XR 1,037,875

from 3 4 7

L. D. CRAIG.

ROAD CUTTER AND THE LIKE.

APPLICATION FILED DEC. 14, 1909. RENEWED FEB. 3, 1912.

1,037,875. **Patented Sept. 10, 1912.**

5 SHEETS—SHEET 1.

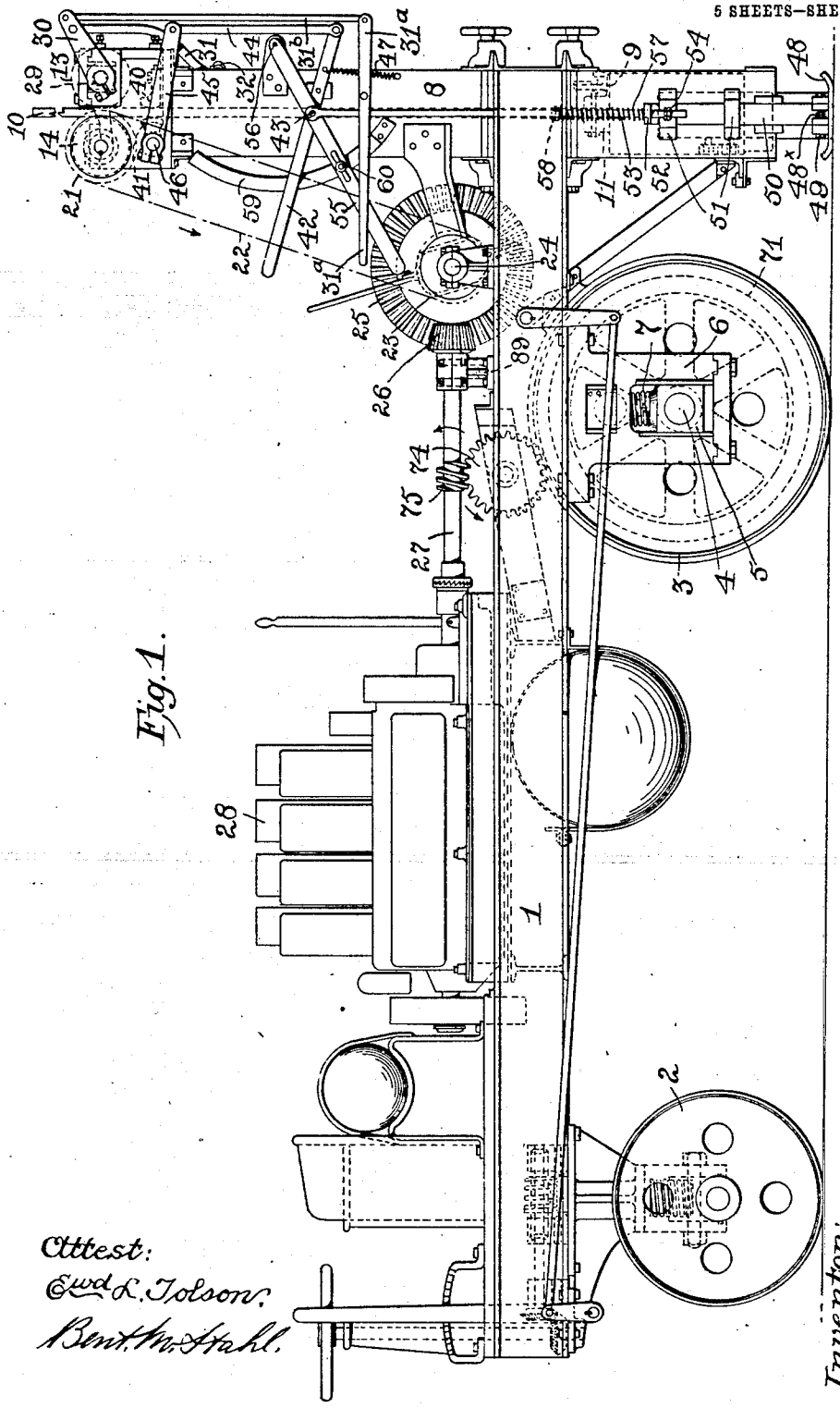

Fig. 1.

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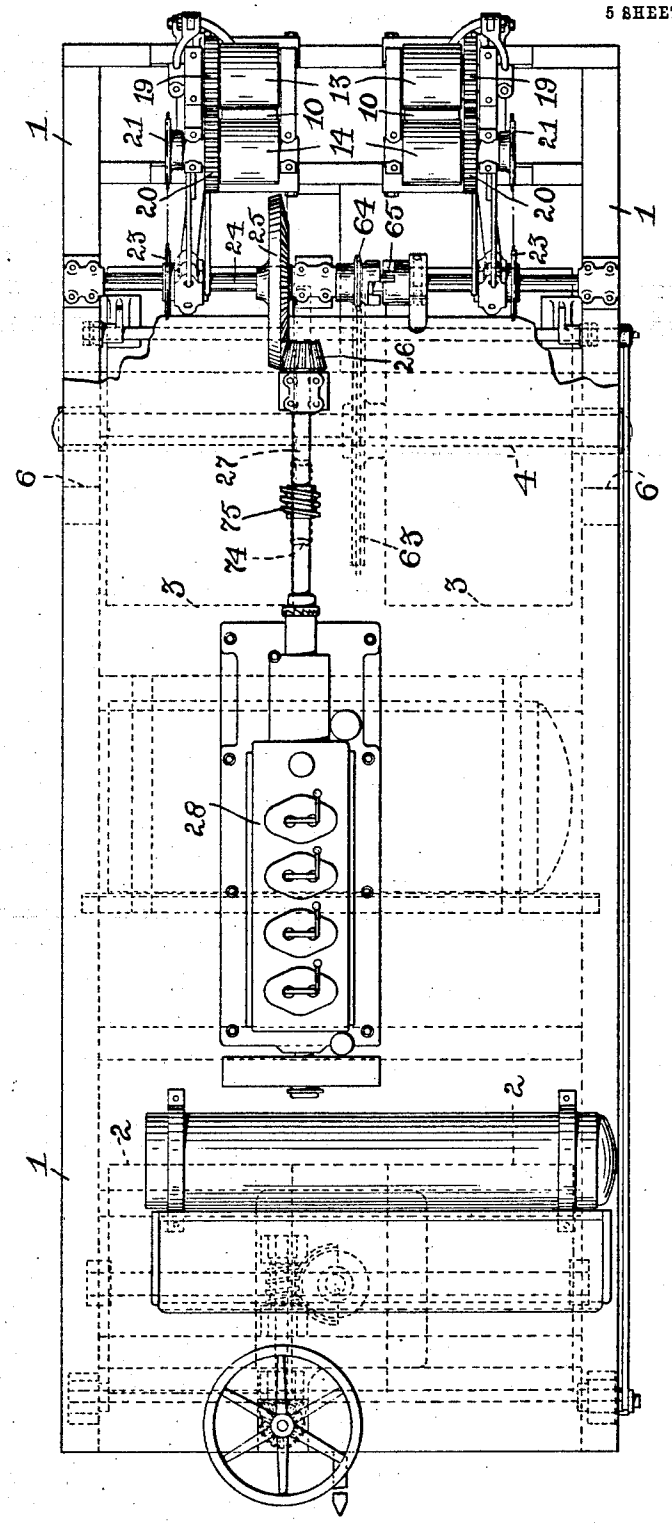

Fig. 2.

