Nov. 22, 1949 L. L. SMITH 2,488,643

STONECUTTING MACHINE

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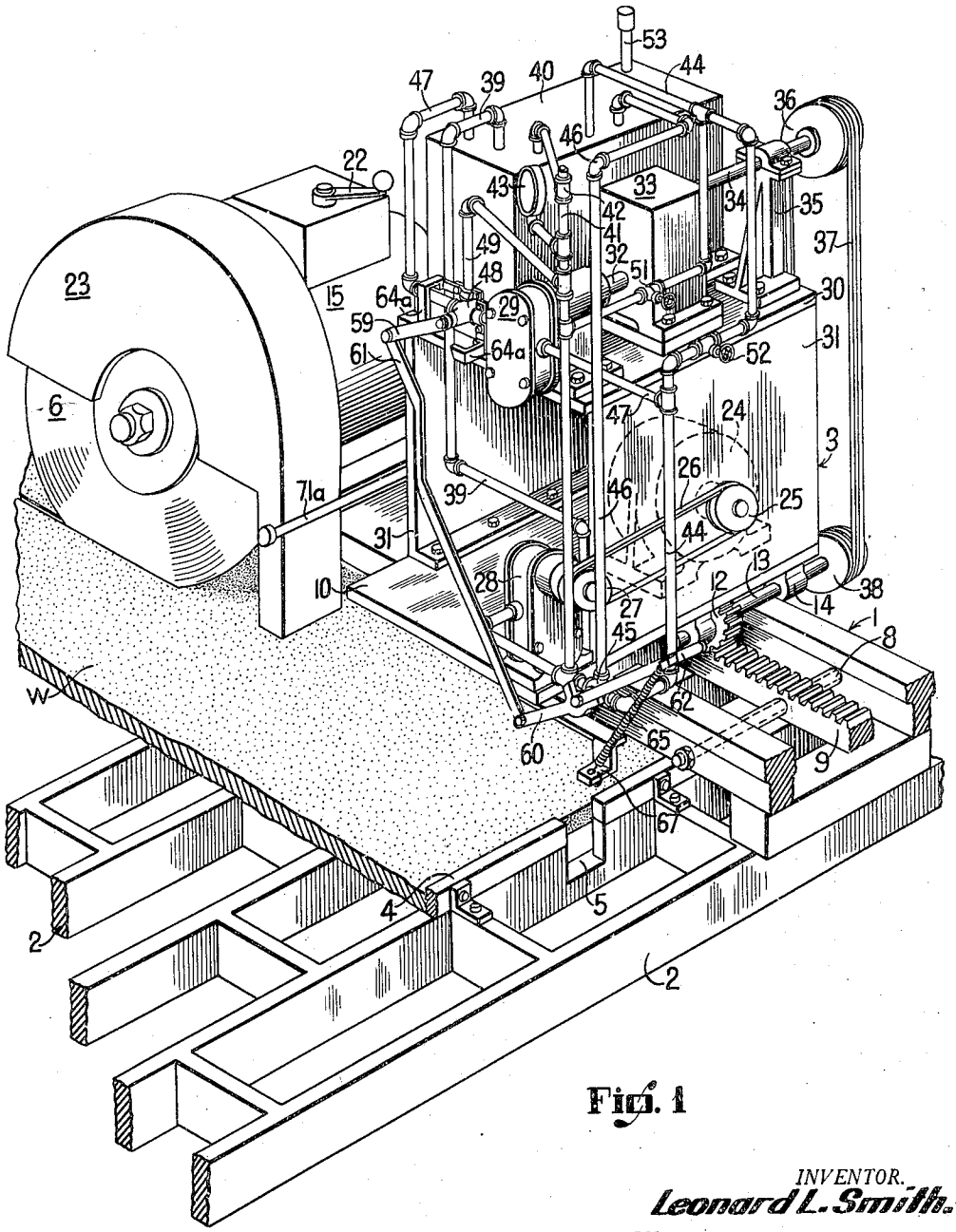


Fig. 1

INVENTOR.
Leonard L. Smith.

