F. V. E. BARDOL.

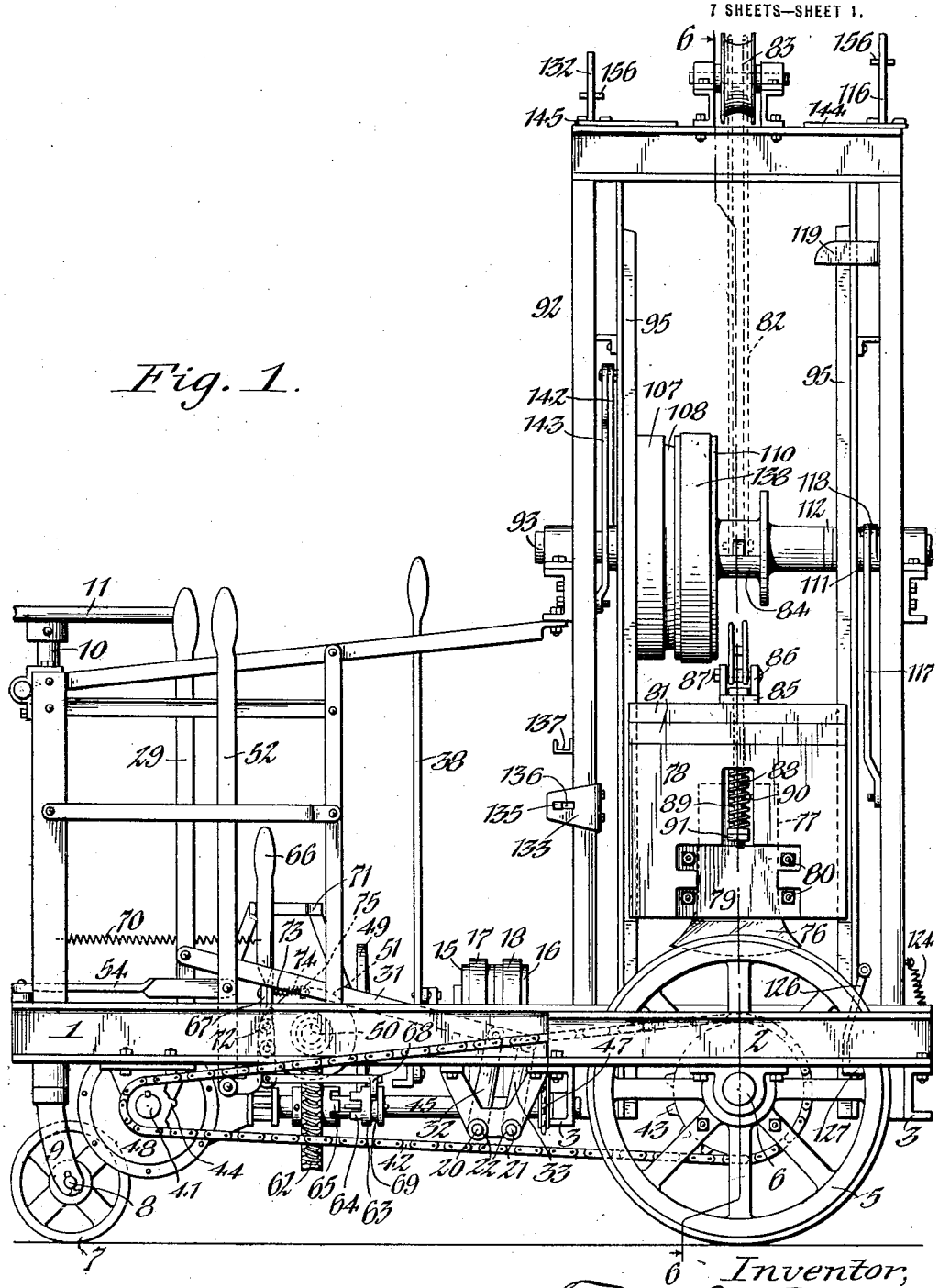
ASPHALT CUTTER.

APPLICATION FILED JULY 20, 1917.

1,337,426. **Patented Apr. 20, 1920.**

7 SHEETS—SHEET 1.

Fig. 1.



Inventor;
Frank V. E. Bardol
by Cuper & Colp
Attorneys.

F. V. E. BARDOL.

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7 SHEETS—SHEET 2.

Fig. 2.

