

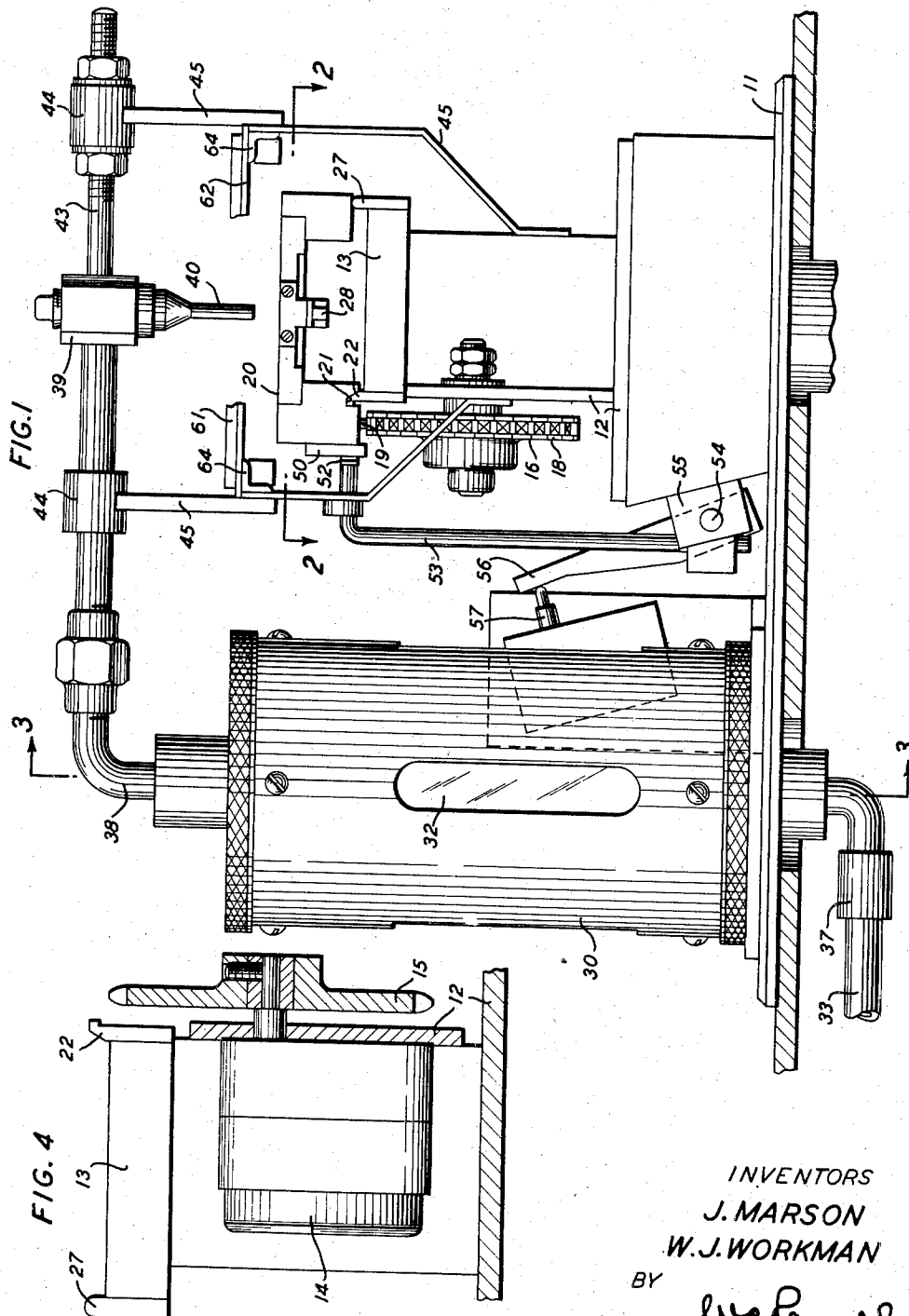
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J. MARSON ET AL
CRYSTAL DIVIDING MACHINE