BY

Corbett, Mahoney & Dunbar
ATTORNEYS

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STONECUTTING MACHINE

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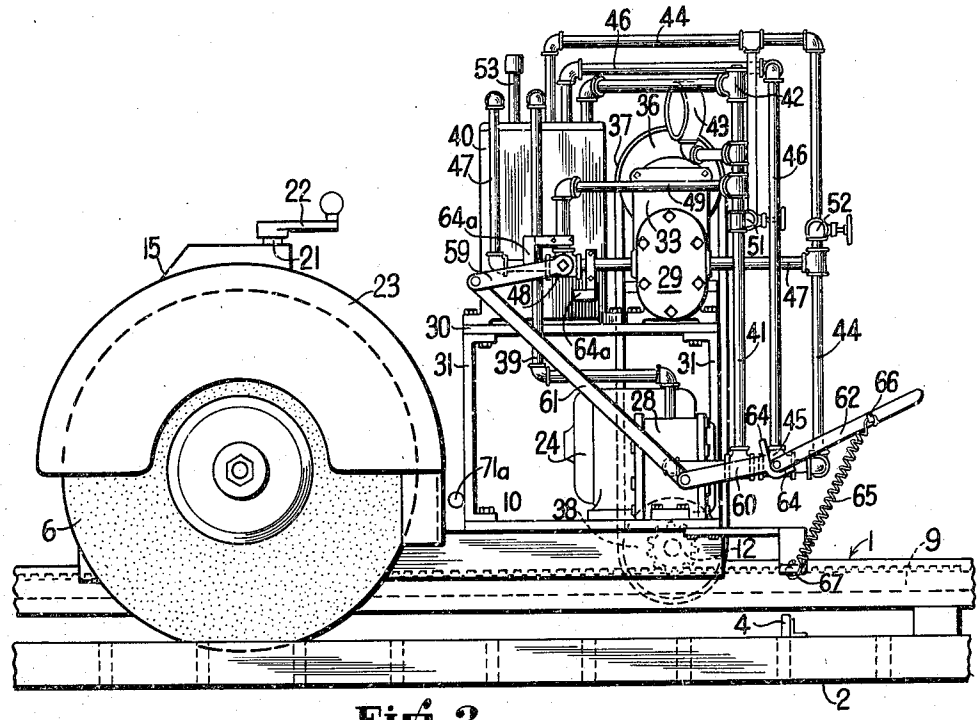


Fig. 2

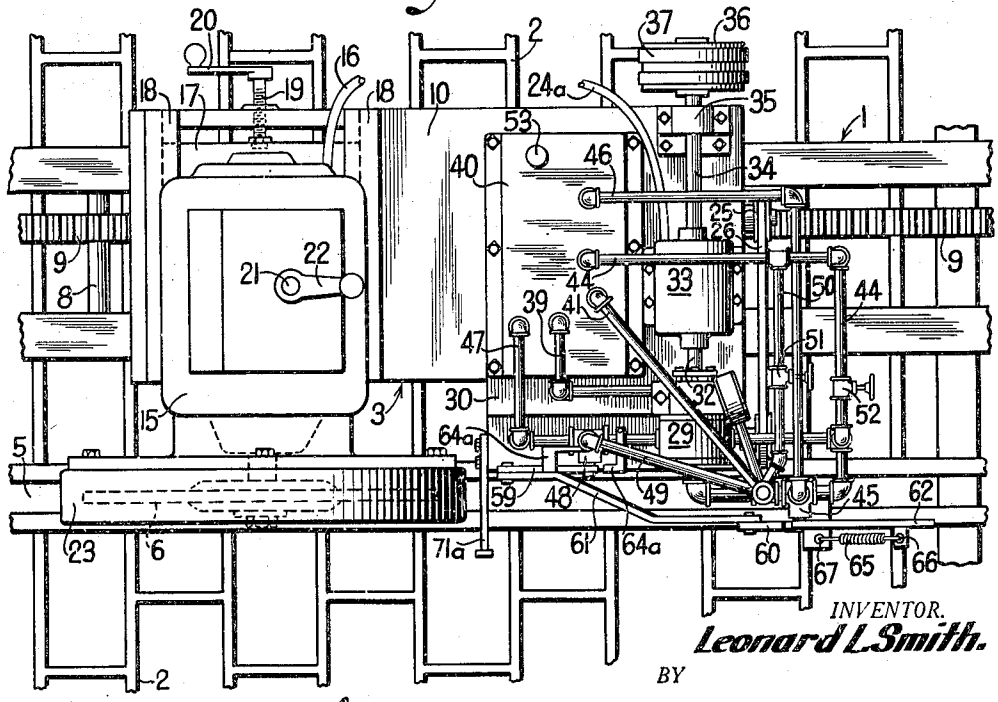


Fig. 3

INVENTOR.
Leonard L. Smith.
BY
Cabett, McInney & Wilber
ATTORNEYS

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STONECUTTING MACHINE

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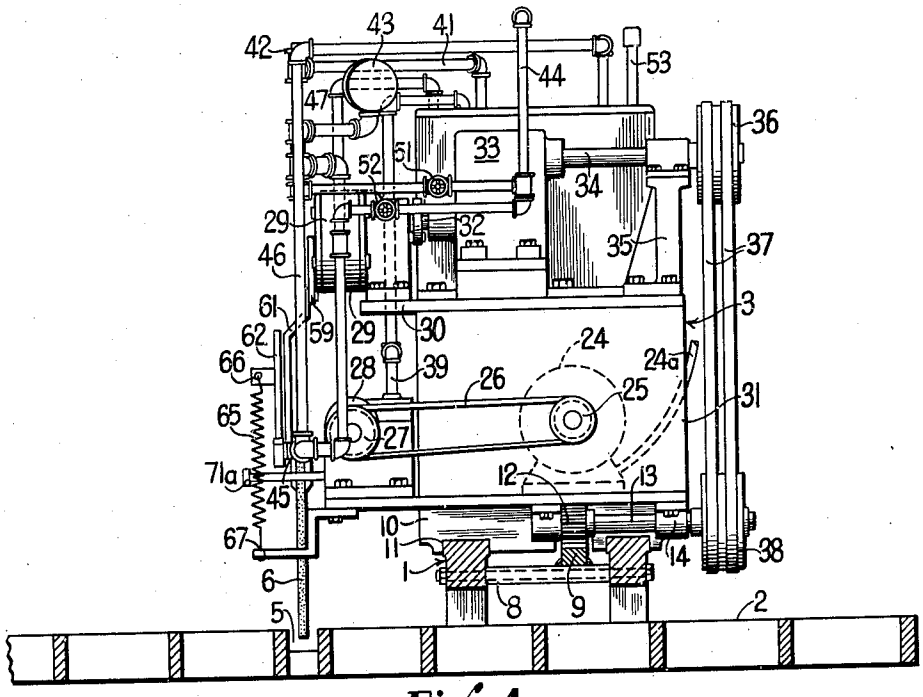
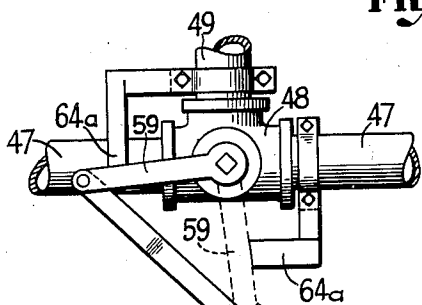