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Fig. 3.

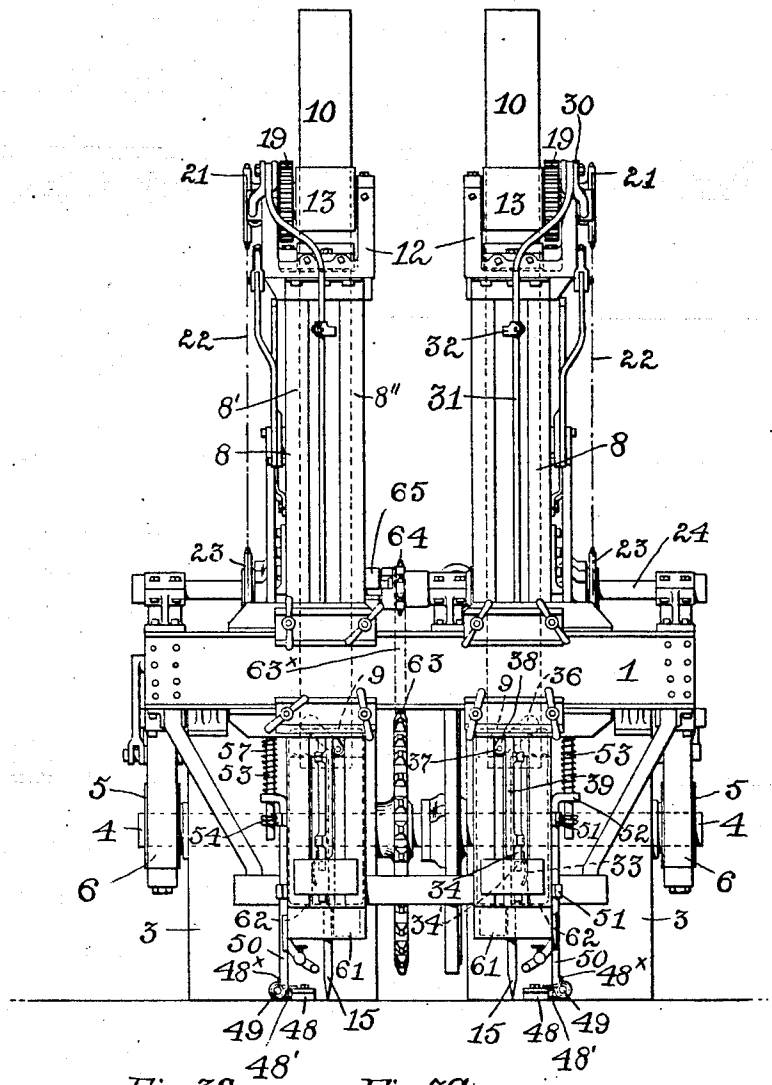


Fig. 3c

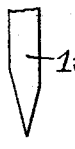


Fig. 3a

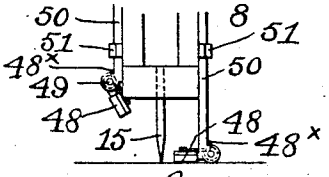
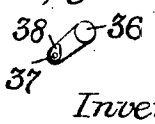


Fig. 3b



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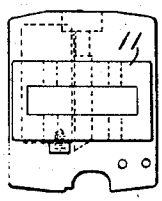
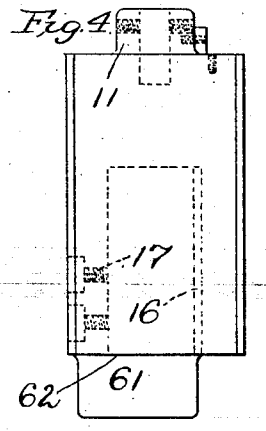
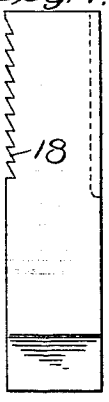
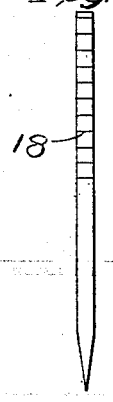
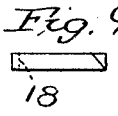


Fig. 5.









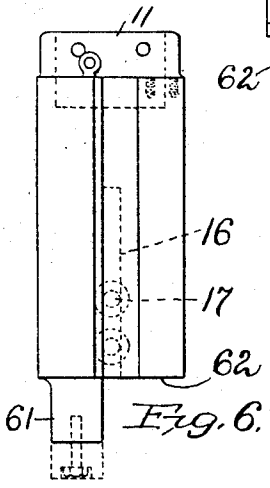


Fig. 6.

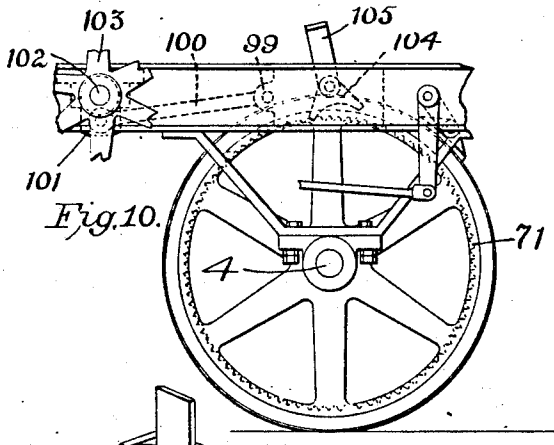


Fig. 10.