2,563,476

Filed March 25, 1949

3 Sheets-Sheet 1



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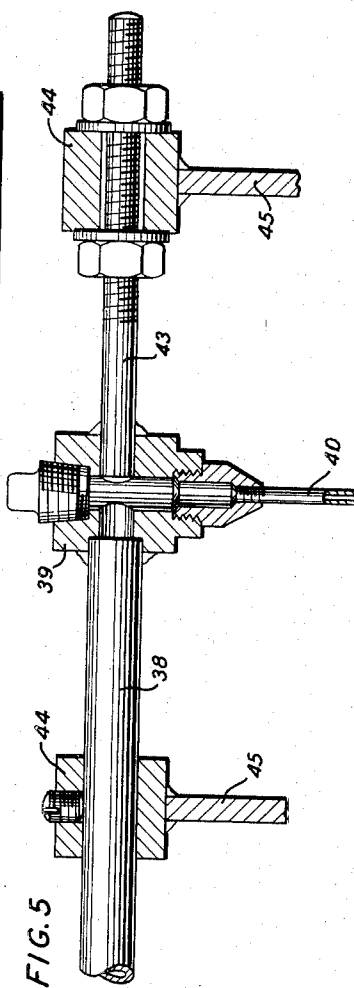
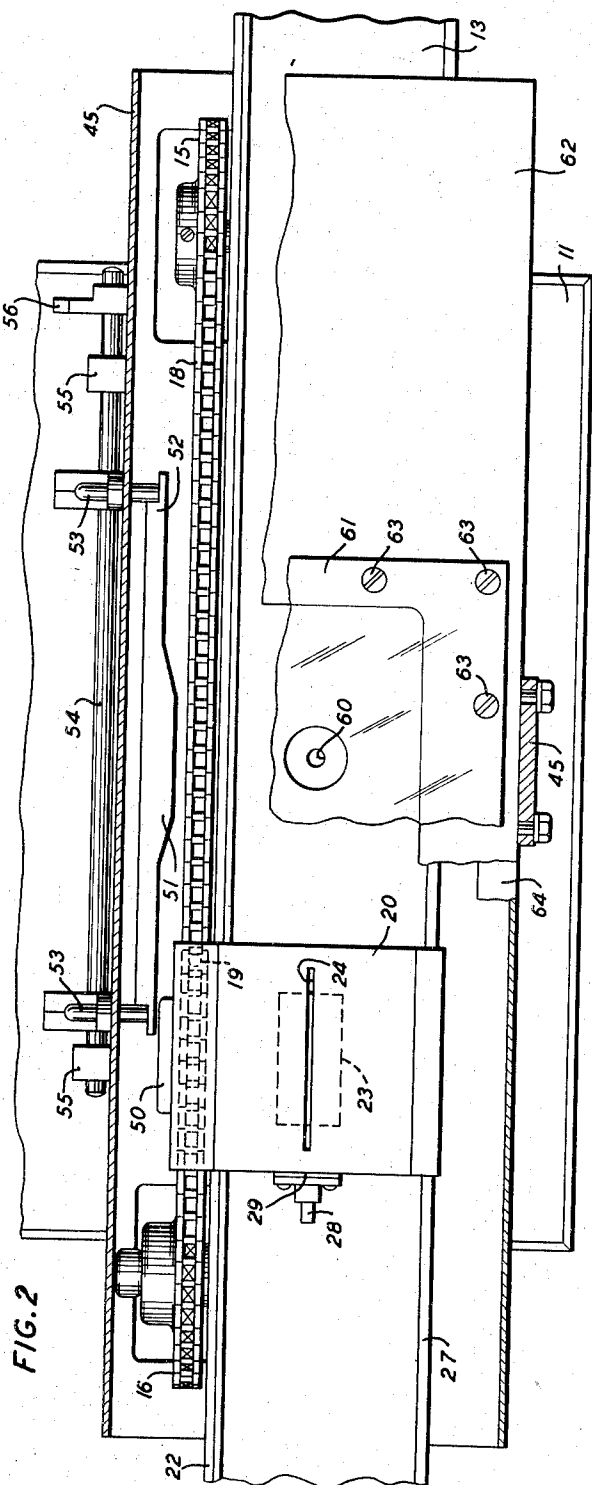