Fig. 4



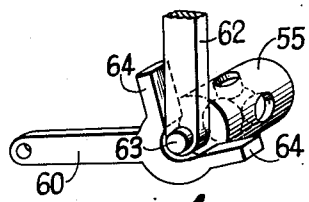


Fig. 6

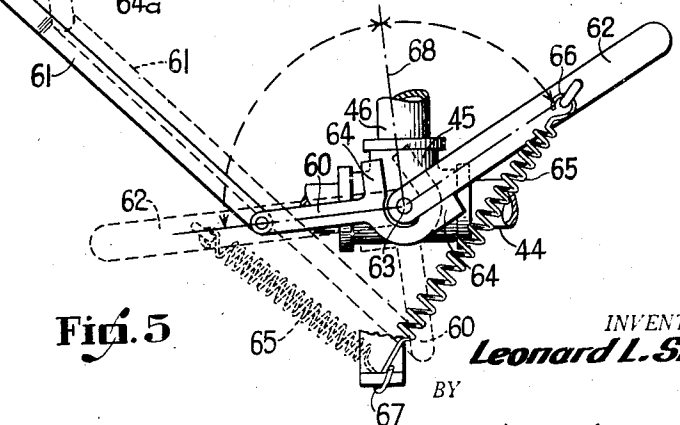


Fig. 5

INVENTOR.
Leonard L. Smith.
BY
Cabell, Mulvey & Miller
ATTORNEYS

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STONECUTTING MACHINE

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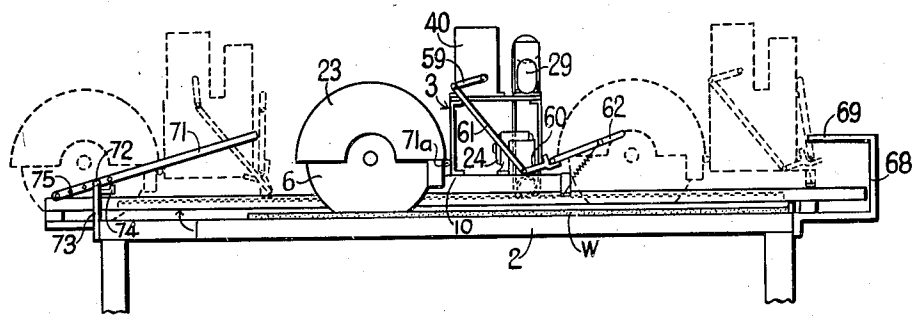