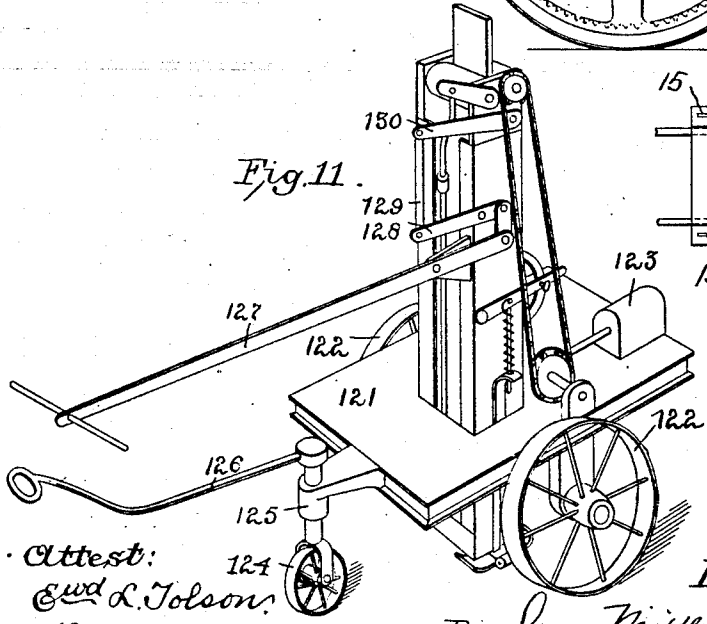


Fig. 11.

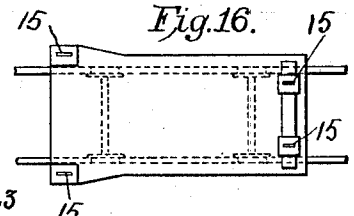


Fig. 16.

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Fig. 12.

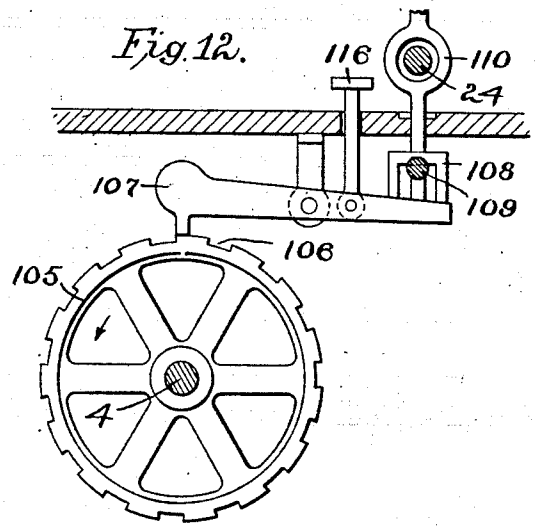


Fig. 13.

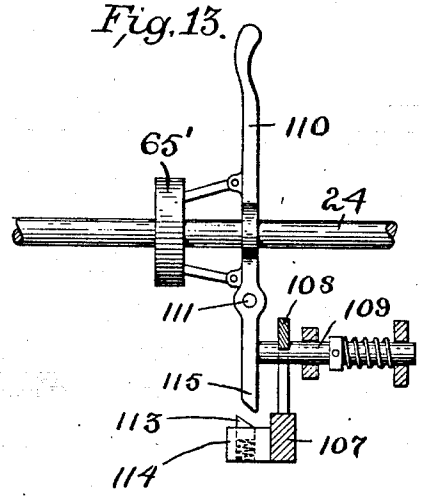


Fig. 14.

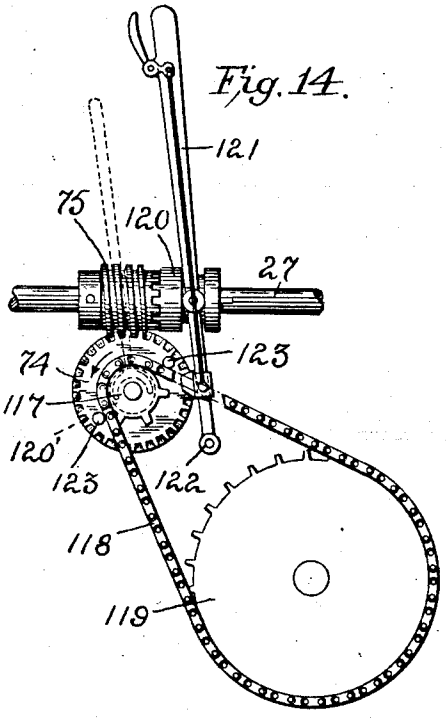
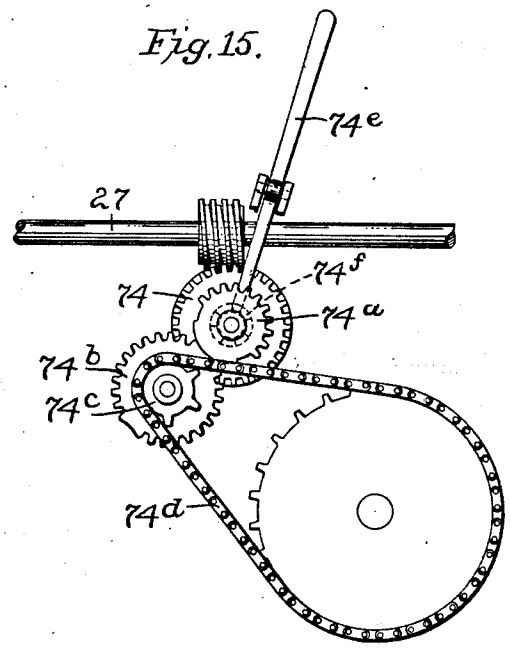


Fig. 15.



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UNITED STATES PATENT OFFICE.

LEE D. CRAIG, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR TO NATIONAL TRENCHING MACHINE COMPANY, OF WASHINGTON, DISTRICT OF COLUMBIA, A CORPORATION OF DELAWARE.

ROAD-CUTTER AND THE LIKE.

1,037,875. Specification of Letters Patent. Patented Sept. 10, 1912.

Application filed December 14, 1909, Serial No. 533,063. Renewed February 3, 1912. Serial No. 675,340.

To all whom it may concern:

Be it known that I, LEE D. CRAIG, citizen of the United States, residing at San Francisco, California, have invented certain new and useful Improvements in Road-Cutters and the Like, of which the following is a specification.

My invention relates to apparatus for cutting roadbeds, and while particularly adapted for cutting the asphalt surface and the concrete base of streets, I do not limit myself to the use of the invention to roadbeds of this character.

The invention consists in the features and combination and arrangement of parts hereinafter described and particularly pointed out in the claims.