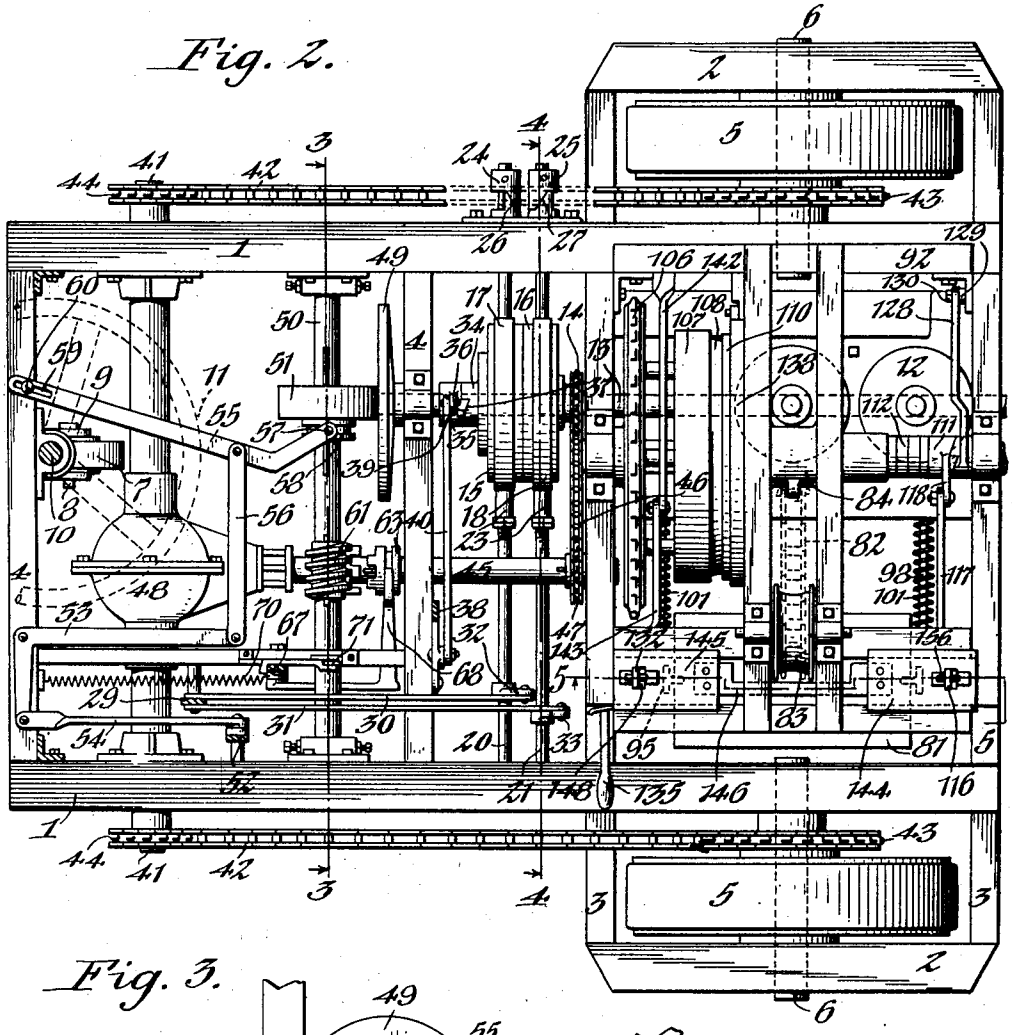
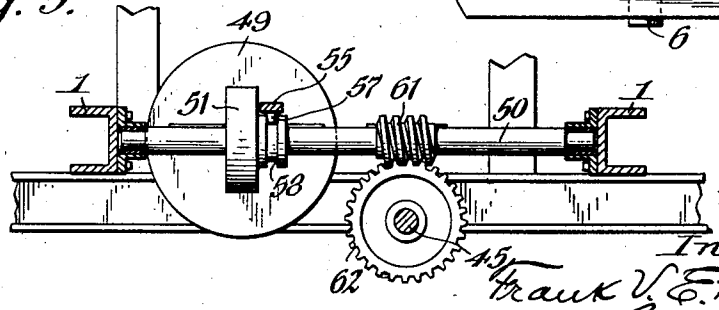


Fig. 3.



Inventor;
Frank V. E. Bardol
by Lemp & Popp
Attorneys.

F. V. E. BARDOL.

ASPHALT CUTTER.

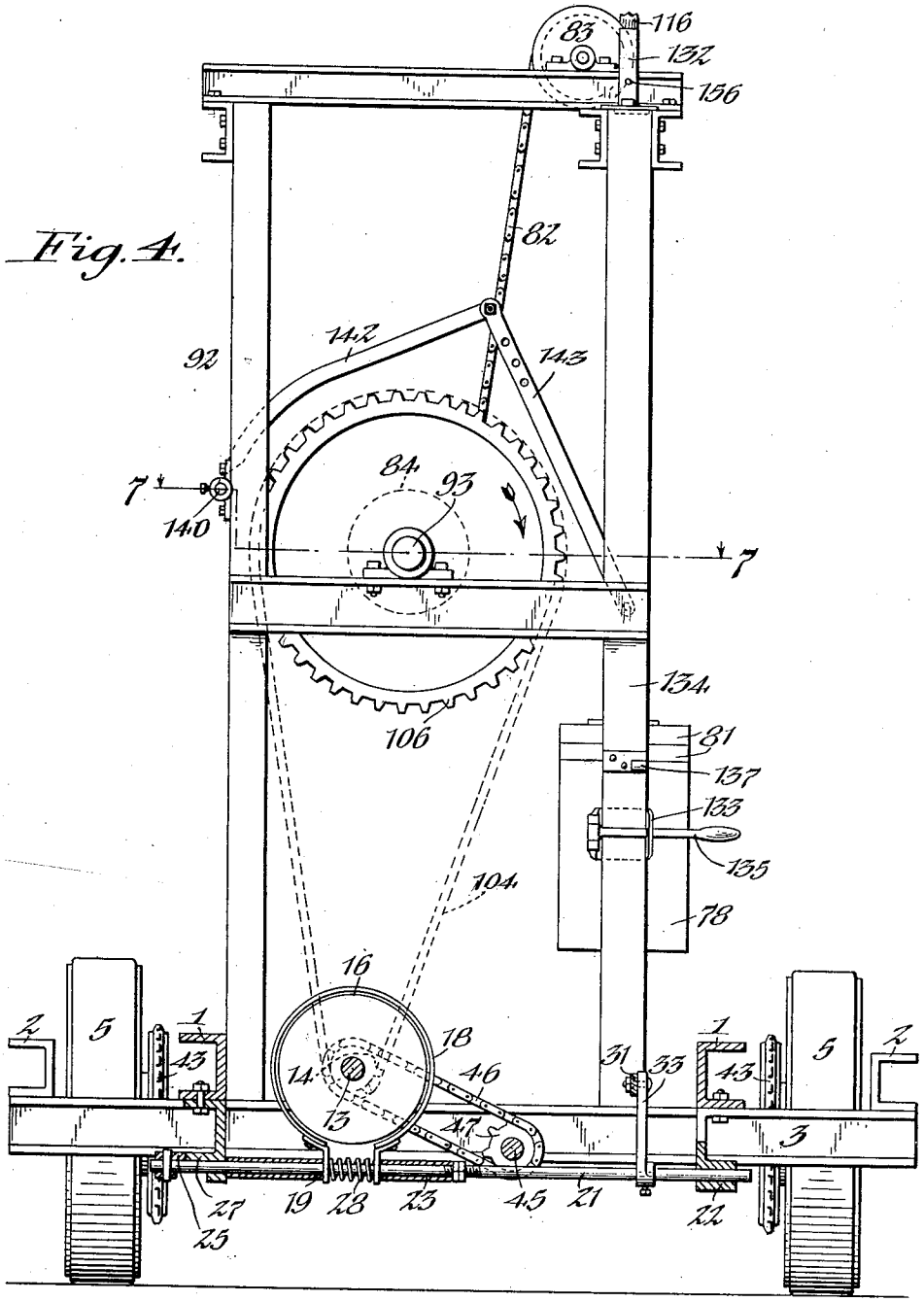
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7 SHEETS—SHEET 3.