Fig. 7

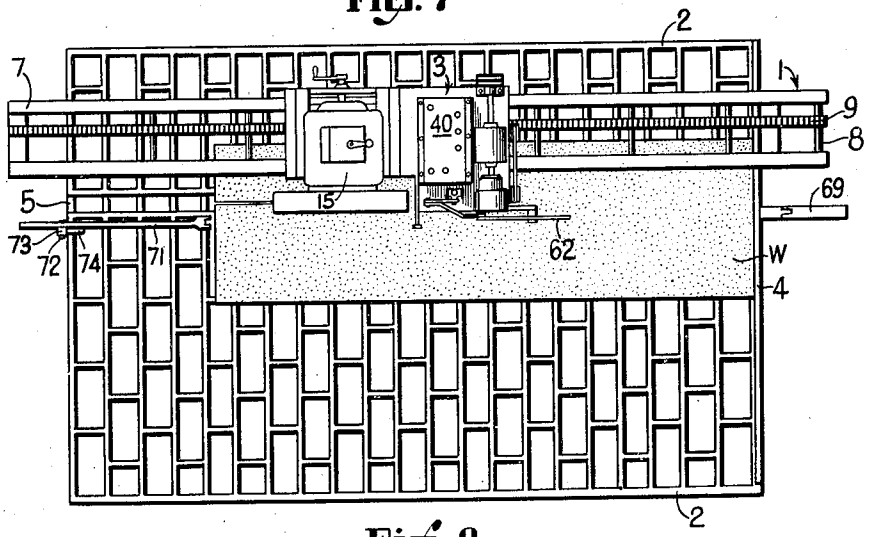


Fig. 8

INVENTOR.
Leonard L. Smith.
BY
Corbett, Mahoney & Miller
ATTORNEYS

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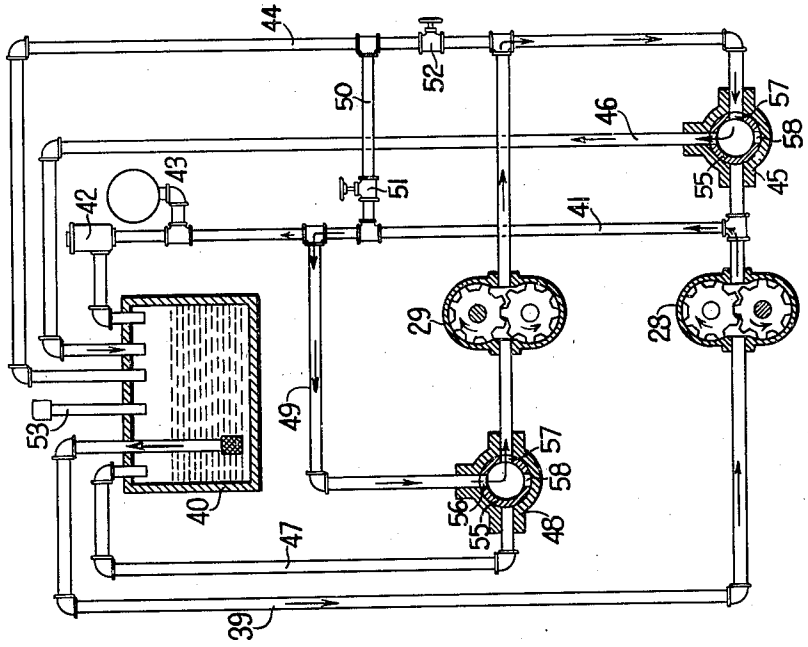


Fig. 10

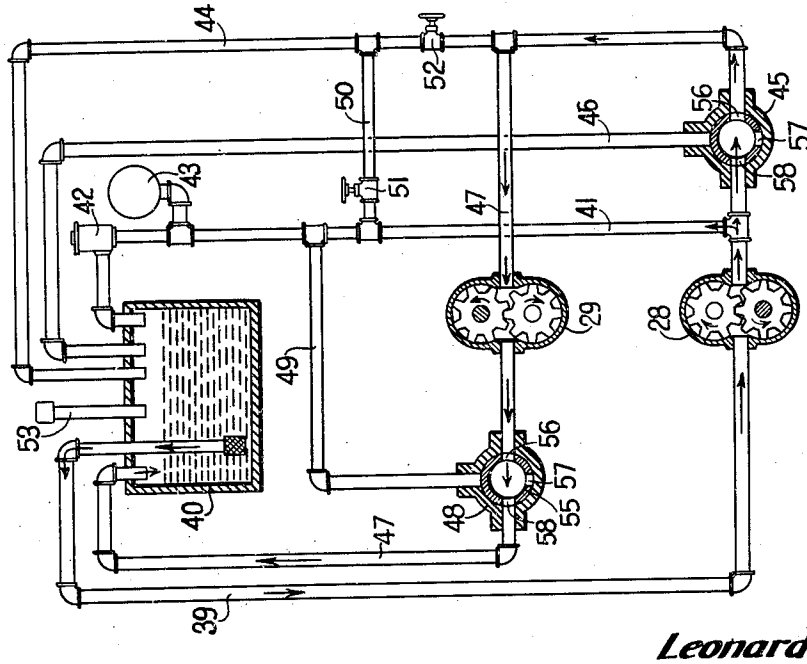


Fig. 9

INVENTOR.
Leonard L. Smith.

BY

Cabell, Mulvey & Walker
ATTORNEYS

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UNITED STATES PATENT OFFICE

2,488,643

STONECUTTING MACHINE

Leonard L. Smith, Columbus, Ohio

Application April 14, 1948, Serial No. 20,996

15 Claims. (Cl. 125—14)

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My invention relates to a stone-cutting machine. It has to do, more particularly, with a machine for cutting quarried and finished sections of stone into various sizes and shapes for use as fixtures and trim in buildings or the like, although it is not necessarily limited thereto.

One of the main objects of my invention is to provide a stone-cutting machine which is lighter, more simple, less expensive, and more efficient than the heavy, cumbersome and complicated machines now commonly in use for this purpose.

Another object of my invention is to provide a stone-cutting machine wherein the stone-cutting wheel is carried by a movable carriage which will travel on a suitable support and will automatically reverse itself at the end of each stroke.

A further object of my invention is to provide a stone-cutting machine of the type indicated in the preceding paragraph wherein movement of the carriage is accomplished with a hydraulic drive as distinguished from mechanical or electrical drives so that the cutting wheel can be fed into the stone with a cushioned pressure.