The invention is an improvement upon that form of apparatus disclosed in Letters Patent of the United States granted to me March 30, 1909, #916,676.

In the accompanying drawings:—Figure 1 is a side elevation of a machine embodying my improvements; Fig. 2 is a plan view; Fig. 3 is a rear view; Figs. 3^a, 3^b and 3^c are views of details; Figs. 4, 5 and 6 are respectively a side and rear elevation, and a plan view of the hammer; Figs. 7, 8 and 9 are views of the cutting knife; Fig. 10 is a side view of the impelling mechanism for giving a limited amount of movement to the carriage upon which the invention is mounted; Fig. 11 is a view of the invention in that form of a machine adapted for patch-work; Figs. 12 and 13 show a modification of the measuring impelling mechanism for the machine; Figs. 14 and 15 show other modifications. Fig. 16 is a diagrammatic view of an apparatus adapted for use in cutting the asphalt and concrete alongside the rails of street railways.

In these drawings, the frame of the machine is indicated at 1 mounted upon wheels or drums 2 and 3, there being a pair of the drums 2 at the front of the machine, and a pair of drums 3 at the rear, the drums of each pair having a space between them, as indicated in Fig. 3. The rear drums 3 are mounted upon an axle 4, the journal boxes 5 of which are mounted in suitable bearings or hangers 6, depending from the frame of the machine, springs 7 being interposed between the bearing boxes and the upper parts of the hangers. At the rear of the machine, upright frames or guides 8 are suitably mounted and attached to the frame, extending partly above and partly below the same, and each of these upright frames is composed of a pair of sides 8′ 8″ with a space between them, in which hammers 9 are guided to move vertically. These hammers are attached to straps or boards 10, the lower ends of the straps fitting in sockets 11 on top of the hammers, where they are held by suitable set screws passing through the walls of the sockets and bearing upon the straps. The frames 8, at their upper ends, carry heads 12 provided each with bearings for a pair of gripping and elevating rollers 13, 14, these rollers being arranged with a space between them to receive the strap of the hammer, so that, by turning the rolls the frictional contact between the same and the strap will be sufficient to elevate the strap with a hammer attached thereto. The hammers carry cutting knives 15, one for each hammer, and these cutting knives are attached to the hammers by fitting in sockets 16, where they are held by set screws at 17 passing through the hammers and engaging the serrated edges 18 of the knives. The knives are so positioned in relation to each other that they will cut the roadbed for the formation of a trench, the said knives being located opposite each other, and the frames carrying the knives and the hammers and elevating mechanism being adjustable toward and from each other so that trenches of different widths may be cut. The elevating rolls are geared together by the gear wheels 19 and 20, and one of the rolls is driven through a sprocket wheel 21 on the shaft thereof, connected by a sprocket chain 22 with a sprocket wheel 23 on a transverse shaft 24 mounted on the frame, and having a beveled gear 25 fixed thereon meshing with a beveled gear 26 on a longitudinally extending shaft 27, which is driven in any suitable manner, as by a gasolene engine, indicated generally at 28. One of the friction rolls 13 is adjustable toward and from the other roll so as to grip or release the strap of the hanger by means of an eccentric 29 and arm 30 connected therewith, and

a depending rod 31. This rod has an adjustable tappet 32 thereon, which is struck by the hammer as the same is about to complete its upward movement, and the rod 31 will therefore be lifted and turn the arm 30 and the eccentric so as to retract the friction roll 13 away from the hammer strap, and this being released, will allow the hammer to fall to deliver the blow and cause the cutter 15 to enter the roadbed. As the rod 31 is lifted by the tappet 32, a spring 33 at the lower end of the said rod will shift the same laterally, so that a shoulder 34 on the rod will be thrust over a supporting shoulder 34′ on the framework 8, and thus the rod 31 will be held in its elevated position to hold the roll 13 retracted for the free fall of the hammer.

The hammer carries a weighted arm 36 at or near its upper end, and this is attached to a pivot or rock shaft 37 mounted on the hammer, which has a finger 38 arranged to bear against a block 39 bolted or otherwise secured adjustably to the lower portion of the rod 31, and as the hammer delivers its blow or rather as the knife strikes the roadbed, the momentum will cause the weighted arm 36 to turn the shaft 37, and the finger 38 will thus be forced against the block 39 to push the rod 31 laterally, so that it will be no longer supported by the shoulder 34′ on the frame, and the weight of this rod now acting through the arm 30, will turn the eccentric 29 and cause the roll 13 to be thrust against the strap or board, and as both rolls 13 and 14 are in constant rotation, the strap, together with the hammer and the cutting knife, will be elevated until the hammer strikes the tappet 32, when the rolls will release the strap, the hammer will fall, and the cutting be accomplished, and the operations above described will be repeated.

In order to hold the hammer up or to allow it to fall gradually at the will of the operator, I provide a pair of grips for each hammer strap, said grips comprising a jaw 40 on one side of the strap, and a pivoted jaw 41 on the other side of the strap, the latter jaw being movable toward and from the strap by operating a hand lever 42 pivoted to the upright frame 8 at 43, and connected by a link 44 with an arm 45 connected with a shaft 46 having an eccentric thereon which, when turned by the turning of the shaft, will advance or retract the jaw 41, and thus grip or release the strap, and by this means the hammer may be controlled in its operation to go down gradually or to be held at any desired height. By keeping the grips released, the automatic action of the hammer mechanism will continue, and the hammer will be raised and allowed to drop so as to deliver any desired number of blows or cuts at the same point. A spring 47 is provided to return the hand lever and the eccentric operating connections to normal position.