Fig. 4.



Inventor;
Frank V. E. Bardol
by Cuper & Pouh
Attorneys.

F. V. E. BARDOL.

ASPHALT CUTTER.

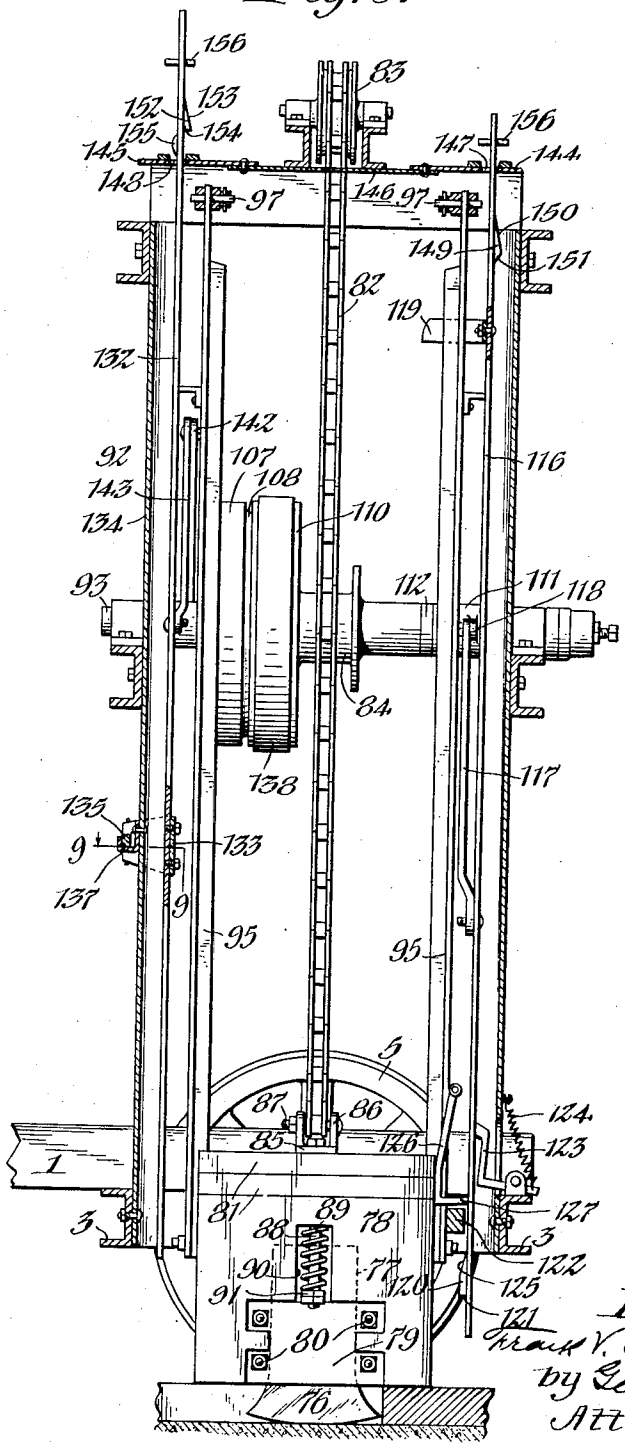
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1,337,426.

Patented Apr. 20, 1920.

7 SHEETS—SHEET 4.

Fig. 5.



Inventor;
Frank V. E. Bardol
by Geyer & Park
Attorneys.

F. V. E. BARDOL.

ASPHALT CUTTER.