Still another object of my invention is to provide a stone-cutting machine of the type indicated above wherein the hydraulic pressure for feeding the carriage into the stone is variable and wherein means is provided for relieving or venting the pressure whenever the stone-cutting wheel encounters excessively hard portions of stone.

Another object of my invention is to provide a stone-cutting machine of the type indicated above wherein the reversing means for the carriage which forms a part of the hydraulic driving system is of such a nature that the carriage will be quickly and smoothly reversed as it reaches a definite predetermined point at the end of its stroke in either direction.

An additional object of my invention is to provide a stone-cutting machine of the type indicated wherein the cutting wheel is driven by a positive drive and the carriage is moved along the bed by a hydraulic drive, the use of these independent drives permitting a decrease in speed of the carriage whenever the cutting wheel encounters an excessively hard portion in the stone without directly affecting the speed of the cutting wheel.

Various other objects will be apparent from the drawings and the following description.

In its preferred form, my invention contem-

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plates the provision of an elongated horizontal trackway having a horizontal work-supporting bed or base associated therewith and at one side thereof. A carriage is mounted for movement along the trackway and carries a stone-cutting wheel which will travel with the carriage along the work supported on the bed. The cutting wheel is preferably adjustable vertically and laterally to accurately locate the cut in the work. The cutting wheel is carried directly in association with an electric motor supported by the carriage. To move the carriage along the trackway, a shaft is rotatably mounted on the carriage and is provided with a pinion which engages an elongated rack extending along the trackway. The shaft is driven by a special hydraulic drive which is completely independent of the motor drive for the cutting wheel.

The hydraulic drive includes an electric motor which drives a hydraulic pump that, in turn, drives a hydraulic motor. The hydraulic motor is connected by a mechanical drive to the shaft which carries the pinion. A pair of reversing valves are associated with the hydraulic system. In one condition of these valves, the hydraulic pressure developed by the pump will be forced in one direction through the hydraulic motor to rotate the pinion-carrying shaft in one direction and in the other condition of these valves the hydraulic pressure developed by the pump will be forced in the opposite direction through the hydraulic motor to rotate the pinion-carrying shaft in the opposite direction. Thus, movement of the carriage can be reversed by actuating the valves at desired instances. I provide automatic means for actuating the valves simultaneously at the end of each stroke. The valves are mechanically connected together for simultaneous operation and a snap-action lever mechanism is provided for quickly operating them at the proper time. This mechanism is engaged by a tripping member mounted on the bed adjacent each end thereof and one of which is preferably adjustable.

The preferred embodiment of my invention is illustrated in the accompanying drawings wherein similar characters of reference designate corresponding parts and wherein:

Figure 1 is a perspective view of the main structure of my stone-cutting machine.

Figure 2 is a side elevational view of the track-

way and carriage and showing the work-supporting bed in section.

Figure 3 is a plan view of the structure of Figure 2.

Figure 4 is a transverse vertical sectional view of the trackway and bench and an end elevational view of the carriage.

Figure 5 is a detailed view of the mechanical connection for the two reversing valves and the snap-action mechanism for actuating the valves.

Figure 6 is a perspective view of part of the valve which has the snap-action lever mechanism associated therewith.

Figure 7 is a diagrammatic view illustrating how the carriage moves along the trackway.

Figure 8 is a plan view of the machine showing how the work may be positioned thereon.

Figure 9 is a diagrammatic view showing the hydraulic driving system in condition to move the carriage in one direction.

Figure 10 is a similar view showing the hydraulic system in one condition to move the carriage in the opposite direction.

With reference to the drawings, in Figure 8 I have illustrated the general arrangement of my machine. The machine comprises mainly an elongated trackway 1 which is horizontally disposed, and which is supported above a work-supporting bed 2 which is also horizontally positioned. The trackway 1 is disposed along one side of the bed 2 and a carriage 3 is mounted for reciprocatory movement on such trackway.

The work-supporting bed 2 is preferably in the form of a grill to permit dust or other waste material to drop therethrough. This bed is disposed at a slightly lower level than the trackway 1, depending upon the thickness of the work W to be cut which is supported on the bed. The trackway 1 and bed 2 may be vertically adjustable relatively, if desired, although I have not illustrated the adjusting mechanism. The bed is provided at one of its ends with a gauge strip 4 which will engage the end of the work W and locate it properly on the bed 2. Adjacent the trackway 1, the bed 2 is provided with an elongated continuous slot 5 which will permit the cutting wheel 6, carried by the carriage, to extend downwardly thereinto during the stone-cutting operation and movement of the carriage 3 along the trackway 1.

The trackway 1 is in the form of a pair of spaced longitudinally extending tracks 7 which are secured together by transverse bars 8. These bars 8 serve to support an elongated rack 9 which extends the full length of the tracks 7 and is located between such tracks just slightly lower than the upper surfaces of such tracks, as indicated best in Figures 1, 4, 7 and 8.