It will be observed that I provide a separate hand lever for each of the hammer mechanisms, so that the blows delivered by the cutters may be simultaneous, or first one cutter may be made to operate and then the other. In order to prevent the asphalt or the roadbed adjacent the knives and on the outer side thereof from being disturbed, I provide pressure plates or shoes 48, one for each of the knives, said shoes being pivotally mounted at 49 at the lower ends of plates or bars 50 arranged to slide in guideways 51 fixed on the outer sides of the upright frames 8. The straps or rods 50 are turned outwardly at their upper ends 52, and through openings in these portions rods 53 pass, having collars or nuts 54 on their lower ends, the upper ends of the rods being connected to levers 55 pivoted at 56 to the upright framework. Springs 57 encircle these rods, bearing at their lower ends upon the outwardly turned ends of the straps 50 carrying the shoes 48, and these springs, at their upper ends, bear upon collars or nuts 58 carried by the rods 53. By this mechanism the shoes are pressed upon the roadbed or the asphalt directly adjacent the knives on their outer sides, and the amount of this pressure can be regulated by pressing down or lifting upon the hand levers 55. These hand levers work over a curved bar 59 attached to the upper framework, and may be secured in any position to which they are adjusted by set screws 60. The effect of the action of the cutters is to cut and disturb the material lying between them, while the shoes prevent the material or the surface of the roadbed lying adjacent the knives on their outer sides from being disturbed when the cutters deliver their blows, or from lifting when the cutters rise after the cutting action. In cutting some grades of asphalt, the portion thereof lying between the knives will be caused to buckle up in the center, and crack and break owing to the fact that the disturbing effect of the knives is concentrated toward the inner sides thereof, and in some grades of asphalt, there will be a shifting effect laterally from one knife to the other if the knives are operated alternatively, so that the intermediate sheet will be loosened from the base and from the binding layer, rendering this portion easy of removal by the workman who is to clear the trench.

Where the trench is to be of such depth as to require the removal not only of the asphalt but of the concrete base, the cutters are used as above described, and, in addition, I may employ the hammers as means for breaking up or disintegrating the concrete, which, as is well known, is made up of small stones and cement. For this purpose,

the cutters and the hammers are so related with respect to each other that after the cutter enters the concrete to a certain depth, the lower face of the hammer will strike the concrete adjacent the cut, and thus crack the same from side to side, and, in fact, in all directions within the line of the trench, so that it will be disintegrated throughout the depth of the concrete, and even below the extent of the cut, and for a considerable area adjacent the cut, but always on the inner side thereof, the concrete beneath the uncut asphalt or concrete being left undisturbed. It will be understood that when the concrete is being cut, the pressure shoes 48 are not necessary, and these may be raised out of service by lifting the hand levers 55, and drawing the straps 50 upwardly, and, as the pressure shoes are pivotally mounted on these straps, they will assume a vertical position and can thus be drawn up alongside of the lower part of the framework 8, where they will be out of the way of the lower face of the hammers.

In order that the hammers may deliver their pulverizing blow, I provide each of them with a lower extension or bumper 61, shown in dotted lines in Fig. 3, and in Figs. 4 and 6, located directly adjacent the inner face of the cutting blade. By this construction the cutter acts upon the concrete first, and having penetrated it to a certain distance, though not necessarily entirely through it, the bumper 61, by striking upon the upper surface of the concrete, will crack and disintegrate the same throughout its whole depth and across the trench from side to side within the lines of operation of the knives. It will be observed that with this construction of hammer having the bumper, a free space will be left on the outer side of the knife opposite the bumper, the lower face of the main portion of the hammer at 62 being some distance above the plane of the lower face of the bumper 61. This will enable the cutting to be done close to the outer edge of the line of the trench, the bumper striking the concrete before the lower face 62 of the main part of the hammer can strike the asphalt, and in this way no damage to the asphalt will take place. In some cases it may be found better to first cut the asphalt and remove this surface before cutting the concrete, but the arrangement of the bumper projecting below the lower face of the hammer will enable the machine to cut and break up the concrete without breaking or marring the edge of the asphalt adjacent the outer side of the trench. It will be understood that the shoe 48, in the position shown in Fig. 3, finds a firm bearing against a shoulder 48′ on the lower end of the strap 50, which engages the shank of the shoe and prevents pivotal movement of the shoe upwardly, but when the shank 50 is raised, the shoe is free to swing down into a vertical plane, and it may then be raised by raising the strap 50.

In order to propel the machine from place to place, I arrange upon the main axle 4 a sprocket wheel 63 which is driven from a sprocket wheel 64 on the shaft 24 by a suitable sprocket chain. I also provide a clutch at 65 for throwing in and out this propelling mechanism. Any suitable form of high and low speed gear may be employed in this driving mechanism. I have also provided mechanism by which the machine may be propelled certain definite or measured distances between the cutting actions so that the knives after performing one cutting action, may be shifted a definite distance along the line of the trench to make their next cut. The knives may be of any suitable form, and any suitable length. For instance, they may be six inches along their cutting edges, and this would require that the propelling mechanism move the machine forward between the cutting actions a distance of approximately five, six or seven inches. It is not absolutely necessary, in all cases, that one cut join the preceding cut, as with asphalt any small portions that may be left uncut between the cuts made by the knives will readily break off when the sheet of asphalt is lifted by the laborer, who follows the machine to clear the trench of the cut material. In providing this mechanism for giving the machine its step by step movements between the cutting actions, I aim to provide an arrangement whereby the propelling mechanism will actuate the driving wheel for a certain distance, and then cease its driving action.

I may employ the measuring impelling mechanism shown in Fig. 10, consisting of a toothed driving wheel 71 mounted on the axle 4 and a block 99 shown in dotted lines, and reciprocating in a suitable guideway on the frame, the said block being moved by a pitman 100 from a crank arm 101 on a shaft 102 bearing in the frame, and operated from the engine through a wheel, part of which is shown at 103.

The reciprocating block carries a double armed pawl 104 suitably pivoted thereto, and having an upwardly extending piece 105 which may be kicked by the operator either one way or the other to make the pawl engage the toothed driving wheel, according as it is desired to move the car a measured distance either one way or the other. The amount of movement is limited because the pawl will pass out of the teeth of the drive wheel after it has moved a certain distance, and the pawl will then assume neutral position by gravity.

It will be understood that the grippers 40, 41, constitute a clutch for controlling the action of the hammer, it being possible for

the operator, by gripping the strap or board 10 of the cutters, to hold either one or both elevated and out of service, or, by releasing these grippers, the cutters may deliver any desired number of blows at one point, and this may be done separately, in unison or alternately. The pawl 104 may be considered the clutch for giving measured feeds to the carriage, and these are controlled independently of the clutch which controls the cutters so that, after the latter have delivered the desired number of blows, the carriage may be fed forward or backward while the cutters are held up, and any desired distances of feed may be accomplished either by the measuring clutch or by the main clutch, 64, 65.

It will be observed that the weighted arm 36 carried by the hammer by its inertia causes the release of the rod 31 from its support when the cutter or hammer delivers the blow, and this action will take place no matter what the adjustment may be as to the length of drop of the hammer or cutter. In other words, I provide means whereby the elevating of the hammer will be controlled by the delivery of the blow so that no matter whether the fall of the hammer be long or short, the elevating rolls will be made to grip the hammer strap and raise the hammer when the blow is delivered. The weighted or inertia arm is the best means now known to me for accomplishing this automatic action, but I do not limit myself thereto. By using the hammer alone, the machine may be employed for tamping material laid in the trench after it has done its work of cutting the trench and the new material has been laid therein.