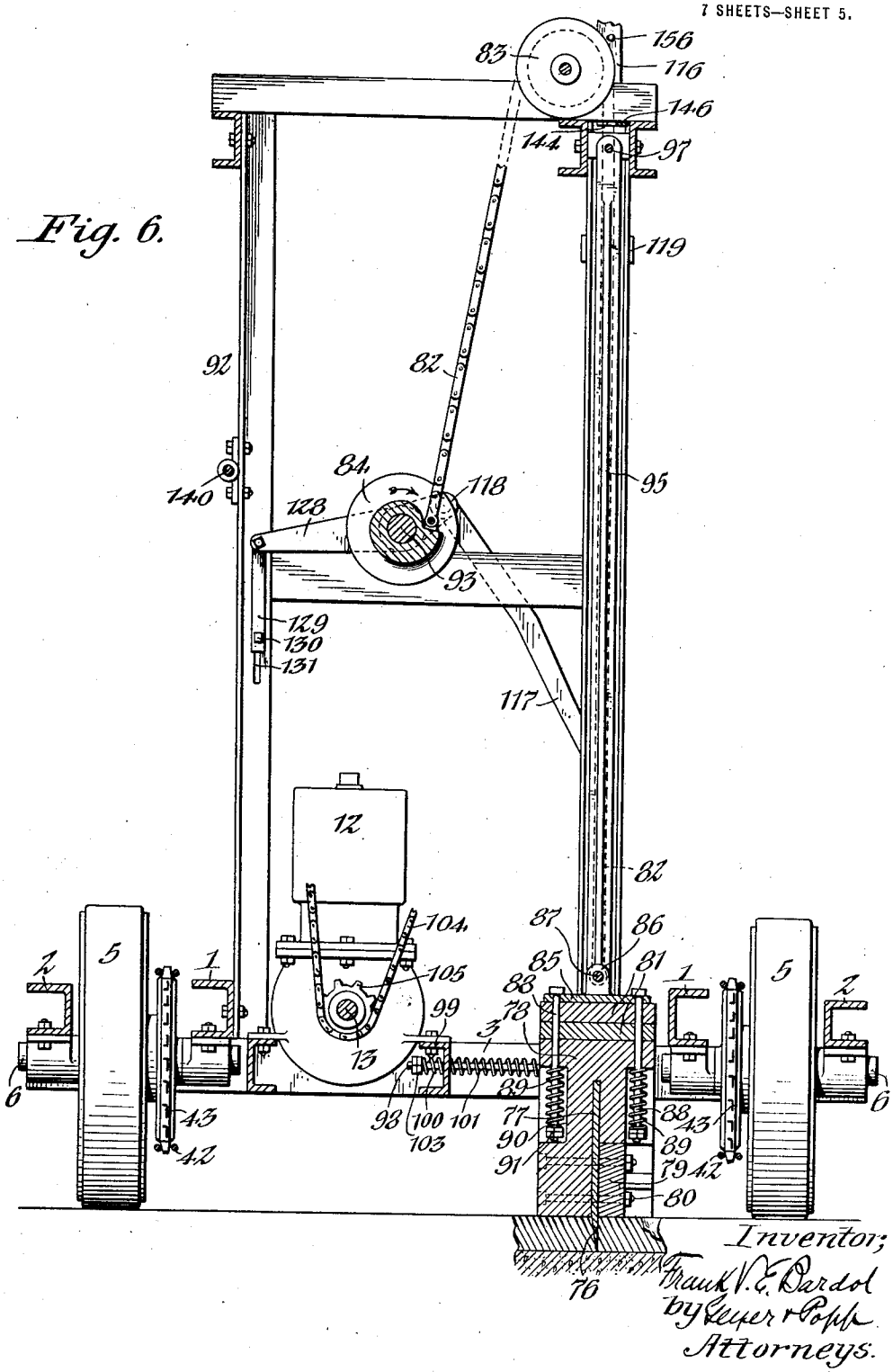
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Patented Apr. 20, 1920.

7 SHEETS—SHEET 5.

Fig. 6.



Inventor;
Frank V. E. Bardol
by Geyer & Popp
Attorneys.

F. V. E. BARDOL.

ASPHALT CUTTER.

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7 SHEETS—SHEET 6.

Fig. 7.

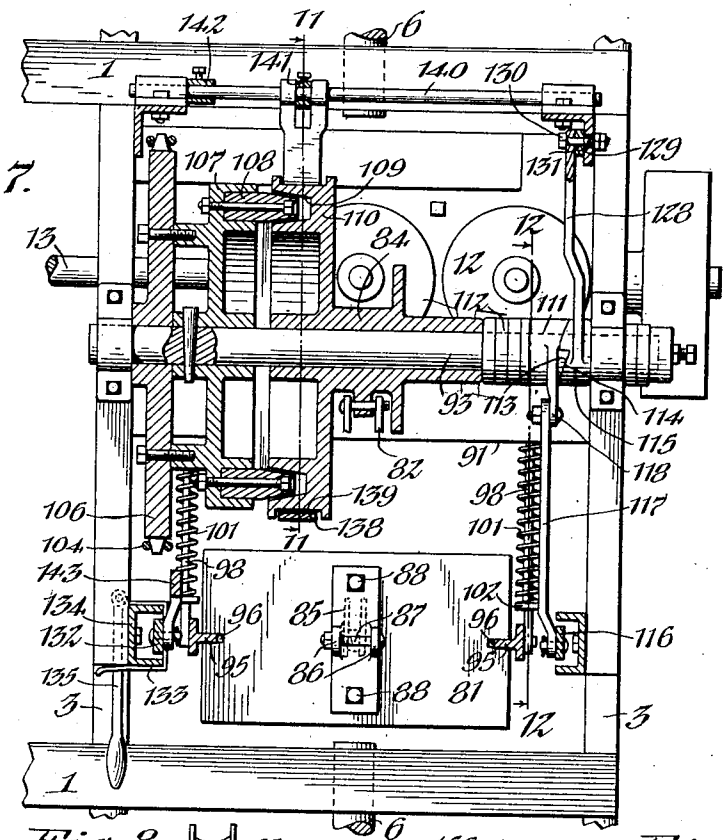


Fig. 8.

