Oct. 10, 1933. M. E. JONES 1,930,170

APPARATUS FOR PRODUCING CURVED EDGED FIGURES IN RELIEF IN STONE AND THE LIKE

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Fig. 1.

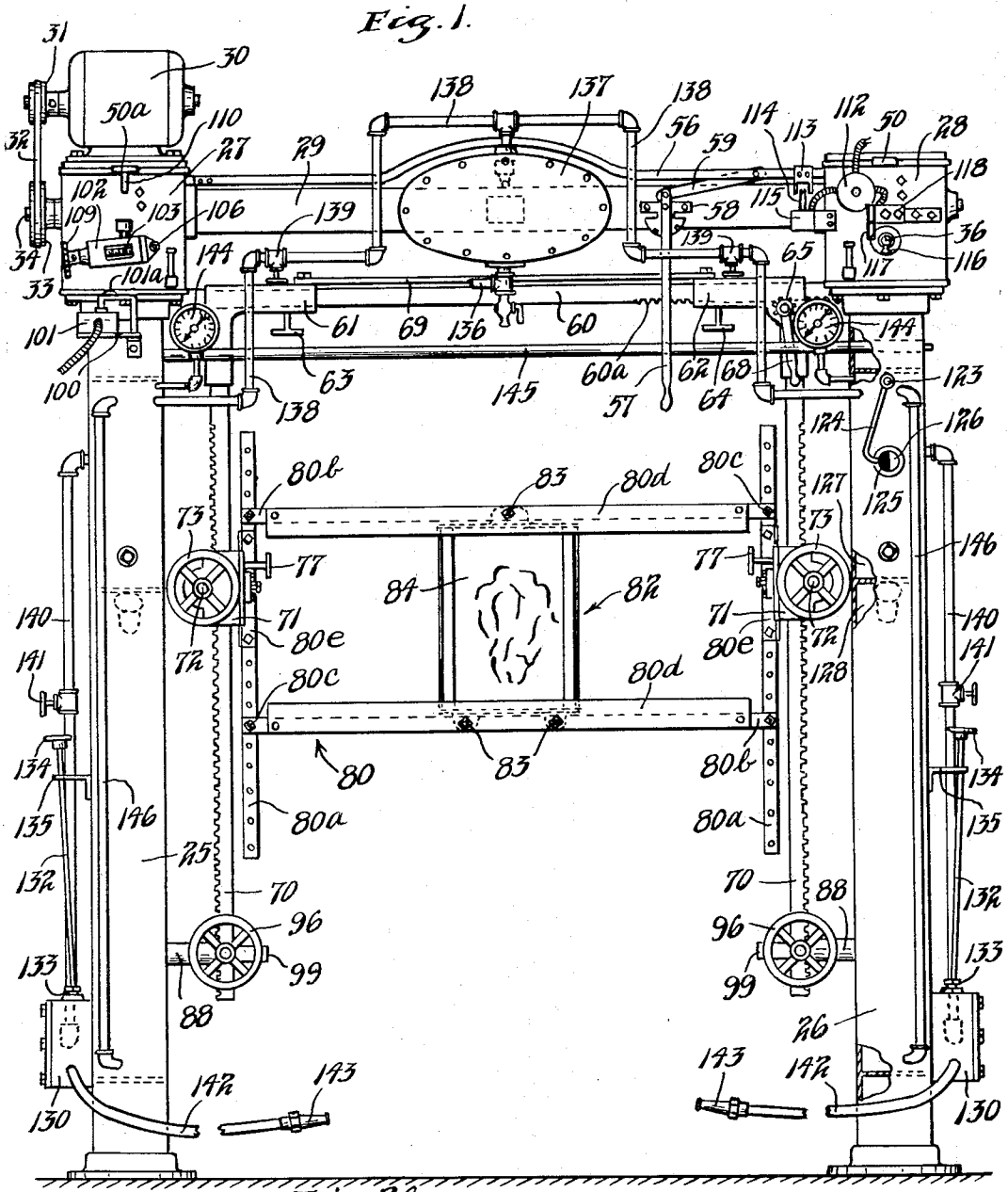
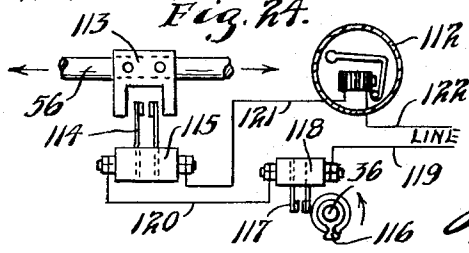


Fig. 2.



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Fig. 3.

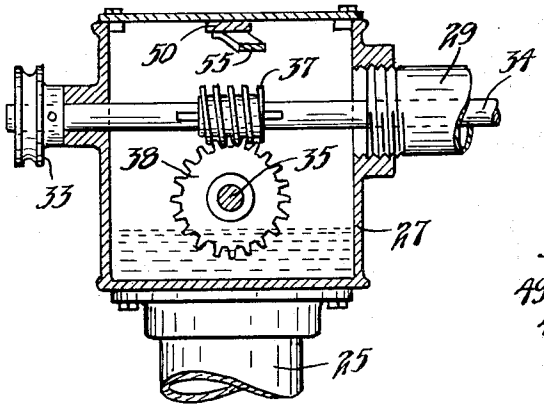


Fig. 4.

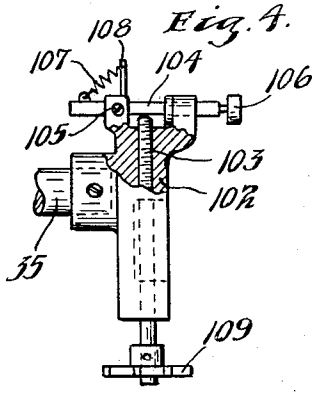


Fig. 6.

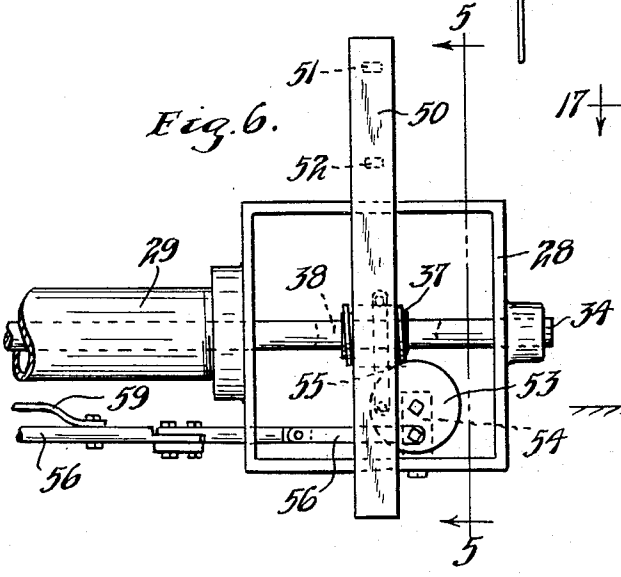
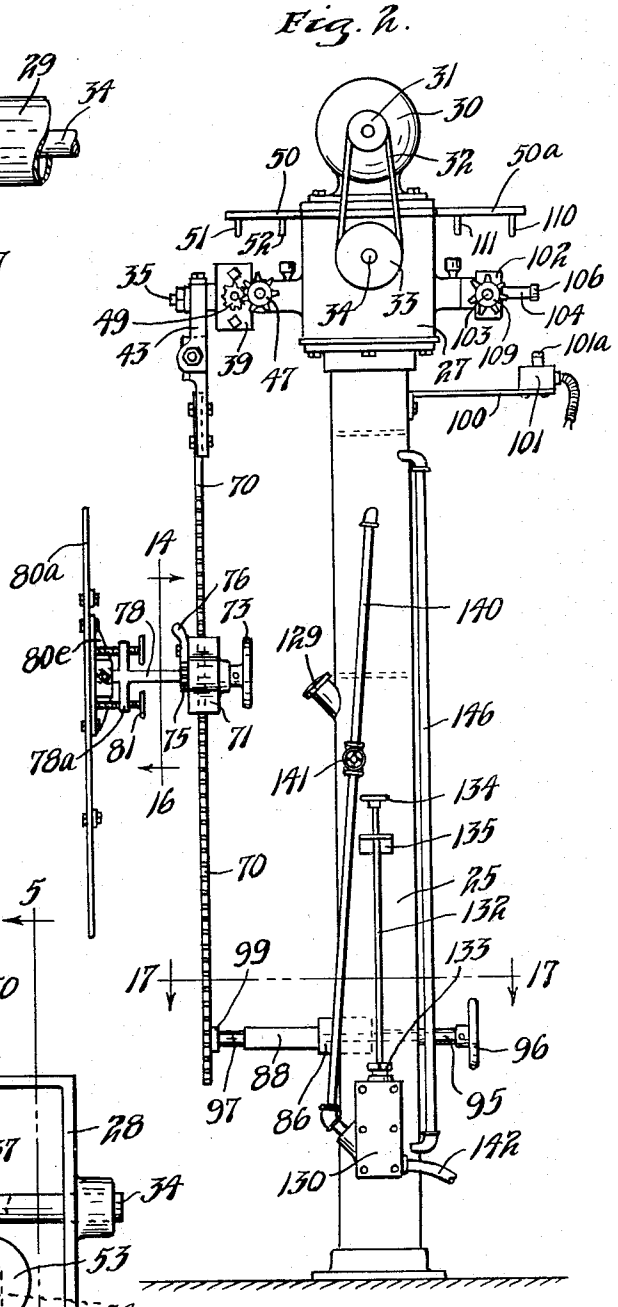