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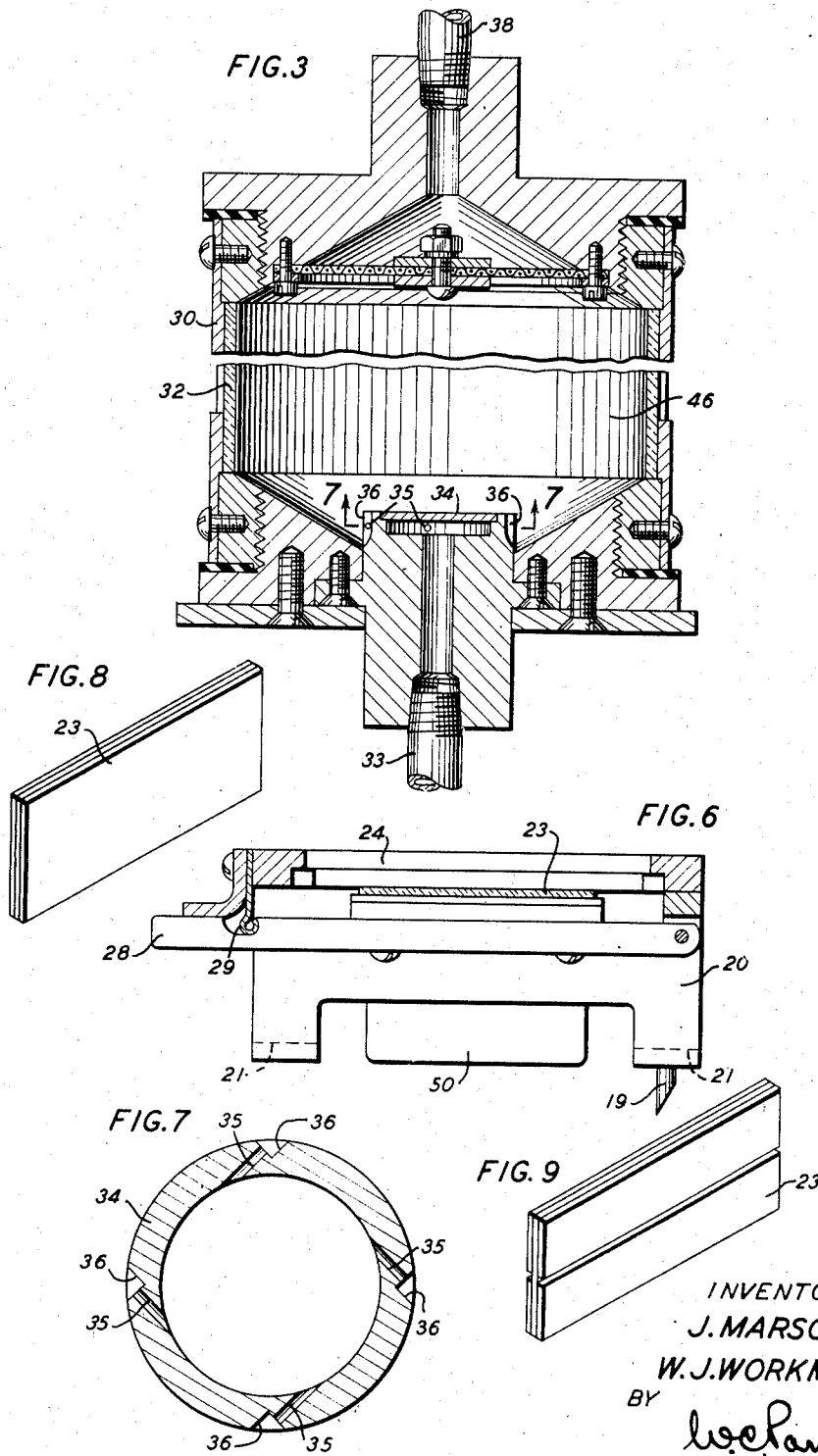
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UNITED STATES PATENT OFFICE