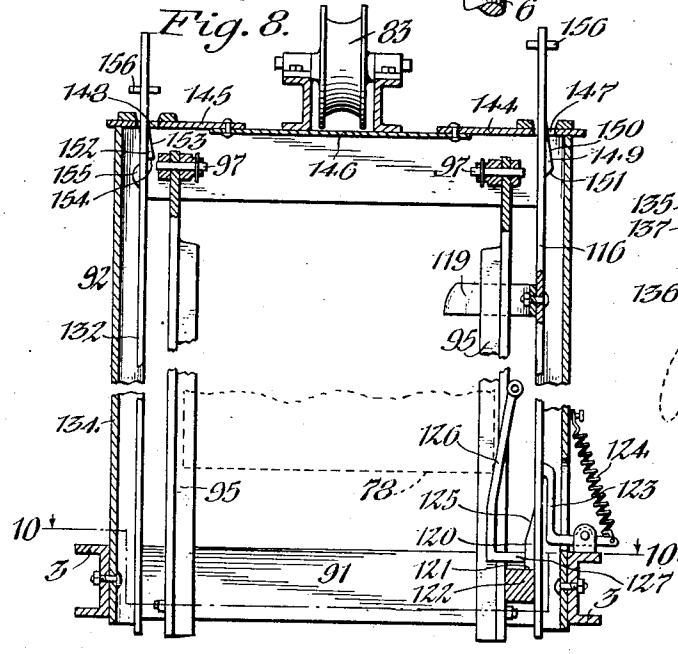
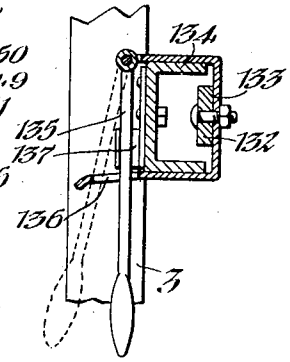


Fig. 9



Inventor;
Frank V. E. Bardol
by Cooper & Kapp
Attorneys.

F. V. E. BARDOL.

ASPHALT CUTTER.

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7 SHEETS—SHEET 7.

Fig. 10.

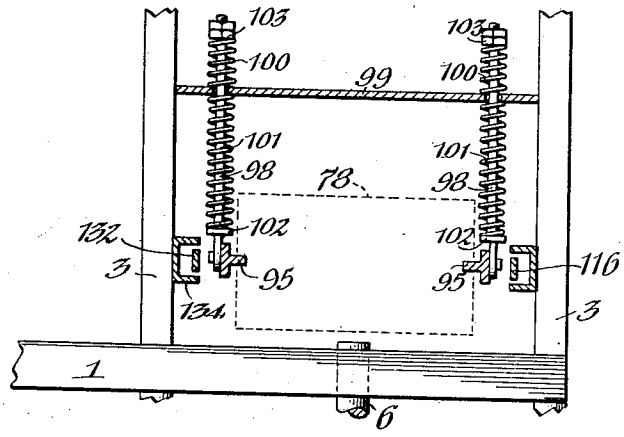


Fig. 11.

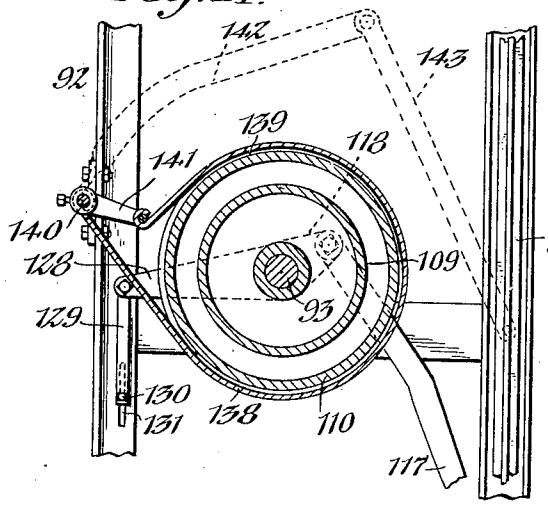
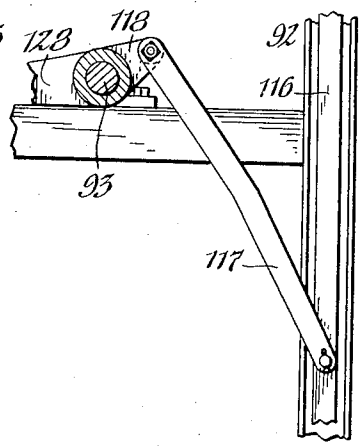


Fig. 12.



Inventor,
Frank V. E. Bardol
by Lemp & Popp
Attorneys.

UNITED STATES PATENT OFFICE.

FRANK V. E. BARDOL, OF BUFFALO, NEW YORK.

ASPHALT-CUTTER.

1,337,426. Specification of Letters Patent. Patented Apr. 20, 1920.

Application filed July 20, 1917. Serial No. 181,869.

To all whom it may concern:

Be it known that I, FRANK V. E. BARDOL, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Asphalt-Cutters, of which the following is a specification.

This invention relates to a machine for cutting asphalt pavement preparatory to digging a trench in the same for receiving water or gas pipes or electric conduits and which is also adapted for cutting out imperfect patches of such pavement preparatory to repairing the same.

It is the object of this invention to produce a machine whereby this work may be accomplished quickly, easily, economically and with a minimum expenditure of manual labor.

