the slab, reducing the high spots to provide flat smooth beds for the reception of a pair of breaking blades.

Another object of the invention consists in the

provision of a machine of the foregoing type in which a slab of stone is automatically reciprocated between spaced abrasive discs, the discs being progressively shifted toward the slab to take fresh cuts upon each travel of the slab.

Another object resides in the provision of a machine including spaced groups of pivotal arms provided with abrasive discs, the arms of each group being independently adjustable, and each group being alined and adjustable with relation to the opposite group.

Another object resides in the provision of a carriage provided with adjustable means for leveling and clamping a slab of stone thereon to be reciprocated between the spaced abrasive discs.

A further object is to provide a carriage of the foregoing type, which is rotatably adjustable to allow rutting of the stone in transverse directions.

With the above and other objects in view, which will appear as the description proceeds, the invention resides in the novel method, construction, combination, and arrangement of parts, substantially as hereinafter described, and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the herein disclosed invention may be made as come within the scope of the claims.

In the accompanying drawings is illustrated one complete example of the physical embodiment of the present invention constructed according to the best mode so far devised for the practical application of the principles thereof.

In the drawings:

Figure 1 is an elevation of a machine incorporating one form of the present invention, parts being broken away and in section to more clearly illustrate structural details;

Figure 2 is a plan view of a machine with parts removed, and parts broken away and in section; Figure 3 is a rear end elevation of the machine; Figure 4 is a transverse vertical section, taken on the line 4—4 of Figure 1;

Figure 5 is an end elevation of the stone carriage, parts being broken away and in section;

Figure 6 is a similar view, showing the clamps swung out of operative position;

Figure 7 is an enlarged fragmentary detail of one of the clamping feet, parts being broken away and in section;

Figure 8 is a schematic view of the machine illustrating an arrangement of circuits for controlling the electrical elements of the machine.

and also showing the operative position of the abrasive discs;

Figure 9 is a perspective view of a slab after being rutted in one direction;

Figure 10 is a perspective view of a severed block;

Figure 11 is a perspective view of a slab rutted in transverse directions;

Figure 12 is an exaggerated section through a slab illustrating the rutting operation; and

Figure 13 is a fragmentary transverse section of the slab, taken on the line 13—13 of Figure 12, and showing the breaking blades in operative position.

Referring now more particularly to the accompanying drawings, which illustrate one structure of apparatus by which the novel method of the invention is practiced, the numeral 1 designates a bed or foundation upon which a fabricated base 2 is mounted. Secured upon the base are spaced uprights 3, upon which a head 4 is mounted.

Slidably journaled upon the uprights 3 is a pair of upper and lower tables 5 and 6 respectively, each of which carries a group of spaced pivotal arms 7, that in turn carry abrasive discs 8 which perform the rutting operation to be later described.

Connected to the base 2, and extending forwardly from the same, is a pair of tracks 9, upon which a reciprocal stone carriage 10 is mounted.

Considering now in detail the structure of the various elements incorporated in the machine, the pivotal arms 7 will be described first. As best shown in Figure 4, secured to the lower face of the upper table 5, and the top face of the lower table 6, is a plurality of boxes 11, each comprising a pair of split brackets 12 adjustably secured to the table by bolts 13 passing through slots 14 in the table, thus permitting slight transverse adjustment of the boxes on the table for the purpose of accurately spacing the arms 7.

The brackets 12 are provided with inwardly extending hubs 15, upon which the arms 7 are journaled for limited pivotal movement. While the arms 7 may be of any desired structure, the form illustrated consists of a tubular box-shaped casing, counterbalanced at the rear end by any desired heavy material 16, preferably lead shot or small weighted particles, to facilitate proper counterbalancing of the arms.

Those portions of the arms disposed within the brackets are provided with openings to permit access to the arms for replacing belts 17 that drive the abrasive discs. These belts, preferably of the V-type, are connected with an elongated cylindrical driving pulley 18, which extends through the hubs 15 of the brackets 12. At its outer ends, the pulley 18 is provided with shafts 19, journaled in brackets 20 carried by the tables, while those portions of the pulley between the brackets are provided with spaced grooves 21 for reception of the drive belts 17. One of the stub shafts 19 of each pulley 18 has secured thereon a pulley 22, operatively connected by a drive belt 24 with a motor 23 mounted on the table.

As will be noted in the drawings, the upper and lower arms 7, and their mountings, are identical in structure, and are merely reversed with relation to their respective tables, the upper group of arms being positioned below the table, while the lower arms are mounted above the table.