Fig. 2.



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Fig. 5.

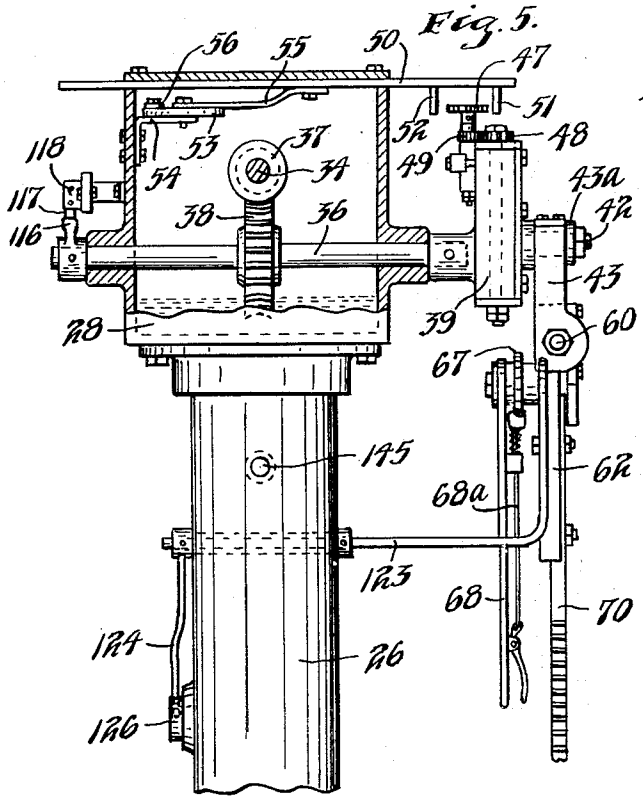


Fig. 8.

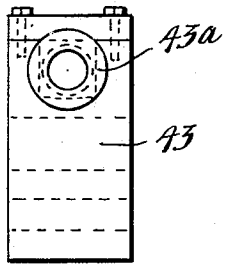


Fig. 7.

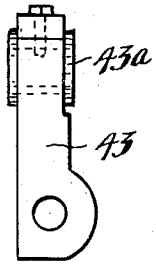


Fig. 10.

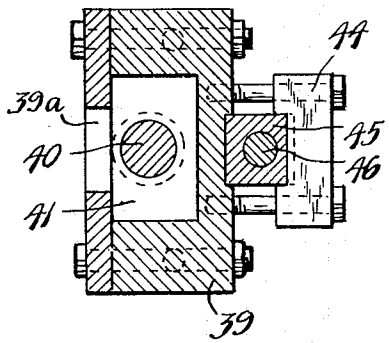


Fig. 9.

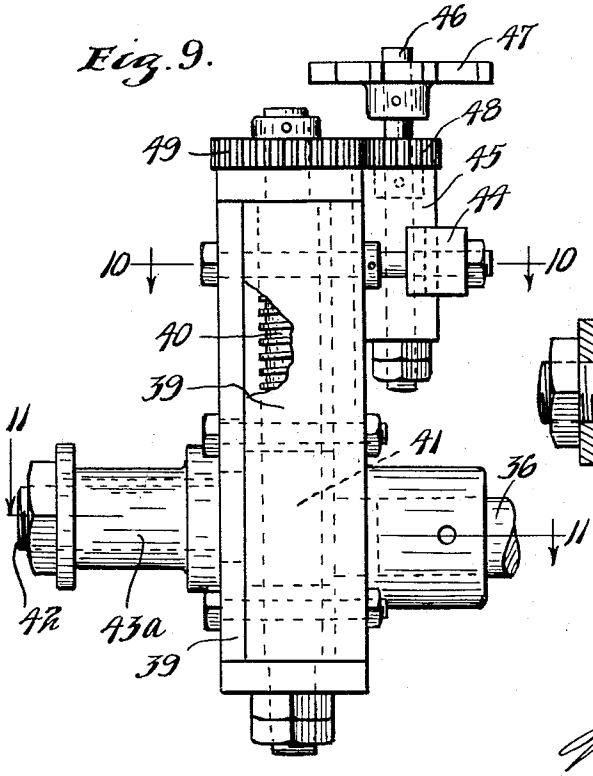
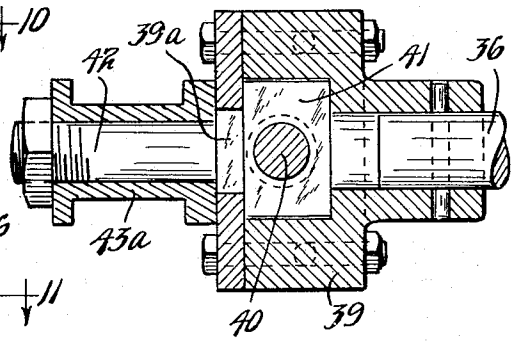


Fig. 11.



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Filed May 29, 1933 6 Sheets-Sheet 4

Fig. 12.

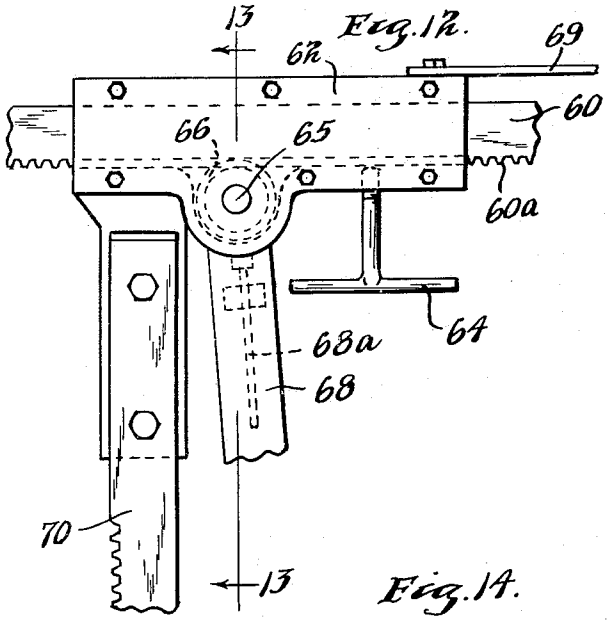


Fig. 13.