In the accompanying drawings:

Figure 1 is a side elevation of an asphalt cutter embodying one form of my invention. Fig. 2 is a top plan view of the same, showing some of the parts in section. Fig. 3 is a fragmentary vertical cross section taken on line 3—3, Fig. 2. Fig. 4 is a vertical cross section taken on the correspondingly-numbered line in Fig. 2. Fig. 5 is a fragmentary vertical longitudinal section taken on line 5—5, Fig. 2. Fig. 6 is a vertical cross section taken on line 6—6, Fig. 1. Fig. 7 is a horizontal section, on an enlarged scale, taken on line 7—7, Fig. 4. Fig. 8 is a fragmentary vertical section, on an enlarged scale, similar to Fig. 5, showing the parts in a different position. Fig. 9 is a fragmentary horizontal section, on an enlarged scale, taken on line 9—9, Fig. 5. Fig. 10 is a fragmentary horizontal section taken on line 10—10, Fig. 8. Figs. 11 and 12 are fragmentary vertical transverse sections, on a reduced scale, taken on the correspondingly numbered lines in Fig. 7.

Similar characters of reference indicate corresponding parts throughout the several views.

The working parts of this asphalt cutter are mounted on a wheeled carriage or truck whereby the same may be transported from the plant or storage place to the job where the work is to be done, also from one job to another, and also along the asphalt pavement which is to be cut. The main frame of this carriage may be of any suitable construction but in its preferred form the same, as shown in the drawings, comprises two main longitudinal beams or sills, 1, 1, which extend the full length of the machine, two outer short auxiliary sills 2, 2, arranged lengthwise adjacent to the front ends of the main sills, two comparatively long transverse sills 3, 3, connecting the front parts of the main longitudinal sills with opposite ends of the auxiliary longitudinal sills, and a plurality of short transverse sills 4, 4, connecting the main sills at different points in their length. The rolling support for this frame preferably comprises two front traction wheels 5, 5, which are comparatively large in diameter and each of which is arranged between the front part of one of the main longitudinal sills 1 and the adjacent outer sill 2 and is mounted upon a horizontal axle 6 which is journaled transversely in bearings on the adjacent parts of the respective main and auxiliary sills, as best shown in Figs. 1, 2 and 6. Underneath the rear part of the main frame is arranged a steering wheel 7 which is comparatively small in diameter and has its horizontal axle or pintle 8 journaled in bearings at the lower end of a fork 9 which latter is secured to the lower end of an upright steering post or shaft 10. The latter is journaled in an upright bearing on the adjacent part of the main frame and provided at its upper end with a hand wheel 11 whereby this shaft and the steering wheel may be turned by one of the attendants for directing the course which the wheeled carriage or truck should take over the surface of the ground.

On this frame are mounted the means whereby the carriage may be propelled either forwardly or backwardly and at different speeds for transporting the machine from the plant to the job and to different places about the job, and also the mechanism which is adapted to cut the surface of the asphalt.

The means for propelling the carriage and controlling its movements may be variously constructed, but as shown in the drawings, these elements are preferably organized as follows:

12 represents a prime mover which is mounted on the front part of the main frame of the carriage and which preferably consists of an explosion engine, although any other suitable motor may be employed for this purpose, if desired.

On the main longitudinal driving shaft 13 of this engine is arranged a driving sprocket

wheel 14 which can either be disconnected from this shaft or it may be coupled with the same and turned either forwardly or backwardly at a comparatively high speed so that the power of the engine propels the asphalt cutter comparatively rapidly, for instance, when shifting the machine from the plant to the job, or from one job to another, which distances are usually very long compared with the distance which the machine has to travel when moving from one patch to another or when cutting the asphalt preparatory to removing a strip of the same for trench work. The means whereby the driving sprocket wheel may be thus disconnected from the driving shaft or connected therewith and turned either forwardly or backwardly may be of any suitable character, that shown in the drawings being a well known type now generally in use, and as there shown the same is constructed as follows:

15, 16, represent two reversing drums arranged side by side on the main driving shaft in rear of the driving sprocket wheel and each operatively connected on its inner side with the driving shaft by means of gearing which is rendered operative by holding the drum against turning and also associated with other means whereby the same is coupled with the main driving shaft and the driving sprocket wheel. The means whereby these two drums may be held against turning preferably comprise two clamping bands 17, 18, which encircle the reversing gear drums 15, 16, respectively, each of these bands having one of its ends engaging a stationary abutment 19 while the other end is adapted to be moved toward and from this abutment for either tightening or loosening the respective band on its drum. The tightening of these bands is effected by two horizontal shifting rods 20, 21, which are arranged transversely side by side below the reversing drums and guided in suitable ways 22 on the adjacent part of the main frame. Each of these rods is provided with a shifting sleeve 23 engaging with the free end of one of the clamping bands. Upon moving one or the other of these rods lengthwise forward or toward the left from the position shown in Fig. 4, the corresponding clamping band will be tightened upon its companion reversing drum, thereby holding the latter against turning and causing the carriage to be moved in one direction, while upon withdrawing this rod and moving the other rod forwardly, the other drum will be held against turning and cause the carriage to move in the opposite direction, but when both rods are withdrawn then both drums are free and the carriage remains at rest. The longitudinal movement of these rods is preferably effected by imparting a rotary motion thereto which is translated into a longitudinal motion by means of rotatable cams 24, 25, secured to these rods respectively and engaging with fixed cams 26, 27 arranged on the adjacent stationary part or frame of the machine. Upon turning either one of these shifting rods its rotatable cam engages its inclined surface with that of the companion fixed cam and thereby causes this rod to move forwardly for tightening the respective clamping band on the corresponding reversing drum. Upon turning this reversing rod in the opposite direction, its cam will recede on the respective fixed cam and permit this rod to be moved lengthwise in a rearward direction by a spring 28 mounted on this rod between the ends of the clamping band and thereby loosen the latter and its reversing drum, as shown in Fig. 4. The inclination of the coöperating surfaces of the two rotary cams 24, 25, and their companion fixed cams 26, 27, are reverse to one another so that upon simultaneously rotating these two rods in the same direction from a central position, one of these rods will remain idle and the other will be shifted lengthwise forwardly for causing its companion band to grip the respective reversing drum, and upon simultaneously turning these reversing rods in the opposite direction from a central position, then the previously-active shifting rod will be idle and the previously-inactive shifting rod will become active and move forwardly for causing its companion clamping band to engage the respective reversing drum. But when both of these rods are in their central position so far as their rotative movement is concerned, they will be in their retracted position and both clamping bands will be disengaged from their companion reversing drums. The means for simultaneously turning these shifting rods in either direction from their neutral or central position may be varied but the same preferably comprise an upright reversing lever 29 which is pivoted at its lower end on an adjacent stationary part of the main frame, two links 30, 31 arranged side by side and connected at their rear ends with the reversing lever 29, and two upright rock arms 32, 33, connected at their lower ends respectively with the shifting rods 20, 21 while their upper ends are connected respectively with the front ends of the links 32, 33, as shown in Figs. 1 and 2.

34 represents a longitudinally-movable clutch sleeve mounted on the rear part of the driving shaft 13 and adapted when moved forwardly to couple the internal gearing of either the drum 15 or the drum 16 with the driving sprocket wheel 14, so that the latter will turn either forwardly or backwardly depending upon whichever drum is being held against turning by its companion

clamping band. The reversing gearing shown in the drawings is so organized that when the clutch sleeve 34 is moved forwardly while the front reversing drum 15 is held against turning, then the driving sprocket wheel and the carriage will be moved forwardly through the medium of the intermediate mechanism connecting the driving sprocket wheel with the traction wheels, but when this clutch sleeve is moved forwardly while the front reversing drum is free and the rear reversing drum 16 is held against turning by its clamping band, then the driving sprocket wheel and the carriage will also be moved rearwardly. This forward movement of the clutch sleeve 34 may be effected by any suitable means, but preferably by a rotatable cam sleeve 35 interposed between the clutch sleeve 34 and an adjacent stationary part of the machine, for instance, the rear bearing of the driving shaft, as shown in Fig. 2. This rotatable sleeve is provided on its front side with a cam face 36 engaging with a cam face 37 on the rear side of the clutch sleeve 34. Upon turning the latter in one direction the coöperating cam surfaces of the same and the clutch sleeve will cause one or the other of the internal gears of the reversing drum 15, 16, to be coupled with the driving shaft and the driving sprocket wheel, while upon turning this cam sleeve in the opposite direction, the pressure on the clutch sleeve 34 will be released and the operative connection between the internal gears of the reversing drums 15, 16, and the driving shaft and the driving sprocket wheel will be removed. The rotation of the cam sleeve 35 is preferably effected by means of a transversely-swinging shifting lever 38 pivoted at its lower end on the main frame and connected with an upwardly projecting arm 39 on this cam sleeve by means of a link 40, as best shown in Fig. 2.

Various means may be employed for transmitting motion from the driving sprocket wheel 14 to the traction wheels of the carriage, those shown in the drawings being suitable and comprising a differential shaft composed of two sections 41, 41, which are journaled horizontally in suitable bearings on the rear part of the main frame, two driving chains 42, 42, arranged adjacent to the outer sides of the main sills and each passing at its front turn around a large sprocket wheel 43 secured to the axle of one of the traction wheels and with its rear turn around a small sprocket wheel 44 on the corresponding section of the differential shaft, a longitudinal intermediate shaft 45 journaled horizontally in suitable bearings on the central part of the main frame, a driving chain 46 passing with one turn around the driving sprocket wheel 14 and with its other turn around a driven sprocket wheel 47 on the front end of the intermediate shaft 45 and a differential gearing arranged within a casing 48 and operatively connecting the rear end of the intermediate shaft 45 with the opposing inner ends of the differential shaft sections. This differential gearing may be of any suitable and well known construction and operate to transmit the motion of the intermediate shaft 45 to both traction wheels when the carriage is moving forwardly or backwardly in a straight line but which will permit one of these traction wheels to move faster than the other when the carriage is turning a curve or a corner. This differential gearing and also the reversing gearing of which the drums 15, 16 and bands 17, 18, form parts are of well known construction and as the same form none of the new elements of this machine, it is not deemed necessary to either illustrate or describe the same with greater detail.