The carriage 3 includes a base plate 10 which has parallel channels or grooves 11 formed in its lower surface and extending longitudinally thereof, as shown best in Figure 4. It will be noted that these grooves or channels 11 fit over the tracks 7 and serve to guide the carriage along these tracks. The carriage is moved along the tracks by means of a pinion 12 which engages the rack 9, as shown best in Figures 1 and 4. The pinion 12 is keyed on a horizontal shaft 13 which is rotatably carried by bearings 14 secured beneath the base plate 10. This shaft is rotated by driving mechanism to be subsequently described.

The base plate 10 adjacent one end thereof carries the stone-cutting unit which includes a driving motor 15 to which current is supplied by a flexible cable 16. This motor, as shown in Figure 3, is carried on a plate 17 which is mounted for sliding movement in transverse guideways 18 secured to the base plate 10. The transverse adjustment is accomplished by means of a screw 19 actuated by a crank 20. The motor is supported for vertical adjustment relative to the plate 17 by means including a screw 21 (Figure 2) which is rotated by means of a crank 22. This stone-cutting unit is of the usual type and need not be illustrated and described in detail. The drive shaft of the motor carries the cutting wheel 6 which is preferably of the diamond-wheel type. It will be noted that the wheel 6 is located over the slot 5 in the bed 2 and may extend downwardly thereinto. The vertical position of the wheel can be adjusted by operating the crank 22 while its lateral position relative to the work can be adjusted accurately by operating the crank 20. A guard 23 is preferably provided over the upper portion of the wheel.

The driving mechanism for driving the shaft 13 so as to propel the carriage 3 along the trackway 1 will now be described in detail. It includes an electric motor 24 which is carried by the base plate 10 at the end opposite to where the motor 15 is disposed. Current it supplied to the motor 24 by a flexible cable 24*a*. The drive shaft of this motor 24 carries a pulley 25 (Figures 1 and 4) which is engaged by a belt 26 that passes around a second pulley 27. This pulley 27 is keyed on the rotor shaft of a gear type hydraulic pump 28 which is also carried by the base plate 10. Thus, the pump 28 will be driven whenever the motor 24 is energized. The hydraulic system also includes a hydraulic motor 29 to which fluid pressure is supplied by the pump 28 in a manner to be described later in detail. This hydraulic motor 29 is carried on a horizontal plate 30 (Figures 1 and 4) which is supported by a pair of vertical plates 31 which are attached to the base plate 10 of the carriage. The hydraulic motor 29 is provided with a drive shaft 32 which extends into a gear reduction unit 33 which is also secured to the plate 30 adjacent the motor 29. This unit 33 is provided with a shaft 34 which extends outwardly beyond the plate 30 but is supported by a bearing standard 35 carried thereby. The outer end of the shaft 34 has a multiple pulley 36 keyed thereto around which pass a plurality of belts 37. These belts 37 extend downwardly around a multiple pulley 38 which is keyed on the outer end of the extended shaft 13 that carries the pinion 12. Thus, it will be apparent that when the pump 28 supplies pressure to the motor 29, the gear reduction unit 33 will be driven which will drive the belts 37 and, in turn, will result in driving the pinion-carrying shaft 13 to traverse the carriage along the trackway 1.

It will be noted best from Figures 9 and 10 that the hydraulic motor 29 is preferably of the gear type being substantially the same as the gear pump 28 but receiving rather than developing fluid pressure. The piping for the hydraulic system includes an inlet or fluid-supplying pipe 39 which extends from a fluid reservoir 40 to the inlet side of the pump 28. It will be noted best from Figure 1, that the reservoir or tank 40 is supported by the upper plate 30 adjacent the motor 29 and unit 33. Referring again to Figures 9 and 10, it will be noted that the pump 28 is provided with a return outlet or relief line 41 leading back to the tank 40. Incorporated in this outlet line adjacent the tank 40 is a relief valve

42 and a pressure gauge 43. Branching from the outlet line 41 of the pump 28 is another line 44 which leads to the tank 40. Interposed in this line is a reversing three-way valve 45. Another line 46 is also connected to the valve 45 and leads to the tank 40. A line 47 is connected to the line 44 and leads to the tank 40. The motor 29 is interposed in this line and is associated with a second three-way reversing valve 48 which is also interposed in this line. The valve 48 is connected by a line 49 to the line 41. The line 41 is connected to a line 50, at a point below the connection of such line 41 to line 40. Line 50 is connected to the line 44, at a point above the connection of line 44 to line 47 and to valve 52. The line 50 had an adjustable needle valve 51 incorporated therein. Between the points of connection of the lines 50 and 47 to the line 44, an adjustable needle valve 52 is interposed in the line 44. Finally the hydraulic system includes the filler pipe 53 provided for the tank 40. The operation of this hydraulic system will be described later in detail.

Each of the valves 45 and 48 comprises a rotatable core 55 (Figures 9 and 10) having three openings 56, 57 and 58 therein. As shown in Figure 1, valve 48 is located adjacent motor 29 while valve 45 is located adjacent pump 28. The valve 48 is operated by means of a lever 59 (Figure 5) which is rigidly connected to its core while the valve 45 is rotated by means of a lever 60 rigidly connected to its core. The levers 59 and 60 are connected together by a link 61 which is pivoted thereto. Thus, when one of the valve cores is rotated, the other is rotated. It will be noted from Figure 9, that in one position of the valve 45 and valve 48 the fluid from the pump 28 will enter the motor 29 at one side thereof. On the other hand, with the valve 45 and the valve 48 rotated to the other position, as shown in Figure 10, fluid will enter the motor 29 from the pump 28 at the other side of the motor. Thus, rotation of the motor can be reversed by simultaneous actuation of the valves.