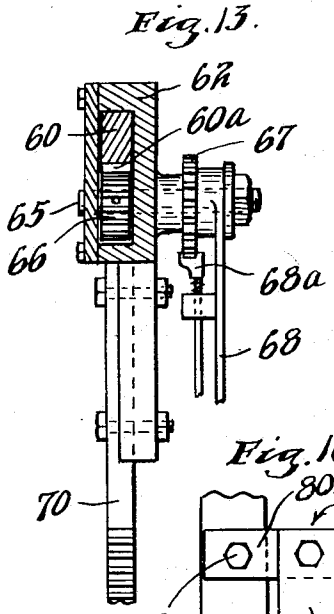


Fig. 16.

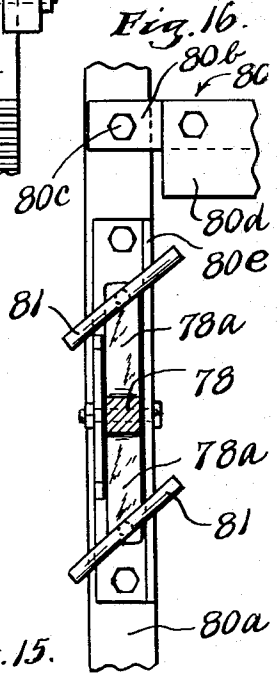


Fig. 14.

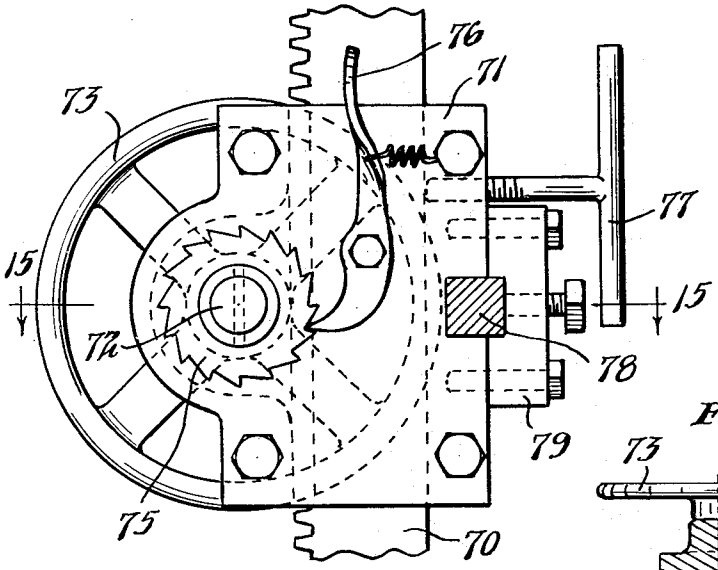
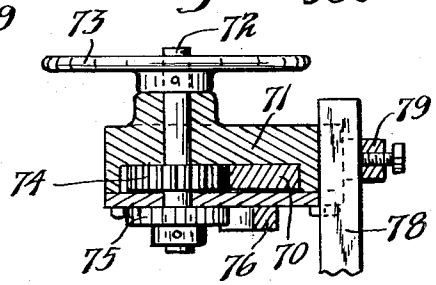


Fig. 15.



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APPARATUS FOR PRODUCING CURVED EDGED FIGURES IN RELIEF IN STONE AND THE LIKE

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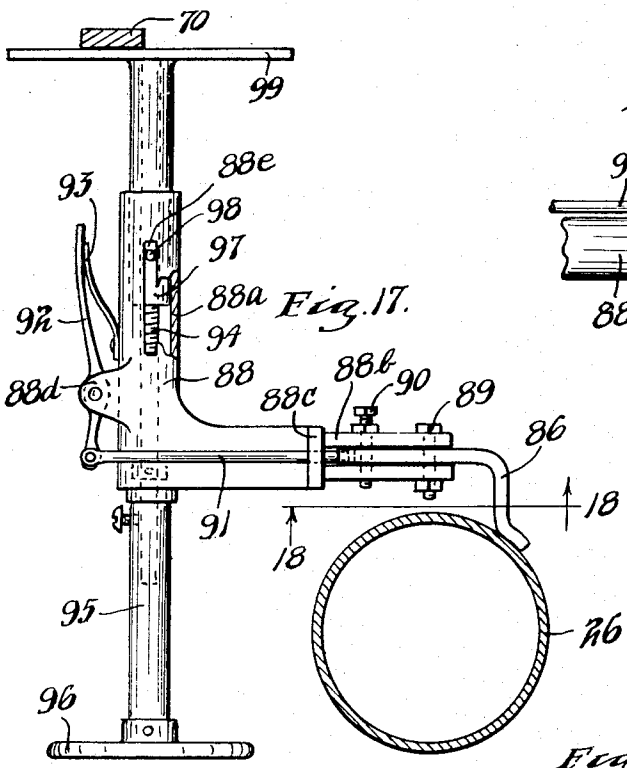


Fig. 17.

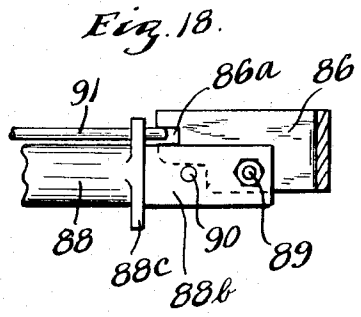


Fig. 18.

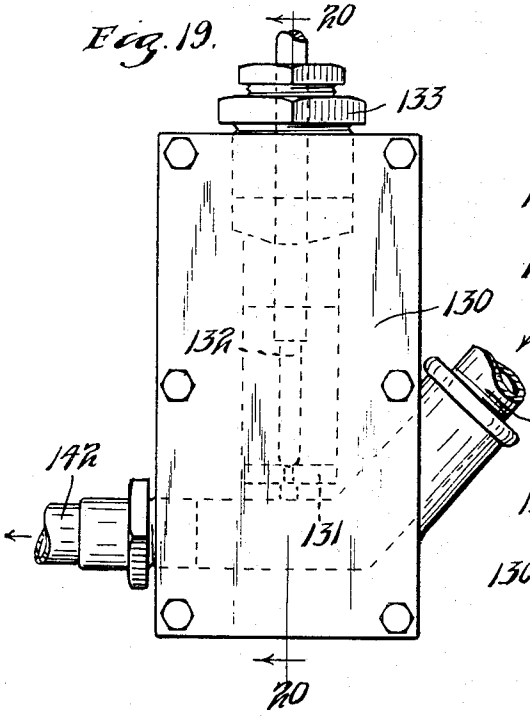


Fig. 19.

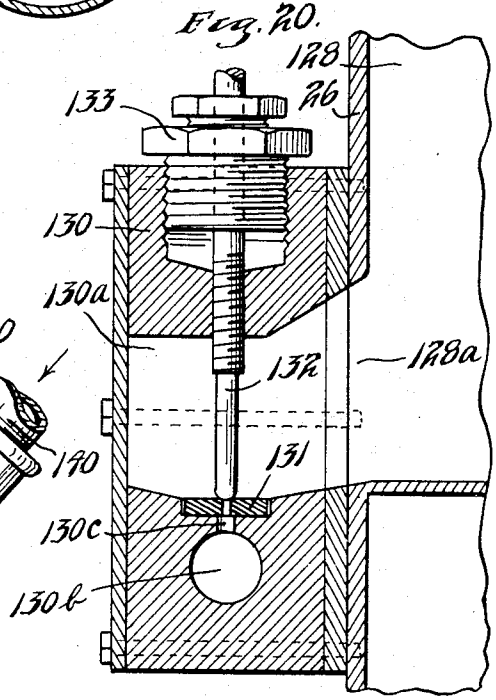


Fig. 20.

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APPARATUS FOR PRODUCING CURVED EDGED FIGURES IN RELIEF IN STONE AND THE LIKE

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Fig. 21.