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CRYSTAL DIVIDING MACHINE

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6 Claims. (Cl. 51—14)

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This invention relates to crystal dividing machines and it is an object of the invention to obtain an abrading action which is efficient and effective.

In using crystals in electrical circuits and apparatus it is often essential that the crystals have duplicate electrical characteristics. Because of the difficulty in manufacturing individual crystals to have identical characteristics with other crystals, it has become common practice to "divide" these crystals, i. e., to abrade a strip down the middle of the conductive plating on both sides of the crystal so as to obtain two halves of the same crystal which are isolated electrically. By connecting these two isolated halves in different parts of an electrical circuit there is obtained in effect two separate crystals having identical electrical qualities.

The normal method of abrading the conductive plating on crystals which abound in nature, such as quartz, is by sandblasting. However, when working with so-called "synthetic" crystals, which are produced by growing and used as a substitute for quartz, the sandblasting technique used on quartz crystal is not suitable, due to the fragile nature of the synthetic crystals. The best results in dividing the coating on synthetic crystals are obtained by using an abrasive which is soft enough not to damage the crystal and is still sharp enough in its abrading action to remove the metallic plating. Ordinary pumice is eminently satisfactory for this purpose, being one of the softer abrasives. However, one disadvantage of pumice and similar abrasives is that they often tend to form coherent masses, as does flour, and will not flow uniformly, which reduces their abrasive qualities. This tendency must be overcome before best results can be obtained.

Applicants have devised an apparatus for dividing the conductive plating of crystals which insures that the abrasive is applied to the crystal in the form of a finely divided dust, thus preventing the formation of coherent masses. In one embodiment of the invention this is accomplished by applying air pressure intermittently to the bottom of the abrasive container to create and maintain a dust cloud of pumice particles in the upper part of the container from which the dust laden air passes through a feeding nozzle to the work. The work holding fixture in its travel across the abrading air stream first opens the air valve and then recloses it to permit the pressure in the abrasive container to bleed off through the nozzle in preparation for the next operation.

Other objects and advantages will be apparent

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from the following detailed description taken in conjunction with the attached drawings in which:

Fig. 1 is a side elevational view of the invention;

Fig. 2 is a partially cutaway plan view of the invention;

Fig. 3 is a sectional view of the abrasive container taken along the line 3—3 of Fig. 1;

Fig. 4 is a view, partly in section, of the driving motor and pinion;

Fig. 5 is a partial sectional view showing the nozzle for feeding the abrasive, and its mounting;

Fig. 6 is a view illustrating the mounting of a crystal to be divided in the work holding fixture;

Fig. 7 is a sectional view of the air swirling device through which compressed air is admitted to the abrasive chamber;

Fig. 8 is a perspective view of a crystal before it has been divided.

Fig. 9 is a perspective view of a crystal after division.

With reference to the drawings, a base 11 mounts a supporting structure 12, and the latter supports a fixed longitudinal metal plate 13. Also mounted on the structure 12 is a motor 14 which drives a sprocket pinion 15, and the sprocket pinion 15 drives a sprocket gear 16 by means of a link chain 18. The spaces in the link chain 18 which are engaged by the teeth of the driving and driven sprockets, are also shaped to receive a pin 19 which forms a projection on a crystal-carrying fixture 20. The fixture 20 also has indentations 21 which are shaped to correspond with and rest on a projecting flange 22 of the fixed metal plate 13. As shown in Fig. 1, the side of the fixture 20 opposite to the side containing the indentations 21 rests on another projecting flange 27 of the plate 13. By means of this construction the carrying fixture 20 slides along the plate 13 and is given longitudinal movement with respect to the plate 13 by means of its pin and slot connection with the chain 18. A crystal 23, which is to be divided, is mounted within the carrying fixture 20 as shown in Fig. 6, being held in position by a lever 28 in conjunction with catch 29, and is so positioned with respect to the slot 24 through which the abrasive dust is admitted to the crystal surfaces that the slot is parallel to its long axis and is equi-distant from the two sides of the crystal. The slot is made slightly longer than the length of the crystal to be divided.

A metal container 30 is mounted on the base 11, and has a lining of Plexiglas or similar material which forms a chamber 46 for the storage of the abrasive being used, such as for example pumice, and the creation of the abrasive dust. The con-

tainer wall has a plurality of longitudinal windows 32 which allows a visual inspection of the level of abrasive material in the container.

Air at a pressure of approximately 5 pounds per square inch is introduced into the container by means of the air line 33, the air entering the chamber through an air inlet fixture 34. This fixture, which is shown in Fig. 7, contains a plurality of non-radial openings 35 in a horizontal plane, which terminate in cutaway portions 36 at the chamber entrance side. These non-radial openings give to the air entering the chamber a swirling motion which acts on the abrasive material to create a finely divided abrasive dust cloud during the time that the air pressure is on. A solenoid 37, located in the air line 33, is used to provide intermittent operation of the abrasive dust forming apparatus as described later.

At the top of the abrasive container 30 is an outlet pipe 38 which terminates in a nozzle housing 39 containing the nozzle 40. The nozzle is positioned approximately above the center of the plate 13, and has its opening directly downwardly. The nozzle housing 39 and the outlet pipe 38 are supported by means of the shaft 43, bushings 44, and supporting arms 45.