In order to obtain a definite quick reversal of the motor rather than a gradual reversal, I provide snap-action mechanism for actuating the valves which is shown in Figures 5 and 6. This mechanism comprises a lever 62 which is pivoted by a pin 63 to the core of the valve 45 at the axis thereof. The valve core extends beyond the valve housing and its outer extremity is integral with or rigidly secured to the lever 60. The lever 60 is provided with angularly spaced stops between which the lower end of the lever 62 may swing within a limited arc. This provides a lost motion connection for the lever 62 to the valve core which permits limited movement of the lever relative to the core before rotating it. A tension spring 65 is connected to the lever 62 at a point 66 towards its outer end and is anchored to the plate 10 of carriage 3 at a point 67 (Figures 1 and 5) which is in the same vertical plane as the lever pivot 63. This provides an off-center mechanism which will quickly snap the lever 62 to the extent of its movement whenever it is moved past the center line 68 shown in Figure 5. Thus, initial movement of the lever 62 in either direction will not rotate the valve core. However, as soon as the lever moves beyond the center line 68, the spring will quickly snap it to its final position and quickly rotate both valve cores due to the mechanical connection provided by the levers 59 and 60 and the link 61. The stops 64 serve to limit swinging movement of the lever 62. For limiting rotation of the valve cores to predetermined positions, stops 64*a* are provided in association with valve 48 to engage lever 59 and to limit swinging movement thereof.

In order to operate the lever 62 as the carriage reaches the end of its stroke in either direction, I provide tripping members carried by the bed 2 adjacent trackway 1. At one end of the trackway, as shown in Figures 7 and 8, the tripping member is in the form of an angular arm 68 which is anchored to bed 2 and which has an inwardly directed horizontal portion 69 for engaging the lever 62 as the carriage moves to the right towards the end of the trackway 1. The tripping member at the other end of the bed comprises a lever 71 which is pivoted at 72 to the upper end of a bracket 73 secured to the bed 2. A stop 74 limits downward swinging of the lever 71. A transversely extending pin 71*a* (Figures 1, 7 and 8) on carriage 3 is adapted to move beneath this lever 71. It will be noted that the lever 71 is provided with a plurality of openings 75 to vary the effective length of the lever 71 and, therefore, to vary the point at which it is engaged by the pin 71*a*. The member 69, aided by spring 65, serves to move the lever 62 into substantially horizontal position directed to the left, as shown by dotted lines in Figure 5 when carriage 3 moves to the extreme right. When the carriage 3 moves to the left, pin 71*a* passes beneath the lever 71 and will force it upwardly. At this time lever 71 is beneath lever 62 and aided by spring 65, will move lever 62 to the full line position shown in Figure 5.

In the operation of this machine, the work, for example a stone slab to be cut, is properly positioned on the bed 2, as shown in Figure 8. The member 71 is properly adjusted to obtain the desired stroke or travel of the carriage 3 along the trackway 1. The wheel-rotating motor 15 is energized and the carriage-driving motor 24 is energized. The wheel 6 will be rotated and will cut into the stone as the carriage is moved along. As previously indicated, and as will be clear from Figures 9 and 10, the pump 28 driven by the motor 24 will actuate the hydraulic motor 29 which rotates the carriage-driving pinion 12 that engages the rack 9. With the valves 45 and 48 in the condition shown in Figure 9, the motor 29 is driven in one direction thereby moving the carriage in one direction through gear unit 33. With the valves 45 and 48 in the condition shown in Figure 10, the motor 29 is rotated in the other direction thereby moving the carriage in the opposite direction.

With the valves 45 and 48 in the condition shown in Figure 9, if the wheel 6 strikes an excessively hard portion of stone and there is undue resistance to movement of the carriage, the back pressure which would be built up thereby in the line 47 leading to the motor 29 will be relieved through valve 52 and line 44 leading to tank 40. On the other hand, if this condition occurs with valves 45 and 48 as shown in Figure 10, the back pressure built up in line 49 will be relieved through valve 51, line 50 and line 44.

Since the cutting wheel 6 is driven by a drive independent from the carriage, the wheel and carriage drives will have no effect on each other.

It will be apparent from the above description that I have provided a stone-cutting machine which is lighter, more simple, less expensive and more efficient and, therefore, capable of cutting more stone, than the heavy, cumbersome and complicated machines now commonly in use for

cutting stone. Many advantages of this machine have been mentioned and others will be apparent.