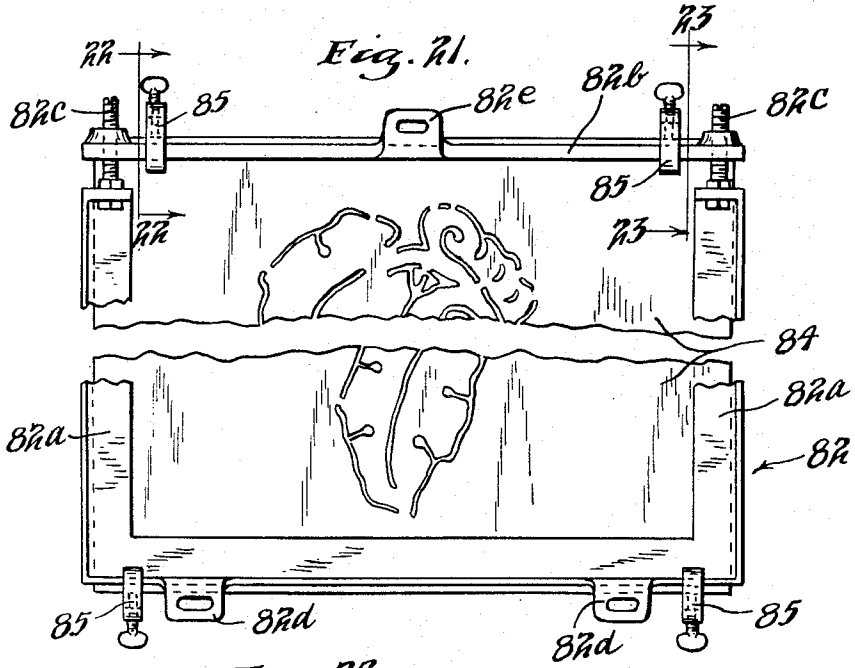


Fig. 22.

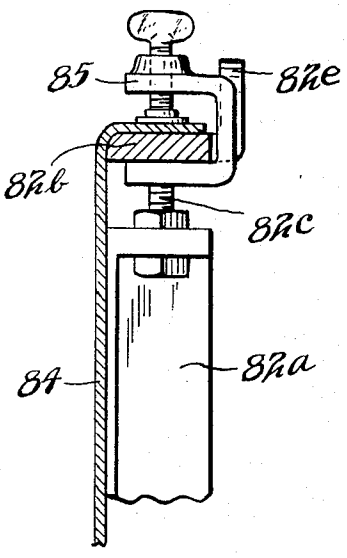
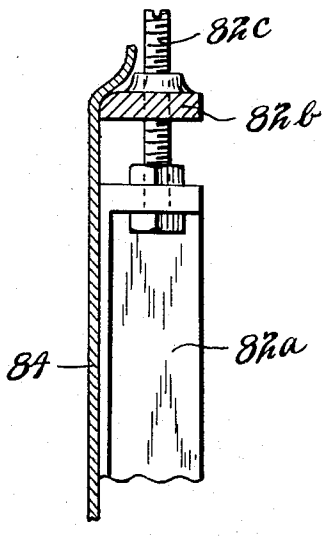


Fig. 23.



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Patented Oct. 10, 1933 1,930,170

UNITED STATES PATENT OFFICE

1,930,170

APPARATUS FOR PRODUCING CURVED EDGED FIGURES IN RELIEF IN STONE AND THE LIKE

Marshall E. Jones, St. Cloud, Minn.

Application May 29, 1933. Serial No. 673,449

11 Claims. (Cl. 41—1)

This invention relates to apparatus for use with a sand blast to produce curved edged figures in relief in stone or similar material.

It is the general object of this invention to provide novel and improved apparatus for use in carrying out the processes of producing curved edged figures in relief in stone disclosed in my prior Patent No. 1,869,427, issued August 2, 1932, and entitled "Process and apparatus for producing convex and concave surfaces in stone".

A more specific object of the invention is to provide a novel and improved machine for gyrating a stencil over a stone or the like to permit direction of a sand blast against the stencil to carve, in the stone or the like, figures in relief having convex and concave surfaces.

A further object is to provide in such a machine means for changing the radius of gyration of the stencil at will, while the machine is running.

Yet another object is to provide means for indicating to the operator of the machine by signal mechanism the radius of gyration of the stencil.

A further object is to provide in such a machine novel sand blast mechanism.

The objects and advantages of the present invention will more fully appear from the following description, made in connection with the accompanying drawings, wherein like reference characters refer to the same or similar parts throughout the various views, and, in which,

Fig. 1 is a view in front elevation illustrating a machine embodying the invention, certain of the parts being broken away and other parts being shown in section;

Fig. 2 is a view in side elevation of the machine looking toward the left side of the machine, as viewed in Fig. 1;

Fig. 3 is a view taken chiefly in vertical longitudinal section through the gear casing at the upper left hand corner of the machine, as shown in Fig. 1, the motor not being shown;

Fig. 4 is a view partly in plan and partly in vertical section of part of the safety limit switch operating mechanism;

Fig. 5 is a view in side elevation looking toward the upper right hand portion of the machine as viewed in Fig. 1, some of the parts being broken away and other parts being shown in section, the section being taken on the line 5—5 of Fig. 6, as indicated by the arrows;

Fig. 6 is a plan view looking down on the right hand gear casing, the top plate of the gear casing being removed;

Fig. 7 is a view in side elevation of one of the hanger blocks;

Fig. 8 is a view in front elevation of the same;

Fig. 9 is a view in side elevation of a portion of one of the devices for controlling the radius of gyration of the stencil, as viewed from the opposite side of the same than that shown in Fig. 5;

Fig. 10 is a horizontal section taken on the line 10—10 of Fig. 9, as indicated by the arrows;

Fig. 11 is a horizontal section taken on the line 11—11 of Fig. 9, as indicated by the arrows;

Fig. 12 is a view looking toward the rear side of the left hand rack carriage as viewed in Fig. 1;

Fig. 13 is a vertical section taken on the line 13—13 of Fig. 12, as indicated by the arrows;

Fig. 14 is a vertical section taken on the line 14—16 of Fig. 2, as indicated by the arrow adjacent the numeral 14;

Fig. 15 is a horizontal section taken on the line 15—15 of Fig. 14, as indicated by the arrows;

Fig. 16 is a vertical section taken on the line 16—14 of Fig. 2 as indicated by the arrow adjacent the numeral 16;

Fig. 17 is a horizontal section taken on the line 17—17 of Fig. 2, as indicated by the arrows;

Fig. 18 is a vertical section taken on the line 18—18 of Fig. 17, as indicated by the arrows;

Fig. 19 is a view in side elevation of the right hand sand discharge mechanism;

Fig. 20 is a vertical section taken on the line 20—20 of Fig. 19, as indicated by the arrows;

Fig. 21 is a view in front elevation of a stencil frame that may be used;

Fig. 22 is a vertical section taken on the line 22—22 of Fig. 21;

Fig. 23 is a vertical section taken on the line 23—23 of Fig. 21; and

Fig. 24 is a wiring diagram.

In accordance with the invention, there are provided left and right hand tubular standards 25 and 26 respectively. Mounted at the upper end of the left hand standard is a gear casing 27, while mounted in the upper end of the right hand standard 26 is a gear casing 28, each of these gear casings preferably being closed at their tops by removable plates. Extending between and communicating with the two gear casings 27 and 28 is a longitudinal tube 29 which ties together the two gear casings and the two standards 25 and 26.

Mounted upon the cover of the gear casing 27 is an electric motor 30 having a motor shaft

equipped with a pulley 31 which drives an endless belt 32 running over a pulley 33 secured to the left end of a longitudinally extending shaft 34 running through gear casing 27, tube 29 and gear casing 28 and journaled within the two gear casings. A pair of transverse shafts 35 and 36 respectively are journaled in the respective gear casings 27 and 28 and have ends which project forwardly and rearwardly from the gear casings. These two shafts 35 and 36 are driven from the shaft 34 by means of worms 37 mounted on the shaft 34 which engage worm gears 38 mounted on the respective shafts 35 and 36 and running in oil within the respective gear casings 27 and 28.