The carrying fixture has a projection 50 which coacts in a camming action with a thickened portion 51 of actuating bar 52. The actuating bar 52 is connected by rods 53 to shaft 54, which is supported by brackets 55. Rigidly mounted on the shaft 54 is an arm 56 which is given a slight rotation whenever a camming action takes place between the projection 50 and the actuating bar 52 and is caused thereby to operate a microswitch 57. When operated this microswitch closes the operating circuit (not shown) of the solenoid 37, whose plunger operates a valve and allows air under pressure to enter the abrasive container 30. When the projection 50 passes by the thickened portion 51 of the actuating bar 52 a spring action returns the bar to its original position, and the microswitch is opened by the resultant rotation of the arm 56. This opens the solenoid circuit and causes the solenoid plunger to shut off the air supply to the abrasive container. The thickened portion 51 of the actuating bar 52 is shaped so as to open the air supply to the container 30 shortly before the crystal carrying fixture approaches the nozzle 40, and to cut it off shortly after the carrying fixture leaves the vicinity of the nozzle.

To protect the operator from the abrasive dust the nozzle 40 extends downwardly through an opening 60 in a cover plate 61, which is secured to a protective shield 62 by screws 63. This protective shield is mounted on the apparatus by bracket 64 supported by arms 45. An exhaust system (not shown) is used to conduct the abrasive dust safely away.

In the actual operation of the invention, the crystal 23 to be divided is placed into position in the carrying fixture 20. The fixture 20 is next laid on the projections of the longitudinal plate 13 so as to be slidably mounted with respect to the plate, and the pin 19 of the fixture is at the same time inserted in a slot of the link chain 18. The fixture 20 is thus given longitudinal movement along the plate 13 by the movement of the chain as it is driven by the motor 14.

As the fixture 20 approaches the nozzle 40 through which the abrasive dust is emitted, its projection 50 engages the enlarged portion 51 of the actuating bar 52 in a camming action, and the resultant rotation of the arm 56 causes the

microswitch 57 to close the solenoid circuit and open the valve controlling the air line 33, allowing air under pressure to enter the container. As this air passes through the openings 35, the non-radial location of these openings causes the air to enter the chamber 46 in a swirling motion which diffuses the abrasive into a countless number of finely divided particles, and results in the creation of a cloud of abrasive dust. The air pressure forces this abrasive dust through the outlet pipe 38 and down through the nozzle 40.

The emission of the stream of abrasive dust begins to leave the nozzle within a fraction of a second after the air line valve has been operated, and begins to impinge against the fixture just before the approaching end of the slot 24 arrives below the nozzle. The nozzle is located so that the slot, which acts as a template for the dividing action, passes directly beneath the nozzle as the fixture is carried along the plate 13, and the crystal has that part of its conductive plating exposed by the slot removed by the abrasive action of the dust as the crystal passes beneath the nozzle.

As the fixture leaves the vicinity of the nozzle the projection 50 passes by the thickened portion 51 of actuating bar 52, and the bar is returned to its original position, allowing the microswitch to be opened as the arm 56 is rotated. The opening of the microswitch opens the solenoid circuit and causes the solenoid plunger to shut off the air supply to the abrasive container.

At the end of its travel, that is, when the pin 19 has reached the center of the driving pinion 15, the fixture is removed from its position on the metal plate 13. The crystal 23 is then turned over, and the fixture is placed in position at the same end of the plate at which it was placed originally. The other half of the crystal is then given a dividing action in the same manner.

The basis of the invention is the swirling action given to the air under pressure as it enters the chamber through the non-radial openings. The swirling action of the air as it leaves the non-radial openings causes it to sweep through the abrasive with a whirlwind effect and to diffuse it into extremely fine particles. As a result, any tendency of the abrasive being used to form coherent masses is overcome, allowing maximum abrasive efficiency.

The operation creating the cloud of abrasive dust is made intermittent so as to take advantage of the high pressure surge of air entering the container when the latter is at atmospheric pressure. If the pressure were to remain on for an indefinite period the pressure inside of the container would build up, and this lowering of the pressure differential would reduce the abrasive effect which could be obtained. By cutting off the flow of air into the container at intervals, the pressure within the container is allowed to bleed off through the nozzle, which quickly reduces the pressure within the container to an atmospheric level. This allows a full differential of pressure between the container and the air inlet, and makes for maximum operating efficiency.