The abrasive discs 8 are journaled in adjustable boxes 25, slidably mounted in the outer ends of the arms 7, each disc being operatively driven by

pulleys 26, connected with the main drive pulley 18 by the belts 17.

For the purpose of relative adjustment of the upper and lower tables 5 and 6, to compensate for slabs of stone of varying thickness, each table has secured thereto a worm screw 36, the worm carried by the upper table 5 extending through the head 4, while the lower worm extends downwardly through the base 2. Threaded on each screw is a beveled gear nut 37, engaged by a pair of beveled pinions 38, secured to opposite extending shafts 39 journaled in suitable brackets 40 carried by the head and base. Mounted upon side plates 41, connected to the head 4 and the base 2, are brackets 42, in which stub shafts 43 are journaled. The shafts 43 are operatively connected with the shafts 49 through beveled gear drives, designated generally as 44. The shafts are provided with hand wheels 45 for manual rotation of the shafts, and consequent adjustment of the tables. To facilitate such adjustment, as well as automatic adjustment, to be later described, each table is counterbalanced by weights 46, connected with the tables through cables 47 passing over suitable pulleys 48.

For independent adjustment of the arms 7 to compensate for irregularities in the surfaces of the slabs, each is provided at its rear end with a yoke 27 for reception of a block 28, having a cylindrical plug 29 journaled therein. As best shown in Figures 1 and 3, the rear ends of the tables 5 and 6 have mounted thereon spaced boxes 30 for reception of the yokes 27. Preferably, the boxes are adjustably secured upon the tables by bolts 31 passing through slots formed in the tables, to permit accurate spacing of the arms.

Extending through each box 30, and threaded into the cylindrical plug 29, is a worm screw 32, provided at one end with a crank 33 for manipulating the same. A coil spring 34 mounted on the screw 32, and disposed between one end of the box and a collar 35 fastened to the screw, serves to urge the plug 28, and consequently the rear end of the arms 7 to its normal operative position. In the event that the abrasive discs 8, carried by the forward ends of the arms, should meet an obstruction or encounter excessive resistance, the springs 34 allow the rear ends of the arms to yield, thus avoiding undue wear and damage to the abrasive discs.

As will be noted in Figure 1, the arms of the yoke 27, which engage the block 28, are bifurcated to straddle the screw 32, which is longitudinally movable in the box 30.

Due to the density and hardness of various types of stone to be treated by the present method and apparatus, in the rutting operation it has been found highly advantageous and more practical to progressively rut the faces of the slab, rather than to accomplish the results desired in a single operation. Therefore, in the practical application of the method, it is proposed to reciprocate the slab between the abrasive discs 8, and after each travel of the slab, to adjust the abrasive discs to a new cut, until such time as the high spots have been leveled to produce a smooth, flat seat or bed for the breaking knives.

While the foregoing operation may be accomplished manually, by manipulation of the hand wheels 45, for the most practical application of the principle involved, it is proposed to accomplish such adjustment automatically, thus enabling operators to service a gang of machines at one time, to effect a material saving in labor; it being realized that the rutting operation of

the machine requires sufficient time to enable the operators required for one machine to successively load and remove slabs from a number of machines.

To accomplish automatic adjustment of the abrasive discs for progressive light cuts upon reciprocation of the slab, the stub shafts 43 on one side of the machine are provided with ratchet wheels 50, which are intermittently actuated by dogs 51 connected to the armatures of electric solenoids 52. Holding dogs 53 serve to prevent retrograde movement of the ratchets, and shiftable levers 54 connected with the actuating and holding dogs 51 and 53, respectively, enable the dogs to be thrown out of engagement with the ratchet wheels 50, to allow manual adjustment of the tables 5 and 6.

Considering now the reciprocal carriage 10, which comprises a platform 55 mounted upon trucks 56 that travel on the channel tracks 9, automatic reciprocation of the carriage is accomplished by means of a worm screw 57 actuated by a reversible motor 58 mounted on the base 2, and extending through a nut 59 carried by the platform. A pair of connected two-way switches 60, which control the motor 58, are actuated by fingers 61 depending from the carriage, to reverse the motor and limit travel of the carriage in opposite directions.

Rotatably mounted upon the platform 55 is a table 62, which is locked in its adjusted position by a detent 63, carried by the table and connected to a spring-urged, manually operable lever 64, as best shown in Figure 5. Mounted upon opposite sides of the table 62 are spaced sectional uprights 65 and 66, respectively, which carry a head 67. The sections of the upright 65 are hingedly connected at 68, while the sections of the upright 66 are provided with dowel connections 69, and spring latches 70 for locking the sections in assembled relation.