As best shown in Figs. 2, 5, 9, 10, and 11, each shaft 35 and 36 has secured to its rear end an elongated housing 39 within which a screw 40 is journaled. In each housing there is mounted a sliding block 41 which carries a rearwardly projecting horizontal pin 42 which works through a slot 39*a* in the rear wall of the housing. Each pin 42 has rotatably mounted thereon a hanger block 43 which carries a bearing 43*a* within which the pin 42 is received. Secured to the rear side of each housing 39 adjacent one end of the same as by means of a clamp 44 is a cylindrical bearing 45 within which a shaft 46 is journaled. This shaft projects outwardly beyond the outer end of bearing 45 and housing 39 and carries at its outer end a star wheel 47. A pinion 48 is secured to each shaft 46 outwardly from the bearing 45 and this pinion 48 meshes with a gear 49 mounted on the outer end of the shaft of the screw 40. With this construction it will be seen that as a star wheel 47 is turned, the screw 40 adjacent thereto will also be turned to slide the block 41 in housing 39 carrying the particular screw 40. As a consequence of this sliding movement, the pin 42 carried by the block will be slid to or from the axis of rotation of the shaft 36 or 35 to which the particular housing 39 is connected. In other words, movement of the star wheels 47 will change the radial spacing of the pins 42 from the axes of rotation of these pins.

Slidably mounted within slots adjacent the upper ends of the two gear casings 27 and 28 are transversely extending sliding bars 50, which project rearwardly from the gear casings and each carries near its rear end a pair of downwardly projecting spaced pins 51 and 52 respectively. The pins 51 and 52 are spaced from each other a distance slightly greater than the diameter of a star wheel 47 and the pins are so positioned that when the bars 50 are located, as shown in Fig. 5, the star wheels 47 will pass between the pins 51 and 52 without striking either of the pins 51 or 52. The bars 50, however, may be slid forwardly to bring the pins 51 into such position that the rear edges of the star wheels 47 will strike the same during each revolution of the shafts 35 and 36, thereby causing the star wheels to be turned intermittently in one direction. The bars 50 also may be slid rearwardly to carry the pins 52 into such position that the forward edges of the star wheels 47 will strike the pins 52 during each revolution of the shafts 35 and 36, thereby causing the star wheels to be turned intermittently in the opposite direction than the direction of their movement when the star wheels strike the pins 51. To simultaneously shift the two bars 50 there are provided, within the two gear casings 27 and 28, disks 53 which are rotatably mounted on small brackets 54 secured to the front walls of the gear casings. Arms 55 have forward ends which are pivotally connected to the disks 54 at points eccentric to the axes of rotation of the disks 53 and the rear ends of these arms 55 are pivotally connected to the bars 50. A bar 56 runs longitudinally of the machine between the two disks 53 and is pivotally connected at its two ends to the disks at eccentric points thereon. To slide this bar 56 longitudinally and thereby cause rearward or forward movement of the two bars 50, there is provided a spring pressed dog equipped lever 57 pivotally mounted on a sector-shaped bracket 58 secured to the tube 29 and having three peripheral notches within any of which the dog of the lever 57 may engage. A link 59 pivotally connects the lever 57 to the bar 56. When the lever 57 is disposed as shown in Fig. 1, projecting straight downwardly, the pins 51 and 52 are so disposed that the star wheels 47 cannot strike these pins. When the lever 57 is swung to the right of the position shown in Fig. 1, the bars 50 are slid rearwardly to carry the pins 52 to such a position that they will lie in the path of the forward edges of the star wheels 47. When the lever 57 is swung to the left of the position shown in Fig. 1, the bars 50 will be slid forwardly to carry the pins 50 to such a position that the rear edges of the star wheels 47 will strike the same.

The two hanger blocks 43 depend downwardly from the pivot pins 42 and they are provided near their lower ends with longitudinal apertures within which the rounded ends of a longitudinally extending hanger bar 60 are rotatably received. This bar 60 has rack teeth 60*a* cut in its lower edge adjacent one end, as best shown in Figs. 1, 12 and 13. Left and right hand angular rack carriages 61 and 62 respectively have sleeve portions through which the bar 60 extends so that the rack carriages 61 and 62 may be slid relative to each other and to the bar 60. The rack carriage 61 is provided with a set screw 63 which can be tightened against the lower edge of the bar 60 to retain the carriage 61 from sliding movement. The rack carriage 62 carries a similar set screw 64 and in addition the carriage 62, as best shown in Figs. 12 and 13, is provided with a short transverse shaft 65 journaled therein below the bar 60 and carrying a pinion 66 which engages the rack teeth 60*a* of the bar 60. A gear 67 is secured to the shaft 65 outwardly from the carriage 62 and rotatably mounted on the shaft 65 outwardly from the gear 67 is a lever 68 carrying a spring pressed dog 68*a* adapted to be engaged with the teeth of the gear 67. The dog equipped lever 68 acting in conjunction with the gear 67 is used for rotating the pinion 66 to cause sliding movement of the carriage 62 on the bar 60. At certain times, the two carriages 61 and 62 may be connected together by means of a removable tie bar 69. This bar may be removed, if desired, at any time and a longer or shorter bar substituted therefor or, if desired, no bar need be used.

Secured to and depending from the rack carriages 61 and 62 are long racks 70 having outwardly facing rack teeth. Slidably mounted on each rack 70 is a block 71 within which a pin 72 is journaled. A wheel 73 is secured to the forward end of this pin and a pinion 74 is secured to the pin to engage the teeth of the rack 70 adjacent thereto. A ratchet 75 is secured to the rear end of the pin and a spring pressed pawl 76 pivotally mounted on the block 71 cooperates with this ratchet. By releasing the dog 76 the wheel 73 may be turned to raise or lower the block 71 on the rack 70. The pawl and ratchet act to retain the block without permitting the same to drop downwardly on the

rack and as additional means for holding the block in position, a set screw 77 is provided which is mounted in the block 71 and engages the inner edge of the rack. Bars 78 are secured by clamps 79 to the inner edges of the blocks 71 and these bars 78 project rearwardly and are pivotally connected at their rear ends to a stencil frame holder 80 consisting chiefly of a pair of longitudinally spaced vertical bars 80*a* and a pair of vertically spaced horizontal bars 80*b* connected to and running between the vertical bars. The vertical bars are provided with a plurality of vertically spaced bolt receiving openings for receiving nutted bolts 80*c* which connect the horizontal bars 80*b* with the vertical bars. Preferably the horizontal bars 80*b* are provided with long plates 80*d* which project respectively downwardly somewhat from the lower edge of the upper bar and upwardly somewhat from the upper edge of the lower bar. As best shown in Figs. 2, and 16, the bars 78 are pivotally connected to brackets 80*e* secured to the forward sides of the vertical bars 80*a* and the bars 78 are provided near the stencil frame holder with up and downturned extensions 78*a* within which upper and lower screws 81 are mounted. These screws 81 bear against vertical bars 80*a* of the frame holder and determine the angular adjustment of the frame holder relative to the bars 78.