The shoes 48 are preferably provided with springs at 48^x, so that as the shoe is lowered from its elevated position of nonuse, it will swing laterally into place. When it is drawn up, the shoe will turn out against the force of its spring by contacting with a suitable part of the frame work or standard 8. I may arrange a shoe on the inner side of the knife as well as upon the outer side, as indicated in Fig. 3^a, so that, in cutting close to a curb, the outer shoe may be raised and the inner shoe employed. This adjustment and use of the parts would be desirable when the part to be removed extends from the curb or the gutter bricks a short distance laterally therefrom. In the operation of the machine, the pressure shoes 48 need not be raised from the ground, as they may slide from place to place between the cutting action while in contact with the surface.

In Figs. 12 and 13 I show mechanism for giving the measuring movement to the machine between the cutting operations, and also for positively locking the machine against further movement in either a forward or backward direction while the cutting is being done or while the machine is in a position to do the same. For this purpose I arrange upon the main axle a disk or wheel 105 having wide notches 106 formed therein or suitably carried thereby, these notches being spaced apart at proper distances to allow the six inch or other measured movement of the machine. A pawl 107 is pivotally supported on the frame of the machine having its end adapted to fall into these notches, and having its extended arm arranged to release a catch 108 from a spring bolt 109 when the said pawl falls into one of the notches. This spring bolt, when released, will operate against a hand lever 110 suitably pivoted on the frame at 111, which hand lever controls the clutch 65′ shown in a conventional manner in Fig. 13 on the shaft 24. The clutch will therefore be released at the same time that the locking pawl or dog 107 drops into one of the notches 106 to lock the machine against traveling movement. The clutch 65′ is geared to the main driving axle in any suitable manner, as, for instance, by the sprocket wheels 63, 64, and the intermediate sprocket chain 63^x.

In order to prevent the throwing in of the lever 110 while the machine is locked by the pawl 107, I provide means whereby said lever will be held locked against inward movement to start the clutch, said locking means being controlled by the pawl 107. Such means may be of various types, and as a representative form of such means I provide a catch 113 on a suitable extension of the pawl arm 107, which, when the rear end of the pawl arm is elevated, will locate the catch in the path of the end 115 of the hand lever, having preferably a beveled side. As the hand lever is pressed laterally by the spring bolt, the latch 115 will ride over the catch 113, and engage upon its other side, and thus hold the hand lever from being returned until after the pawl 107 has been operated to release the wheel 105. In order to release the pawl, I provide a foot lever 116 connected with the pawl, so that, by pressing this down, the pawl will be released from the wheel, and, at the same time, the latch 108 will be allowed to fall and get in position to catch the spring bolt when this is pressed back by throwing the lever 110 into position to set the clutch, and, at the same time, the catch 113 will be lowered from the latch 115 to release the hand lever. This locking of the machine, after it has made a measured movement, may be accomplished in other ways, a representation of which appears in Fig. 14. In this form the worm wheel 74 driven from the worm 75 of the shaft 27 is associated with a sprocket wheel 117 connected by a sprocket chain 118 with

a sprocket wheel 119 on the main axle of the machine. The worm 75, in this case, is loose on its shaft, and has a clutch jaw to be engaged by a clutch 120 splined on the shaft and controlled by a lever 121 suitably pivoted, as at 122. This lever is adapted to be operated automatically by pins 123 carried by the worm wheel 74 or by a suitable disk moving in conjunction therewith, so that, as these pins come around, they will strike the hand lever, throw out the clutch 120, and, by reason of the employment of the worm wheel and worm, an automatic locking effect will be secured by the resistance offered by the worm to the turning movement of the worm wheel. Any suitable form of clutch indicated generally at 120′ may be employed between the worm wheel and the transmitting mechanism, consisting of the sprocket wheel 117, chain 118 and sprocket 119, so that this transmission mechanism may be thrown out of operative engagement with the worm and worm wheel when the machine is continuously traveling forward by its main impelling mechanism 63, 63^{x} and 64.

As shown in Fig. 15, I may employ measuring mechanism for driving the carriage intermittingly, said mechanism being in normal operation to feed the machine forward step by step without attention on the part of the operator, who can then devote himself to operating the cutters during the interval between the feeding movements. For this purpose the shaft of the worm wheel 74 has thereon a time gear 74^{a} meshing with a second time gear 74^{b}, said gears having locking surfaces as shown. The gear 74^{b} is suitably supported on the frame and has a sprocket wheel 74^{c} on its shaft connected by a sprocket chain 74^{d} with a sprocket on the main axle. This mechanism will give a step by step movement to the carriage, locking itself at the end of each movement, and between the movements the operator will have time to operate the hammers. Should, however, he want to stop the feed movement to deliver more blows of the cutter than that for which the machine is set, he can, by operating a hand lever 74^{e}, throw out a clutch at 74^{f} to stop the feed movement. In order to insure the gripping of the strap or board of the weighted cutter by the hoisting rolls, I may employ manually operated connections to assist the weight of the rod 31, these consisting of a hand lever 31^{a} pivoted to the upright guide, and connected by a link 31^{b} with the arm 30 of the eccentric, so that by pulling upwardly slightly on the handle or lever, the rolls may be made to grip the boards or straps. A set of these connections may be used for each of the weighted cutters capable of being operated simultaneously or separately. By the use of the beveled edge cutters and the shoes for holding the asphaltum or surface down directly adjacent the point where the cut is made, the tendency of the cutter in delivering the blow is to be deflected or shifted slightly inwardly toward the center of the trench, or, where one cutter is being used, away from the shoe. This tendency, together with the fact that the hammer or weight has slight play laterally in its guides, will cause pressure of the cutter laterally, with the result that the edge of the cut will be clean and sharp, and the lateral pressure, together with this form of cut, will cause the material between the lines of the trench to be cracked and broken, in some cases buckling up, and in all cases being subjected to a lateral disturbance. The slight lateral play of the cutters will also take place when cutting concrete without the shoes as the wall of the trench left by the removal of the asphalt will supply the necessary resistance on this side to cause all the disturbing effect to be concentrated toward the interior of the trench.