Mounted upon the revolving table 62 is a plurality of vertical supporting bars 71, provided at their upper ends with adjustable points 72, by which the slabs of stone are leveled and supported. Threaded into the head 67 are corresponding clamping members 73, provided with cranks 74 at their upper ends for manipulating the same. The lower ends of the clamps 73 are provided with sockets for reception of tubular resilient gripping feet 75, which engage the irregular upper face of the slab to firmly impinge and hold the same on the points 72.

As indicated in Figure 2, a plurality of supporting bars 71 may be arbitrarily arranged on the table 62 to compensate for slabs of different shapes and sizes, a relatively small slab being indicated in dotted lines. Likewise, the clamping members 73 may be shifted in the head 67.

To facilitate initial setting of the abrasive discs for slabs of various thicknesses by manipulation of the hand wheels 45 at either side of the machine, the uprights 3 are provided intermediate the tables 5 and 6 with frames 77, which carry aligned front and rear horizontal sight wires 78, that enable the operator to accurately aline the peripheries of the abrasive discs with the surfaces of the slab.

The purpose in providing sectional uprights for supporting the head 67 is to permit the head to be swung out of the way, as shown in Figure 6, to facilitate the deposit and removal of a slab from the carriage. As a matter of convenience, a yoke 76 is pivotally connected to one side of the head 67 adjacent the uprights 65, the yoke

serving as a support for the head when the same is swung to open position, as shown in Figure 6.

Operation

In the operation of the apparatus illustrated in the drawings, the slabs of stone are delivered to the apparatus by a conveyor 79, or any other suitable means, and with the head 67 swung out of operative position, as shown in Figure 6, the slabs are disposed upon the supporting bars 71, either manually or by means of a hoist. The points 72 are then adjusted to substantially level the slab, after which the head 67 is swung back to operative position and locked by the latches 70. The clamping members 73 are then turned down to engage the top of the slab, and firmly anchor the same on its supports.

After the slab is clamped on the carriage 10, an operator positioned at the rear of the machine manipulates the hand wheels 45, to raise or lower the tables 5 and 6 until the opposed edges of the upper and lower group of abrasive discs 8 are in approximate alinement with the upper and lower surfaces of the slab, the operator utilizing the sight wires 78 to aid him in this adjustment.

After initial adjustment of the tables, the operator then proceeds to individually adjust each arm by manipulation of the crank handles 33, to compensate for minute irregularities in the surfaces of the slab. With the groups of upper and lower abrasive discs 8 thus substantially aligned with the high spots on the surfaces of the slab, the apparatus is put into operation by closing a switch 80 in the motor circuit 81 to actuate the motor 58 and the worm screw 57, which causes the carriage 10 to move inwardly in the direction of the arrows shown in Figure 1, which carries the slab between the abrasive discs 8.

Upon the first inward travel of the carriage 10, it is not contemplated that the abrasive discs take other than a minor cut in the high spots of the slab. However, when the carriage reaches its inward position clear of the abrasive discs 8, a switch 82, connected with the circuit 83 that energizes the solenoids 52, is engaged by one of the depending fingers 61 mounted on the carriage, to close the circuit and simultaneously actuate the dogs 51 to rotate the ratchet wheels 50, and consequently move the tables 5 and 6 toward each other a limited distance.

At the same time, one of the two-way switches 60 is tripped by a finger 61 to reverse the current in the motor 58, causing the carriage 10 to be moved outwardly by the worm screw 57. During the outward movement of the carriage, the abrasive discs 8, which have been shifted toward the slab, take a cut as indicated by the dotted lines *a* in Figure 12. When the carriage 10 reaches its outermost position, in which the slab has cleared the abrasive discs 8, a switch 84 is closed, again actuating the solenoids 52 to move the tables toward each other a limited distance for a second cut, as indicated by the dotted lines *b* on Figure 12, which, because of the usual formation of the surfaces of the slabs treated, produces a rut having a continuous, smooth, flat bottom.

As the motor is again reversed, and the carriage 10 travels outwardly, no additional cut is taken; but in the event that any hard spots have been encountered during the preceding cut, which may have caused the arms 7 to yield against the springs 34, the abrasive discs 8 upon

second contact will level such spots to provide a

flat, smooth seat or bed, as indicated by the dotted lines *b* in Figure 12.