Mounted on the stencil frame holder 80 is a stencil frame 82, best shown in Figs. 1, 21, 22 and 23. This stencil frame 82 includes a U-shaped member 82*a* forming the bottom and sides of the frame and preferably of angle iron construction. The top of the frame is formed by a bar 82*b* and this bar is adjustably secured to the member 82*a* by means of screws 82*c*, which are mounted for rotation in the upper ends of the member 82 and extend through tapped openings at the ends of the bar 82*b*. The member 82*a* has two slotted lugs 82*d* formed at its lower edges and a central slotted lug 82*e* is formed on the bar 82*b*. The frame is secured to the horizontal bars 80*b* of the stencil frame holder 80 by means of nutted bolts 83 which run through the respective bars 80*c*, plates 80*d* and through the slots of the lugs 82*d* and 82*e*. A stencil designated by the numeral 84 is shown as being applied to the stencil frame 82. This stencil is preferably provided with angularly bent portions adjacent its top and bottom edges and these angularly bent portions are engaged respectively with the upper surface of the bar 82*b* and the lower surface of the member 82*a*. Clamps 85 are used for securing the stencil to the frame 82. In applying the stencil to the frame 82, the screws 22*c* are first preferably turned to move the bar 82*b* toward the member 82*a*, whereupon the upper and lower angularly bent edge portions of the stencil are secured by means of the clamps 85 whereupon the screws 82*c* are turned to draw the bar 82*b* away from the member 82*a* to tension the stencil. The stencil is preferably formed of zinc or similar material coated with a rubber preparation on its front face. The stencil frame 82 and the plates 80*d* may be similarly coated if desired to protect the same from the action of the sand blast.

To swing the rack bars 70, the stencil frame holder 82 and the stencil frame 84 rearwardly to bring the stencil 84 into engagement with the face of a stone or the like, there are provided a pair of presser feet, best shown in Figs. 1, 2, 17 and 18. The presser feet include angular arms 86 secured respectively to standards 25 and 26 and projecting inwardly therefrom. Angular bodies 88 are pivotally connected to the arms 86 by means of pivot studs 89. Each body 88 includes a tubular portion 88*a* which extends transversely of the machine and an arm 88*b* which extends at right angles to the tubular portion and is equipped with a groove at its outer end within which the arm 86 may be received. The pivot stud 89 extends across this groove to connect the arm 86 with the arm 88*b* and the arm 88*b* carries a stop pin 90 adapted to engage the lower notched edge of the arm 86 to limit upward swinging movement of the body 88 relative to the arm 86. The arm 33*b* is provided with an upturned lug 88*c* which is apertured to receive a sliding locking dog 91, the inner end of which may be received within a notch 86*a* when the body 88 has been raised to such a position that the pin 90 is engaged with the lower notched edge of the arm 86. The sliding dog 91 is pivotally connected to an operating lever 92 pivotally mounted in ears 88*d* formed on the tubular portion 88*a* of body 88 and a bar spring 93 secured to the tubular portion 88*a* bears against the handle of the lever 92 to urge the dog 91 into the notch 86*a*. A screw 94 is mounted in the tubular portion 88*a* of body 88 for rotation but it is restrained from sliding movement. A tube 95 is secured to the forward end of the screw 94 and a hand wheel 96 is secured to the forward end of the tube 95. A tube 97 telescopically fits within the tubular portion 88*a* and this tube 97 is provided with an internal screw threaded portion receiving the screw 94 as a nut. Oppositely disposed slots 88*e* are provided in the tubular portion 88*a* and a cross pin 98 carried by the tube 97 has end portions received within the slots 88*e* to prevent rotation of the tube 97 relative to the tubular portion 88*a*. The tube 97 projects rearwardly some little distance beyond the body 88 and carries at its rear end a bar 99 which bears against the forward side of one of the racks 70. It will be seen that by turning the wheels 96 of the presser feet, the lower ends of the racks 70 may be pressed rearwardly to a greater or less extent. It will also be seen that if it is desired to disengage the presser feet from the racks, this may be readily accomplished by pressing downwardly the handles of the levers 92 to disengage the dogs 91 from the notches 86*a*, thereby permitting the presser feet to swing downwardly about the pivots 87.

Secured to the upper end of the standard 25 is a bracket 100 upon which is mounted a normally closed circuit opening hand reset switch 101 having a button 101*a* which, when pressed downwardly, will cause the switch to open. The switch 101 controls the circuit to the electric motor 30 and the button 101*a* is located below the forward end of the shaft 35. The forward end of this shaft carries a block 102 within which a screw 103 is mounted, the screw having screw threaded engagement with block 102, as best shown in Figs. 1 and 4. This screw bears at one end against a bar 104 pivotally connected to the block 102 by the pivot 105 and having a roller 106 mounted at one end of the same. The bar 104 is normally held retracted within a notch formed in block 102 by means of a tension spring 107 secured at one end to the non-roller equipped end of bar 104 and secured at its other end to a short rod 108 mounted on block 102. The bar 104 is so located relative to the push button 101*a* of switch 101 that when the bar 104 is positioned, as shown in Fig. 4, the roller 106 will not strike the push button 101*a*. However, when the screw 103 is turned sufficiently to swing the roller equipped end of the

bar 104 outwardly from the block 102 about its pivot 105*a* a certain distance, the button 101*a* will stand in the path of rotation of the roller 106, so that the roller will strike the button to open the switch and thereby open the circuit to the motor 30. To turn the screw 103, the screw is provided at its end opposite that bearing against the bar 104 with a star wheel 109. The left hand sliding bar 50, as viewed in Fig. 1, is provided with a forwardly extending portion 50*a*, best shown in Figs. 1 and 2, equipped with a pair of downwardly projecting spaced pins 110 and 111 for cooperation with the star wheel 109 in the same manner as are the pins 51 and 52 with the star wheels 47. When the sliding bar 50 equipped with the extension 50*a* is located, as shown in Fig. 2, neither pin 110 nor pin 111 will stand in the path of the star wheel 109. When the bar is slid forwardly, the pin 111 will stand in the path of the rear edge of the star wheel to strike the same to cause rotation of the screw 103 in one direction, as viewed in Fig. 2, while when the bar is slid rearwardly, the pin 110 will stand in the path of the forward teeth of the star wheel to strike the same and cause rotation of the star wheel in an opposite direction. It will be seen that the pins 110 and 111, star wheel 109, screw 103, block 102, bar 104, roller 106 and spring 107 cooperate to form safety limit switch operating mechanism for controlling the opening of the switch 101 to turn off the motor 30.

Referring now to Fig. 1 and to Fig. 24, there is mounted on the gear casing 28 an electric bell 112. Mounted between the arms of a fork 113 carried by the bar 56 are a pair of spring electrical contacts 114 secured in spaced relation to a block 115 of insulating material mounted on the tube 29. The two contacts 114 form an electrical switch which will remain open when the lever 57 is disposed as shown in Fig. 1 and the bar 56 is in its central position there shown. When the lever 57 is swung to either side of its central position, the bar 56 will be shifted to cause the fork 113 to carry the two contacts 114 into engagement and thereby close the switch formed by these contacts. A hammer 116 is secured to the forward end of the shaft 36 and this hammer is adapted to engage one of two spring contacts 117 as the shaft 36 rotates. The two spring contacts 117 are mounted in spaced relation on an insulating block 118 secured to the gear casing 28 and these contacts form a switch which will be momentarily closed once during each rotation of the shaft 36. An electrical conductor 119 runs from a suitable source of electrical supply to one of the contacts 117; another conductor 120 runs from the remaining contact 117 to one of the contacts 114; another conductor 121 runs from the remaining contact 114 to the bell 112 and yet another conductor 122 runs back to the source of electrical supply. The bell 112, hammer 116, contacts 117, contacts 114 and fork 113 together form a signal indicator which will inform the operator whenever the radius of gyration of the stencil is changed.

There is also provided a visible indicator for indicating to the operator of the machine the radius of gyration of the stencil at a particular time. This visible indicator, as best shown in Figs. 1 and 5, includes a rod 123 journaled in the standard 26 adjacent its upper end and having an angularly bent, upwardly projecting arm at its rear end lying in the path of movement of the right hand hanger block 43, so as to be struck thereby as this block is gyrated. Secured to the forward end of the rod 123 is an arm 124 carrying a semi-cylindrical block 125 normally engaging another semi-cylindrical block 126 mounted on the standard 26. The two blocks 125 and 126 are colored in contrast to each other, one of the blocks being preferably colored white and the other black. The block 125 is normally held in engagement with the block 126 by gravity and the upwardly extending arm of the rod 123 is normally held by the weight of the block 125 in engagement with the side of the right hand hanger block 43. As the block 43 gyrates, it will strike the upwardly extending arm of the rod 123 and thereby cause the arm 124 to swing to carry the block 125 away from the block 126. By observing the relative spacing between the blocks 125 and 126 at their maximum separation, the radius of gyration of the hanger blocks 143 and accordingly of the stencil, can be determined at any time.