I show in Fig. 11 an apparatus designed for doing patch work, and particularly in asphaltum alone. In making patches in the asphalt surface, it is necessary to cut irregular figures along lines marked out by the man in charge of the work, and the form of apparatus now to be described is designed to be moved along the irregular lines to do the cutting for making patches in the surface. For this purpose a platform or frame 121 is supported upon carrying wheels 122, and the frame carries at a point substantially between the carrying wheels a single guide frame for guiding a weighted cutter, said guide frame, together with the weighted cutter, the pressure shoe and the lifting rolls, together with the drive connections leading thereto from the engine 123, being all substantially similar to the devices above described in connection with the main form of the apparatus designed for trench work. In order to steer this small machine, a caster wheel 124 is swiveled in a bracket 125, and is connected with a handle 126 by which the truck may be readily turned, and by which also the truck may be drawn along by hand. One attendant may do the steering, the hand propelling and the controlling of the cutter, for which purpose a hand lever 127 exemplifies any suitable connection or connections whereby the attendant on the ground at the steering handle may control the cutting. This lever 127 connects through the lever 128, link 129 and lever 130 with the clutch for controlling the cutter. This form of the apparatus may be arranged to deliver the same number of blows per minute as in the large machine, though its cutting blade may be of less length than that employed in the trenching apparatus, it

being understood, however, that the rise and fall of the cutter will go on automatically so long as the attendant desires this to be done. When, however, he desires to move the machine, he can arrest the operation of the cutter by operating the lever 127, and then draw the machine and turn it, if necessary, to get the cutter in position for the next cutting action. It will be observed that by having the cutter arranged substantially between the carrying wheels 122, and approximately in the same vertical plane with the axis thereof, the machine may be made to turn sharp curves or corners in following the irregular lines necessary for patch work. In other words, the cutter is arranged in such a relation to the carrying wheels that it forms practically the point about which the truck may be turned without giving the truck any advance movement. A supplemental bumper face may be attached to the main bumper or hammer projection so as to shorten the distance from the point of the knife to the lower face of the bumper; such a face is indicated at 61^x. I may, in some cases, employ in connection with the oppositely positioned cutters having their cutting edges extending lengthwise of the trench to be cut or parallel with the direction of movement of the machine, a cutter or cutters having the cutting edge extending transversely of the line of the trench so as to chop the material between the lines of cuts made by the side knives first described. These transverse knives may be attached to the hammers or they may form parts of the main knife blades.

As shown diagrammatically in Fig. 16, I may employ my machine for cutting the asphalt and concrete alongside the car tracks, and for this purpose I employ a car having wheels to run on the tracks and having cutting mechanism substantially like that above described, including cutters arranged at the proper distance from the rails to make the cut. I show a pair of cutters 15 at one end of the machine for cutting the material along the inner sides of the rail, and at the other end of the machine I show another pair of cutters 15 for cutting the material along the outer sides of the rail. The machine may be propelled from the electric power furnished the railway, and the cutting mechanism may be operated from an electric motor mounted on the truck or platform to which current is supplied from the electrical conductor of the railway.

I claim as my invention:

1. In combination in apparatus of the class described, a penetrating tool and a breaking tool with means for operating the same, substantially as described.

2. In combination in apparatus of the class described, a tool to penetrate the material and a breaking tool, said tools, working in unison and adjacent each other, substantially as described.

3. In combination in apparatus of the class described, a breaking hammer and a cutting tool attached thereto, and projecting below the same, said hammer having a breaking surface at a point above the cutting point, substantially as described.

4. In combination in apparatus of the class described, a hammer, a knife attached thereto, said hammer projecting lower down on one side of the knife than on the other, substantially as described.

5. In combination in apparatus of the class described, a pair of hammers arranged on opposite sides of the line of the trench to be cut, and knives carried thereby, said hammers having bumping portions located only on the inner sides of the cutters, substantially as described.

6. In combination in a machine of the class described, a hammer having a removable lower portion, and a cutter projecting beyond the hammer, substantially as described.

7. In combination in a machine of the class described, a hammer, a cutter attached thereto, said hammer having a bumping portion located only on its inner face, and a shoe to bear on the material adjacent the outer face of the cutter, substantially as described.

8. In combination in a machine of the class described, a cutter, a weight carrying the same, and a pressure shoe located adjacent the outer face of the cutter, and displaceable laterally in relation to the cutter and weight, substantially as described.

9. In combination in a machine of the class described, a cutter, a weight carrying the same, and a pressure shoe located adjacent the outer face of the cutter and displaceable laterally in relation to the cutter and weight, and means for holding the pressure shoe elevated when displaced, substantially as described.

10. In combination a gravity cutter, a pressure shoe, a hanger to which said shoe is pivoted, with means for limiting its pivotal movement to hold the shoe pressing on the surface of the road bed, and means for holding the hanger elevated with the outwardly swung shoe elevated, substantially as described.

11. In combination in a machine of the class described, cutter mechanism, including a reciprocating cutter with means for controlling its operation, a portable carrier for the cutter mechanism and impelling mechanism including automatically operating means for throwing the impelling mechanism out of connection when the machine

has been moved forward the prescribed distance for making a new cut, substantially as described.

12. In combination in a machine of the class described, cutter mechanism including a portable carriage therefor having a drive wheel and impelling means for the carriage to move it only a prescribed distance at each impelling action, said means including a member having a constant movement, and means under the control of the operator for throwing said member into connection with the drive wheel of the carriage for a prescribed period of operation, and then to disconnect therefrom, substantially as described.

13. In combination in a machine of the class described, cutter mechanism including a portable carriage therefor having a drive wheel, and impelling means for the carriage to move it only a prescribed distance at each impelling action, said means including a member having a constant movement, and means under the control of the operator for throwing said member into connection with the drive wheel of the carriage for a prescribed period of operation, and then to disconnect therefrom, said member having a back and forth movement, substantially as described.

14. In combination in a road cutting machine, a gravity cutter with operating means therefor, a portable carriage, and measuring impelling mechanism for the carriage, substantially as described.

15. In combination in apparatus of the class described, cutting mechanism, a carriage having a drive wheel, and impelling mechanism including a constantly driven member having engaging and disengaging connection with the drive wheel of the carriage to move it either in one direction or the other, said constantly driven member being released from connection with the impelling wheel after moving it a prescribed distance either forward or backward, substantially as described.

16. In combination in apparatus of the class described, a cutting mechanism, a carriage therefor, having a drive wheel, an impelling means including a member having a constant back and forth movement, and an automatic releasing connection between the same and the drive wheel releasable on either stroke, and a controller operable by the attendant to throw said connection into operation on either the backward or forward stroke of the said member, substantially as described.

17. In an apparatus of the class described, and in combination, cutting mechanism, with operating means, a portable carriage and an automatically releasable measuring clutch for said impelling mechanism for impelling the carriage measured distances, substantially as described.