As the carriage reaches the limit of its outward movement upon completion of the rutting operation as heretofore described, the motor circuit is automatically opened to stop operation of the apparatus. This is accomplished by means of a toothed cam 85, which is intermittently actuated by a dog 86 connected to the plunger 87 of the switch 84. The dog 86 comprises one of the contacts of a switch 88 connected in the motor circuit 81, and consequently after the cam 85 has been shifted two teeth, and the rutting operation has been completed, the dog 86 rides upwardly on the high part of the cam 85 to open the switch 88 and break the motor circuit 81, thus stopping further operation of the carriage 10. The slab is then removed from the carriage after swinging the head 67 to open position, as shown in Figure 6.

Upon completion of the rutting operation, the slabs are then placed between a pair of breaker blades 89, which are seated in the aligned ruts *c*, as shown in Figure 13. The lower plate 89 may be stationary, and serves as an anvil. After a slab is placed between the blades, pressure or impact is exerted upon the upper blade 89, the force of which causes the slab to break along a substantially straight plane, as indicated by the dotted line *d* in Figure 13.

From the foregoing explanation, considered in connection with the accompanying drawings, it will be apparent that an exceedingly novel method and apparatus has been provided for accurately breaking slabs of stone into uniform blocks having substantially regular, smooth broken faces, highly desirable for the building and construction trade.

It will also be appreciated that the present invention reduces cost of labor to a minimum, and provides for maximum production, thus permitting the use of stone blocks at a cost comparable to manufactured brick and other building materials, at a profit to the producers.

I claim:

1. The method of breaking slabs of stone having irregular top and bottom faces into blocks of predetermined size and shape consisting of, first rutting the opposite rough faces of a slab in the same vertical plane to a depth sufficient to provide continuous flat surfaces, and thereafter simultaneously applying impact upon the flat beds of the opposite ruts throughout their entire length in a directional plane common to both ruts to transversely break the slab on the common plane of said upper and lower ruts.

2. The method of breaking slabs of stone having irregular top and bottom faces into blocks of predetermined size and shape consisting of, first rutting the opposite rough faces of the slab in the same vertical plane to a depth sufficient to provide continuous aligned straight surfaces in a substantially right angular plane to the faces of the block, and thereafter simul-

taneously applying impact upon the flat beds of the opposite ruts throughout their entire length in a directional plane common to both ruts to transversely break the slab on the common plane of said upper and lower ruts.

3. An apparatus for rutting opposite irregular faces of stone slabs comprising, spaced aligned abrasive discs, means for reciprocating a slab between said discs, and means actuated by said reciprocating means for successively shifting said discs toward said slab at the completion of each travel of said slab to progressively rut the faces of said slab.

4. An apparatus for rutting opposite irregular faces of stone slabs comprising, upper and lower groups of abrasive discs, means for relatively adjusting said groups, means for independently adjusting said discs, and means for passing a slab between said discs.

5. An apparatus for rutting opposite irregular faces of stone slabs comprising, a pair of relatively movable tables, a plurality of abrasive discs carried by each of said tables, means for reciprocating a slab between said discs, means for relatively adjusting said tables, and means for independently adjusting said abrasive discs with relation to said tables.

6. An apparatus for rutting opposite irregular faces of stone slabs comprising, a pair of relatively movable tables, a plurality of pivotal arms carried by each of said tables, abrasive discs journaled in said arms, means for effecting automatic adjustment of said tables, means for independently adjusting said arms with relation to said tables, and a carriage for passing a slab between said abrasive discs.

7. The method of breaking slabs of stone having irregular top and bottom faces into blocks of predetermined size and shape consisting of, first progressively rutting the opposite rough faces of the slab in a common vertical plane until ruts of sufficient depth are produced to provide continuous parallel flat grooves aligned in a vertical plane, and thereafter applying impact to the flat surfaces of the upper and lower ruts throughout their entire length to transversely break the slab on the common plane of said ruts.

8. The method of mechanically breaking slabs of stone having irregular top and bottom faces into blocks of predetermined size and shape consisting of, first simultaneously and progressively rutting the opposite rough faces of the slab in a common vertical plane and in parallel horizontal planes until ruts of sufficient depth are produced to overcome the irregularities in the faces of the stone and provide continuous parallel flat grooves aligned in a vertical plane, and thereafter simultaneously applying impact to the flat surfaces of the upper and lower ruts throughout their entire length to transversely break the slab on the common vertical plane of said ruts.

ERNEST M. ORLOW.