Although the invention as herein described has particular reference to use in the division of the plating on synthetic crystals such as ethylene diamine tartrate, it is equally applicable for use in the division of the plating on quartz crystals, or in fact on any abrading operation where the features of a finely divided abrasive mixture and intermittent operation are desired.

It is to be understood that the above-described

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arrangements are simply illustrative of the application of the principles of the invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. In abrading apparatus, the combination with a supporting table and a fixture movably mounted on said table for carrying work to be abraded, of a container partially filled with a quantity of abrasive, a source of air under pressure, an air inlet containing a plurality of non-radial openings through which the air enters the container and which lie in a plane transverse to the path of the air when first entering the inlet, said non-radial openings imparting a swirling motion to the air within the container to create a dispersed abrasive suspension, a nozzle fixedly mounted on the supporting table and adapted to emit a stream of abrasive dust in a path which intersects the line of travel of the carrying fixture, and a pipe connecting the nozzle to the container.

2. In abrading apparatus, the combination with a supporting table and a fixture movably mounted on said table for carrying work to be abraded, of a container partially filled with a quantity of abrasive, a source of air under pressure, an air inlet containing a plurality of non-radial openings through which the air enters the container, said openings lying in a plane transverse to the path of the air when first entering the inlet, a nozzle fixedly mounted on the supporting table and adapted to emit a stream of abrasive dust in a path which intersects the line of travel of the carrying fixture, a pipe connecting the nozzle to the container, and means operated by the fixture for intermittently stopping the passage of air from the air source into the container.

3. In abrading apparatus, the combination with a supporting table and a fixture movably mounted on said table for carrying work to be abraded, of a container partially filled with a quantity of abrasive, a source of air under pressure, an air inlet containing a plurality of non-radial openings through which the air enters the container, said openings lying in a plane transverse to the path of the air when first entering the inlet, a nozzle fixedly mounted on the supporting table and adapted to emit a stream of abrasive dust in a path which intersects the line of travel of the carrying fixture, a pipe connecting the nozzle to the container, and means for intermittently stopping the passage of air from the air source into the container, said means including a solenoid, a circuit for the solenoid, an air valve operated by the solenoid, a projection on the carrying fixture, and means actuated by the projection for opening and closing the solenoid circuit.

4. In abrading apparatus, the combination with a supporting table and a fixture movably mounted on said table for carrying work to be abraded, of a container partially filled with a quantity of abrasive, a source of air under pressure, an air inlet containing a plurality of non-radial openings through which the air enters the containers,

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said openings lying in a plane transverse to the path of the air when first entering the inlet, a nozzle fixedly mounted on the supporting table and adapted to emit a stream of abrasive dust in a path which intersects the line of travel of the carrying fixture, a pipe connecting the nozzle to the container, and a longitudinal opening in the top of the carrying fixture which is immediately above the material to be abraded and which is so positioned with respect to the nozzle that the stream of abrasive dust relatively traverses the length of the opening.

5. In abrading apparatus, a supporting table, a fixture slidably mounted on said table for carrying work to be abraded, means for moving the fixture including a motor, two sprockets, a chain and a pin located on said fixture which engages the chain; a container partially filled with a quantity of abrasive, a source of air under pressure, an air inlet containing a plurality of non-radial openings through which the air enters the container, said openings lying in a plane transverse to the path of the air when first entering the inlet, a nozzle fixedly mounted on the supporting table and adapted to emit a stream of abrasive dust in a path which intersects the line of travel of the carrying fixture, a pipe connecting the nozzle to the container, a longitudinal opening in the top of the carrying fixture which is immediately above the material to be abraded and which is so positioned with respect to the nozzle that the stream of abrasive dust relatively traverses the length of the opening, and means for intermittently stopping the passage of air from the air source into the container, said means including a solenoid, a circuit for the solenoid, an air valve operated by the solenoid, a projection on the carrying fixture, and means actuated by the projection for opening and closing the solenoid circuit.

6. In abrading apparatus, a container, abrasive in the container, a source of compressed air, an inlet in the container connected to the source and having openings in a plane transverse to the path of the air when first entering the inlet for discharging air non-radially into the chamber, a fixture for work to be abraded, a nozzle connected to the upper part of the container and disposed in abrading relationship to the fixture, a carriage for producing relative motion between the nozzle and the fixture, and means operated by the carriage for controlling the flow of air from the source to the inlet.

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