Having thus described my invention, what I claim is:

1. A machine for cutting stone or the like comprising a bed, a carriage mounted for reciprocable movement along the bed, a cutting member rotatably supported on the carriage, driving means on the carriage for directly rotating said cutting member, means for moving the carriage along the bed, independent driving means on the carriage for actuating said last-named means, said independent driving means comprising a hydraulic motor, a pump for supplying fluid pressure to said motor, means for automatically reversing said carriage driving means as the carriage reaches predetermined points along the bed, said means comprising control means for controlling the supply of pressure fluid from the pump to opposite sides of said hydraulic motor, said control means comprising a pair of valves connected to said pump and to said motor for changing the flow of pressure fluid from said pump to opposite sides of said hydraulic motor, and means for actuating said valves simultaneously, said means including snap-action mechanism and tripping members along the bed for actuating said snap-action mechanism.

2. Apparatus according to claim 1 wherein one of said tripping members is adjustable along the bed.

3. Apparatus according to claim 1 wherein the means for moving the carriage along the bed comprises a pinion disposed on a driven shaft carried by the carriage and a rack carried by the bed, and a mechanical drive between said hydraulic motor and said shaft.

4. A machine for cutting stone or the like comprising a bed, a carriage mounted for reciprocable movement along the bed, a stone cutting member carried by the carriage, means for moving the carriage along the bed, means for driving said means and including a hydraulic motor, a pump for supplying fluid pressure to said motor, and means for automatically reversing said carriage moving means as the carriage reaches predetermined points along the bed, said means comprising control means for controlling the supply of pressure fluid from the pump to opposite sides of said hydraulic motor, said control means including a pair of valves connected to said pump and to said motor for changing the flow of pressure fluid from said pump to opposite sides of said hydraulic motor, means for actuating said valves simultaneously, said means including snap-action mechanism and tripper members along the bed for actuating said snap-action mechanism.

5. Apparatus according to claim 4 wherein said snap-action mechanism includes a lever to be engaged by the tripper members, and lost motion means associated with said lever to permit limited movement thereof in either direction without actuating said valves.

6. Apparatus according to claim 5 wherein one of said tripper members is adjustable along the bed.

7. A machine for cutting stone or the like comprising a work-supporting bed, a trackway associated with the bed, a carriage mounted for reciprocable movement along the trackway, said trackway including tracks which cooperate with guides on the carriage, a cutting member rotatably supported on the carriage and overhanging the bed, means on said bed for properly locating the work, an electric motor on the carriage for directly rotating said cutting member, means for moving the carriage along the trackway, said means comprising a pinion disposed on a rotatable shaft carried by the carriage which engages a rack associated with the trackway, independent driving means on the carriage for rotating said shaft and including a hydraulic motor supported on the carriage, a pump supported on the carriage for supplying fluid pressure to said hydraulic motor, an electric motor on the carriage for driving said pump, and a pair of control valves connected to said pump and to said hydraulic motor for changing the flow of pressure fluid from said pump to opposite sides of said hydraulic motor, mechanical means connecting said valves together for simultaneous operation, and tripper members disposed along the trackway for actuating said valves at predetermined times during movement of the carriage along the trackway to reverse movement of said carriage.

8. Apparatus according to claim 7 including a snap-action lever mechanism associated with one of said valves and engaged by said tripper members.

9. Apparatus according to claim 8 wherein the lever mechanism includes a lever having lost motion connection to said mechanical means which connects said valves together.

10. A machine for cutting stone or the like comprising a bed, a carriage mounted for reciprocable movement along the bed, means for moving the carriage along the bed, said means comprising a mechanical drive between the bed and carriage, means on the carriage for actuating said mechanical drive, said means comprising an electric motor, a fluid pump driven by said motor, a fluid motor for receiving pressure from the pump, said pump being connected to said fluid motor by its pressure line leading to one side of said fluid motor, a line leading from said pump to the opposite side of said fluid motor, a control valve associated with the said pressure line and a separate control valve associated with said other line, mechanical means for connecting said valves together for simultaneous operation to control the flow of fluid from the pump to opposite sides of said fluid motor, and operating members associated with said bed for operating said valves to reverse movement of said carriage along the bed.

11. A machine according to claim 10 wherein snap-action off-center lever mechanism is associated with said mechanical means for connecting said valves, said operated members engaging said lever mechanism.

12. A machine according to claim 11 wherein the operating members are adjustable along the bed.

13. A machine according to claim 11 wherein a lost motion connection is associated with said lever mechanism to permit limited movement of said lever before actuating said valve.

14. A machine according to claim 10 wherein an adjustable valve is connected to the pressure line of said pump and an adjustable valve as associated with said other line to relieve back pressure built up in such lines.

15. A machine for cutting stone or the like comprising a bed, a carriage mounted for reciprocable movement along the bed, means for moving the carriage along the bed, said means comprising a mechanical drive between the bed and carriage, means on the carriage for actuating said mechanical drive, said means including a fluid pump and a fluid motor for receiving pressure from the pump, said pump being connected

to said fluid motor by its pressure line leading to one side of said fluid motor, a line leading from said pump to the opposite side of said fluid motor, a control valve associated with the said pressure line and a separate control valve associated with said other line, mechanical means for connecting said valves together for simultaneous operation to control the flow of fluid from the pump to opposite sides of said fluid motor, and operating members associated with said bed for operating said valves to reverse movement of said carriage along the bed.

LEONARD L. SMITH.

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