The two standards 25 and 26 are divided by cross partitions into upper compressed air chambers 127 and lower sand receiving chambers 128. These sand receiving chambers 128 are equipped with filling spouts 129 through which sand may be inserted into the chambers. At their lower ends, the chambers 128 are provided with quite large outlet openings 128*a* which lead into chambers 130*a* formed in blocks 130 secured to the standards 25 and 26 near their lower ends. Passages 130*b* are provided through the blocks 130 adjacent the chambers 130*a* and small branch passages 130*c* run from the chambers 130*a* to the passages 130*b*. Above the passages 130*c* apertured valve seats 131 are provided with which valves 132 cooperate. These valves 132 have screw threaded portions engaging screw threaded apertures of the blocks 130 and the stems of the valves run upwardly through packing glands 133 secured to the blocks 130 and the stems of the valves are provided at their upper ends with handles 134 by which the valves can be controlled. The stems of the valves 132 near their upper ends run through brackets 135 secured to the standards 25 and 26.

An air conduit 136 running from any suitable source of compressed air supply, leads to an air drier 137 supported on the tube 29 at its central portion. From the air drier 137 branch conduits 138 equipped with control valves 139 run into the upper ends of the compressed air chambers 127. Air conduits 146 run from the air chambers 127 into the lower ends of the sand chambers 128 near the outlet openings 128*a* and the discharge of air from these conduits acts to stir up the sand in the lower parts of the sand chambers 128 to prevent the sand from clogging near the outlet openings 128*a*. Other air conduits 140 equipped with control valves 141 run from the air chambers 127 into the air passages 130*b*, so that the air discharged into the passages 130*b* will move past the passages 130*c* to draw sand from the chambers 130*a* when the valves 132 are raised from their seats 131. Hoses 142 equipped with sand blast nozzles 143 at their outer ends extend from the outlet ends of the passages 130*b*. Preferably the compressed air chambers 127 are equipped with pressure gauges 144 as shown in Fig. 1.

Secured to and extending between the two standards 25 and 26 adjacent their upper ends is a curtain rod holder 145 from which curtains (not illustrated) may be hung.

Operation

Preparatory to using the machine, the stone in which the carving is to be done will be placed rearwardly of the machine so that the stencil frame holder 80 is located near the portion of the face of the stone upon which the carving is to appear. The stencil frame holder 80 is then raised to the proper level relative to the stone by turning the wheels 73 to raise or lower the blocks 71 on the racks 70. Of course, the horizontal bars 80*b* of the stencil frame holder are properly spaced on the vertical bars 80*a* so that the stencil frame 82 to be used may be properly connected to the bars 80*b*. The two rack carriages 61 and 62 are properly spaced from each other on the bar 60 by loosening the set screw 63 and sliding the rack carriage 61. A tie bar 69 of proper length for use with bars 80*b* of the stencil frame holder may be connected to the rack carriages 61 and 62. Fine longitudinal adjustment of the rack carriages 61 and 62, racks 70, stencil frame holder 80, stencil frame 82 and stencil 84 may then be made by loosening the two set screws 63 and 64 of the rack carriages 61 and 62 and operating the lever 68 to properly position the stencil longitudinally relative to the portion of the stone that is to be carved. The wheels 96 of the presser feet will then be operated to cause the presser feet to swing the lower ends of the racks 70 rearwardly toward the stone and the angularity of the stencil frame holder 80 may be adjusted by means of the screws 81, so that the stencil 84 may be set against the portion of the stone to be carved. In actual practice, a protective stencil is applied to the stone over the portion of the stone to be carved and the stencil 84 is positioned to overlie this protective stencil.

Let us assume that the screws 40 in the elongated housings 39 are originally similarly turned to such a position that the pins 42 are concentrically set relative to the respective axes of rotation of the two shafts 35 and 36, and that the lever 57 is centrally positioned as shown in Fig. 1. In this position, the screw 103 of the safety limit switch operating mechanism is disposed as shown in Fig. 4, so that the bar 104 is substantially horizontally disposed with the roller 106 located in its extreme retracted position, so that it cannot strike the button 101*a* of the switch 101 as the shaft 35 is rotated. Also the two sliding bars 50 are centrally positioned so that the pins 51 and 52 and 110 and 111 will not be disposed in the path of rotation of the star wheels 47 or 109 as the shafts 35 and 36 are rotated.

With the parts positioned as described, the safety limit switch 101 may be hand set to close the circuit to the motor 30 and thereby set the motor in operation. The motor will drive the longitudinally extending shaft 34 through the pulley 31, belt 32, and pulley 33 and the shaft 34 will, in turn, drive the two shafts 35 and 36 through the worms 37 and worm gears 38. The housings 39 will, of course, rotate with the shafts 35 and 36 but as the pins 42 are at this time concentrically located relative to the respective axes of the shafts 35 and 36, no gyration will be imparted to the hanger blocks 43 and no movement will be given to the racks 70, stencil frame holder 80, stencil frame 82 or stencil 84. A sand blast can be played against the stencil 84 at this time if desired, although as a general rule the sand blast will not be directed against the stencil 84 until this stencil is gyrated. Although the two contacts 117 are engaged once during each rotation of the shaft 36 by reason of the action of the hammer 116, no current will flow to the bell 112 as, when the lever 57 is in the vertical position, the fork 113 is positioned, as shown in Fig. 24, so that the two contacts 114 are not engaged.

When it is desired to impart gyration to the stencil 84, the lever 57 is swung to the right, as viewed in Fig. 1, to engage the dog of the lever in the right hand peripheral notch of the sector-shaped bracket 58. As this occurs, the bar 56 is shifted to the left to carry one arm of the fork 113 into engagement with one of the contacts 114 so as to engage these two contacts and also to turn the disks 53 to the left. As the disks 53 are turned to the left, the links 55 will be actuated to slide the sliding bars 50 rearwardly to carry the pins 52 into the path of the front teeth of the star wheels 47. Then as the shafts 35 and 36 rotate, the pins 52 will strike the front teeth of the star wheels to cause them to turn and rotate the shafts 46 slightly to turn the screws 40. As the screws 40 turn, the blocks 41 will be slid in the housings 39 to carry the pins 43*a* out of concentric relation relative to the axes of rotation of the two shafts 35 and 36. In other words, the pins are carried to such a position that they are gyrated relative to the axes of the shafts 35 and 36 respectively as these shafts rotate. The hanger blocks 43 will, accordingly, be gyrated and the motion of these hanger blocks will be transmitted to the rack bars 70, stencil frame holder 80, stencil frame 82 and stencil 84.

As the sand blast is played against the stencil 84, certain portions of the stone will be exposed to the action of the sand blast longer than other portions of the stone due to the gyration of the stencil and, accordingly, certain portions of the stone will be cut away to a greater extent than other portions to tend to produce a figure in relief in the stone having both convex and concave surfaces.

As the shaft 36 is rotated, the hammer 116 will strike one of the contacts 117 to throw it into engagement with the other contact 117 and as the two contacts 114 are in engagement, current will flow to the bell 112 to cause the bell to ring once during each rotation of the shaft 36 when the lever 57 is swung to the right. The operator can count the number of rings of the bell and thus he can determine the radius of gyration of the pins 42 and of the stencil 84. After the bell has rung a certain number of times, corresponding to the radius of gyration for which the operator desires to set the machine, the lever 57 may be swung back to the central position, whereupon the stencil will continue to gyrate about a set radius.