18. In apparatus of the class described, the combination of a cutter with operating means, a portable carriage, impelling means therefor, a clutch to control the cutter and a clutch to control the impelling mechanism, said clutches being independently operable, substantially as described.

19. In apparatus of the class described, the combination of a gravity cutter with operating means for raising the cutter, an automatically operating clutch for holding the cutter elevated, a portable carriage for supporting the cutter, impelling mechanism for the carriage, and a clutch for the impelling mechanism, substantially as described.

20. In apparatus of the class described, the combination of a gravity cutter with operating means for raising the cutter, an automatically operating clutch for holding the cutter elevated, a portable carriage for supporting the cutter, impelling mechanism for the carriage, and a clutch for the impelling mechanism, said clutch being operable independently of the cutter controlling clutch, substantially as described.

21. In apparatus of the class described, the combination of a gravity cutter with means for elevating it, a portable carrier therefor, impelling mechanism, an automatic clutch for holding the hammers elevated, and an automatic releasable measuring clutch for the impelling mechanism, substantially as described.

22. In combination in apparatus of the class described, a portable carriage, a gravity cutter having a strap, friction rolls to engage said strap, a rod with connections to one of the rolls for moving it toward and from the other, a tappet on the rod to be struck by a part moving with the cutter, a support for the lower end of the rod, and a weighted trip moving with the cutter and contacting with the rod for throwing it off of its support to allow the rod to operate the rolls to grip the strap, substantially as described.

23. In a machine for working upon asphalt, concrete and the like, on roads, the combination of a gravity tool, guides therefor, elevating rolls and means for giving the gravity tool different lengths of fall, and means controlled by the striking of the tool on the surface to be cut or broken for causing the elevating rolls to raise the tool, substantially as described.

24. In a machine for working upon asphalt, concrete and the like on roads, the combination of a gravity tool, guides therefor, elevating rolls, and means for giving the gravity tool different lengths of fall, and inertia operated means controlled by the

striking of the tool on the surface to be cut or broken for causing the elevating rolls to raise the tool, said inertia operating means being carried by the tool or tool carrier, substantially as described.

25. In combination in a machine for working upon asphalt, concrete and the like on roads, a vertical reciprocatory tool, guides therefor, elevating means for the tool, and inertia operated means carried by the tool or its carrier with connections controlled thereby for setting the elevating means in operation when the tool delivers its blow, substantially as described.

26. In combination in a machine of the class described, a gravity tool, guides therefor, elevating means for the tool, a rod connected with the elevating means, a support for said rod, inertia operated means moving with the tool to throw the rod off of its support to thereby set the elevating means in operation, means for elevating the rod from the rise of the tool to thereby release the elevating means to allow the tool to fall, and replacing means for setting the rod again on its support, substantially as described.

27. In combination in a machine of the class described, a cutter and a pressure shoe on each side of the same, each of said shoes being adjustable to and from working position, substantially as described.

28. In combination in a machine of the class described, a cutter, a pressure shoe, a support therefor to which the shoe is pivoted, and a spring for throwing the shoe into working position, substantially as described.

29. In combination in a machine of the class described, a cutter, a pressure shoe, a support therefor to which the shoe is pivoted, and a spring for throwing the shoe into working position, said shoe moving laterally automatically into vertical position against the pressure of said spring when the shoe is raised, substantially as described.

30. A machine for cutting asphalt and concrete comprising a weighted cutter, a vertical guide therefor, elevating mechanism and adjustable means for releasing the cutter from the elevating means to allow the cutter to fall different distances to cut different depths, substantially as described.

31. In apparatus of the class described, and in combination, cutting mechanism with operating means, a portable carriage, and impelling mechanism including means for giving measured movements to the carriage, and a locking device for locking the carriage at the ends of said movements, substantially as described.

32. In combination in apparatus of the class described, cutting mechanism with operating means therefor, a portable carriage, and measuring-impelling and locking mechanism for the carriage, substantially as described.

33. In combination in a road cutting machine, a weighted cutter, a guide therefor, a strap connected with the cutter, a pair of lifting rolls, and manually operated connections for operating the rolls to lift the cutter.

34. In combination in a road cutting machine, a weighted cutter, a guide therefor, a strap connected with the cutter, a pair of rolls to engage the strap, eccentric bearings for one roll, automatic means operated by the weighted cutter near the ends of its stroke for releasing and gripping the said rolls through the eccentric, and hand operated means for operating the eccentric, substantially as described.

35. In combination in a road cutting machine, a frame, a pair of guides extending vertically thereof and on opposite sides of the trench line, weighted cutters guided thereby, a cross shaft, connections extending from said cross shaft to the upper ends of the guides for operating the cutters, a transverse axle, drums or wheels spaced apart thereon on opposite sides of the center line of the trench, and a driving connection from the cross shaft to the axle, substantially as described.

36. In combination in a road cutting machine, a portable carriage consisting of a frame and a pair of drums or wheels near one end separated from each other, a pair of weighted cutters at one end of the frame, guide means therefor, operating connections extending from a cross shaft on the frame to the upper parts of the guide means, driving connections extending to the axle of the drums or wheels for propelling the machine forward continuously, and measuring driving mechanism also connected with the axle of said drums or wheels at a point between them, substantially as described.

37. In combination in a machine for cutting roadways, a gravity cutter having a beveled cutting edge and a guide for said cutter on which the cutter has slight lateral play, substantially as described.

38. In combination in a machine for cutting roadways, a gravity cutter having a beveled cutting edge and a guide for said cutter on which the cutter has slight lateral play, and a shoe adjacent the beveled side of the cutter to press on the surface being cut, substantially as described.

39. In combination in a machine for cutting roadways, a pair of gravity cutters arranged opposite each other to cut a trench, guide means on which the cutters have some lateral play toward and from each other, said cutters being beveled on their outer sides, substantially as described.

40. In combination in a machine for cut-

ting roadways, a pair of gravity cutters arranged opposite each other to cut a trench, guide means on which the cutters have some lateral play toward and from each other, said cutters being beveled on their outer sides, and shoes to bear on the surface adjacent the beveled outer sides of the cutters, substantially as described.

41. In combination in apparatus for cutting asphalt and concrete, a gravity cutter, means for elevating the same and allowing it to fall, and measuring impelling means for the carriage, substantially as described.

In testimony whereof, I affix my signature in presence of two witnesses.

LEE D. CRAIG.

Witnesses:
HENRY E. COOPER,
EDWARD N. SARTON.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."