In carving the stone, it is generally desirable to play the sand blast against the stencil 84 for a given time while the stencil is gyrating about a certain radius and then to increase the radius of gyration from time to time so as to produce the desired curvature of the carved figure in the stone. It will be seen that the radius of gyration can be readily increased while the machine is operating by merely swinging the lever 57 to the right from its central position. If it should be desired to reduce the radius of gyration of the stencil, this can be readily accomplished by swinging the lever 57 to the left of its central position. When the lever 57 is swung to the left, the screws 40 will be turned to move the pins 42 towards the axes of rotation of the shafts 35 and 36.

When the lever 57 is swung to the right of the central position, the star wheel 109 will be

actuated by its engagement with the pin 110 to swing the roller 106 of the bar 104 outwardly from the block 102 until after the screw 103 has been turned sufficiently, the roller 106 will strike the button 101*a* of safety limit switch 101 to open this switch and shut down the motor 30 to stop the machine. The switch 101 will be automatically opened before the screws 40 have carried the blocks 41 to their limit of outward movement from the shafts 35 and 36. Accordingly, no injury can be done to the machine if the machine should be allowed to run for a considerable period of time with the lever 57 swung to the right of its central position.

The visible indicator formed by the rod 123, arm 124, and contrastingly colored blocks 125 and 126 will show the radius of gyration of the stencil at any particular time, this radius being determined by the spacing between the two blocks 125 and 126 as the right hand hanger block 43 strikes the rod 123.

Preferably the sand blast equipment illustrated will be used only for finishing of the carving after most of the preliminary work has been done. Fine sand dust may be placed in one of the sand chambers 128, while fine floured emery dust may be placed in the other sand chamber 128. In utilizing the sand blast equipment at the right hand of the machine, for example, the two right hand valves 139 and 141 will be opened and the right hand valve 132 will be turned by means of the knob 134 to raise the lower end of the valve 132 from the valve seat 131. Compressed air will run from the compressed air supply conduit 136 to the air drier 137 and thence through the right hand branch conduit 138 to the right hand compressed air supply chamber 127. From this chamber the compressed air will run downwardly through the conduit 146 into the lower end of the right hand sand chamber 128 to keep the air in the lower part of the chamber stirred up and the outlet 128*a* clear. Also compressed air will run downwardly through the right hand conduit 140 into the right hand passage 130*b* and the air running through this passage will draw sand from the right hand chamber 130*a* and carry the same into the discharge hose 142 and the sand blast nozzle 143. This nozzle may be played against the stencil as it gyrates.

It will be seen that an extremely efficient machine has been provided for the purposes intended. The machine has been found to be successful in actual operation.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the various parts without departing from the scope of the present invention, which, generally stated, consists in the matter shown and described and set forth in the appended claims.

What is claimed is:—

1. A machine for use with a sand blast to produce curved edged figures in relief in stone and the like, comprising a supporting structure, a stencil holder mounted for gyration on said supporting structure, means for gyrating said stencil holder and means for changing the radius of gyration of said stencil holder without stopping said machine whereby the radius may be increased or reduced to cause the sand blast to produce different effects upon stone.

2. A machine for use with a sand blast to produce curved edged figures in relief in stone and the like, comprising a supporting structure, a stencil holder mounted for gyration on said supporting structure, means for gyrating said stencil holder, means for changing the radius of gyration of said stencil holder without stopping said machine, a safety switch controlling the operation of said machine and means for opening said safety switch to stop the operation of said machine after the radius of gyration of said stencil holder is increased beyond a certain limit.

3. A machine for use with a sand blast to produce curved edged figures in relief in stone and the like, comprising a supporting structure, a stencil holder mounted for gyration on said supporting structure, means for gyrating said stencil holder, means for changing the radius of gyration of said stencil holder without stopping said machine and a signal indicator operated each time that said radius is changed.

4. A machine for use with a sand blast to produce curved edged figures in relief in stone and the like, comprising a supporting structure, a stencil holder mounted for gyration on said supporting structure, means for gyrating said stencil holder, means for changing the radius of gyration of said stencil holder to increase and reduce said radius without stopping said machine and a visible indicator operated by the gyration of said stencil holder to show the radius of gyration of the stencil holder at a particular time.

5. A machine for use with a sand blast to produce curved edged figures in relief in stone and the like, comprising a supporting structure, a shaft mounted for rotation in said supporting structure, means for rotating said shaft, a pin mounted on said shaft for sliding movement transversely thereof, a stencil holder rotatably mounted on said pin and hung therefrom and means for sliding said pin in either direction when said machine is in operation to vary the radius of gyration of the stencil holder hung from said pin.

6. A machine for use with a sand blast to produce curved edged figures in relief in stone and the like, comprising a supporting structure, a shaft mounted for rotation in said supporting structure, means for rotating said shaft, a block mounted on said shaft for sliding movement to and from the axis of rotation of said shaft, a stencil holder pivotally mounted on said block and hung therefrom, a screw working through said block as a nut for sliding the same, a star wheel for turning said screw, a forked sliding bar mounted in said supporting structure and between the prongs of which said star wheel normally passes without striking the prongs as said block rotates and means for sliding said bar to carry one or the other of said pins into the path of portions of said star wheel to cause turning movement of the same to slide said block to or from the axis of rotation of said shaft when said machine is in operation.

7. A machine of the class described, comprising a supporting structure, a shaft mounted for rotation in said supporting structure, a casing carried by said shaft, a block mounted for sliding movement in said casing to and from the axis of rotation of said shaft, a screw journaled within said casing and engaging said block as a nut, a stencil holder pivotally connected to said block and hung therefrom, a star wheel mounted for rotation on said casing, means for turning said screw as said star wheel is rotated, a forked bar slidably mounted in said casing and having two

prongs one at either side of said star wheel, said prongs being spaced apart a distance greater than the diameter of said star wheel and means for sliding said fork from a position where the star wheel cannot strike either prong during its rotation to position where the star wheel may engage either one of said prongs whereby said screw may be turned in either direction to slide said block to vary the radius of gyration of the stencil holder while the machine is in operation.

8. A machine of the class described, comprising a supporting structure, a shaft mounted for rotation in said supporting structure, a casing carried by said shaft, a block mounted for sliding movement in said casing to and from the axis of rotation of said shaft, a screw journaled within said casing and engaging said block as a nut, a stencil holder pivotally connected to said block and hung therefrom, a star wheel mounted for rotation on said casing, means for turning said screw as said star wheel is rotated, a forked bar slidably mounted in said casing and having two prongs one at either side of said star wheel, said prongs being spaced apart a distance greater than the diameter of said star wheel and an electrically operated signal operated each time said pin is slid.

9. A machine of the class described, comprising a supporting structure, a pair of spaced shafts mounted for rotation in said supporting structure, means for rotating said shafts, blocks mounted for sliding movement on said shafts to and from the axes of rotation thereof, a stencil holder pivotally connected to said blocks and hung therefrom and mechanism for sliding said blocks to and from the axis of rotation of said shaft step by step during the operation of said machine.

10. A machine for use with a sand blast to produce curved edged figures in relief in stone and the like, comprising a supporting structure, hanger blocks mounted for rotation on said supporting structure, a stencil carrier pivotally mounted in said blocks for swinging movement about a horizontal axis and depending from said blocks, said stencil carrier being adapted to be placed adjacent the face of a stone to be carved and adjustable presser feet mounted on said supporting structure and bearing against the lower portions of said carrier to urge the same toward the face of the stone.

11. A machine of the class described comprising a supporting structure, a pair of shafts mounted for rotation in said supporting structure, hanger blocks having eccentric pivotal connection with said shafts and depending therefrom, a pair of rack bars mounted for swinging movement on said blocks, a stencil frame holder mounted on said rack bars and adapted to be placed over the face of the stone to be carved, means for raising and lowering said stencil frame holder relative to said rack bars and means mounted on said supporting structure for swinging said rack bars toward the stone, said last mentioned means being presser feet mounted on said supporting structure bearing against lower portions of said rack bars and extensible to and from said supporting structure.

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