The means for transmitting motion from the engine to the traction wheels when it is desired to move the carriage either forwardly or backwardly at a very slow rate of speed while the cutting mechanism is in operation is preferably constructed as follows:

49 represents a driving friction disk secured to the rear end of the engine shaft 13. 50 represents a transverse intermediate shaft journaled horizontally in suitable bearings on the central part of the main frame and having its axis intersecting the axis of the engine shaft. On this transverse intermediate shaft is splined a driven friction wheel 51 which has its periphery engaging with the central part of the driving friction wheel and which is compelled to turn with the shaft 50 but capable of sliding lengthwise thereon so that the periphery of the driven friction wheel may either be engaged with the central part of the driving friction wheel or moved radially in opposite directions from the axis of the latter and engage the latter at different distances from its axis. When the driven friction wheel engages the central part of the driving friction wheel, no motion will be communicated from the latter to the former, but when the driven friction wheel is moved away from the center of the driving friction wheel in one direction, then the driven friction wheel and the shaft upon which it is mounted will be turned in one direction, and when this driven friction wheel is moved radially toward the opposite side of the axis of the driving friction wheel, then the driven friction wheel and the shaft upon which it is mounted will be turned in a reverse direction. The speed at which the driven friction wheel and shaft are turned depends upon the distance which this driven friction wheel is moved away from the axis of the driving friction wheel, thereby enabling the speed at

which the carriage is being moved at this time to be governed according to the work to be accomplished. The shifting of the driven friction wheel may be effected by various means, those shown in the drawings being suitable and comprising an upright hand lever 52 pivoted at its lower end on the main frame so as to swing forwardly and backwardly, a horizontally-swinging elbow lever 53 pivoted on the main frame and having one of its arms connected by means of a link 54 with the hand lever 52, and a shifting lever 55 connected between its ends by means of a link 56 with the other arm of the elbow lever and having one of its ends provided with a pin 57 which engages with an annular groove 58 in the hub of the driven friction wheel while its opposite end is provided with a longitudinal slot 59 which receives a guide pin 60 arranged on the rear part of the main frame, as best shown in Figs. 1 and 2. By this means the driven friction wheel may be moved by an attendant either into its central position, as shown in Fig. 2, so that the machine will remain at rest, or the driven friction wheel may be moved either in one direction or the other and at various distances from opposite sides of the axis of the driving friction wheel, so that the carriage will be moved either forwardly or backwardly at the required speed.

61 represents a worm which is secured to the transverse intermediate shaft above the longitudinal intermediate shaft and 62 represents a worm wheel meshing with the underside of the worm and mounted on the longitudinal intermediate shaft 45. A clutch is provided whereby the worm may be coupled with the shaft 45 or uncoupled therefrom, which clutch may be variously constructed but in its preferred form the same comprises a clutch sleeve 63 splined on the longitudinal shaft 45, so as to be compelled to turn therewith but free to move lengthwise thereon and provided on its rear side with clutch teeth or jaws 64 which are adapted to be engaged with and disengaged from corresponding clutch teeth or jaws 65 on the front side of the hub of the worm wheel. Longitudinal movement of this clutch sleeve is preferably effected by means which comprises a vertically-swinging clutch shifting lever having upper and lower sections 66, 67, the lower one being pivoted on the adjacent part of the main frame, and a fork 68 pivoted on the lower section of this lever and engaging with a circumferential groove 69 on this clutch sleeve. This lever is yieldingly held in its rearward position in which the clutch sleeve is moved into its inoperative position by means of a spring 70 connected with the upper section of this lever and with the adjacent part of the main frame, as shown in Figs. 1 and 2. The shifting lever is locked in its forward or operative position by engaging the upper section of the same with a hook or shoulder 71 on the adjacent part of the main frame. In order to permit this clutch lever to be moved forwardly and engage with this shoulder or hook even though the clutch sleeve 63 is so positioned that its teeth are arranged edge to edge relative to those of the worm wheel, the two sections of the clutch lever are yieldingly connected and capable of independent swinging movement. For this purpose, the upper section 66 is pivoted on the lower section 67 by means of a pin 72 and yieldably connected therewith by means of a tension device comprising a tension rod 73 passing through both of these lever sections and connected at its rear end with the lower lever section, and a spring 74 surrounding this tension rod and engaging with one end against the front side of the upper lever section and at its other end against a shoulder formed by a nut 75 on the front end of the tension rod. Normally, this spring 74 holds the upper and lower sections 66, 67, of this clutch lever in engagement with each other and with sufficient rigidity so that when this lever is thrown forwardly while the teeth of the coupling sleeve 63 are opposite the spaces between the teeth of the worm wheel, then the upper and lower sections of this shifting lever will move in unison and the upper section of this lever may be engaged with the detent hook 71. But when the rearward movement of this clutch sleeve is temporarily prevented by reason of its teeth being arranged edge to edge with those of the worm wheel, and the upper section of the clutch lever is at this time moved forwardly, then the upper section of this lever will move forwardly independently of the companion lower section in order to permit of engaging the same with the hook 71. But the instant the clutch sleeve 63 is turned sufficiently by the engine to bring its teeth opposite the spaces between the teeth of the worm wheel, then the tension spring 74 will also draw the lower section 67 of the clutch lever forwardly so that it bears against the companion upper section 66 and causes the teeth of the clutch sleeve 63 to properly engage those of the worm wheel so as to establish a driving connection between the engine and the traction wheels.

It will thus be noted that two systems of transmitting the motion of the engine to the traction wheels are by this means provided, one for propelling the carriage either forwardly or backwardly at a comparatively high speed for rapidly transporting the machine long distances and another for propelling the machine either forwardly or backwardly at a low speed such as is necessary while operating the machine for cutting asphalt.

The mechanism whereby the cutting of the asphalt is effected is constructed as follows:

76 represents a knife, blade or ax which has a vertically-reciprocating movement toward and from the surface of the asphalt pavement which is to be cut and which is preferably constructed of flat form and provided with a convex lower cutting edge one side of which is beveled. The upper part of this knife is constructed to form a reduced flat shank 77 whereby the same is attached to the parts which operate the same. Although the knife may be variously arranged relative to the other parts of the machine, it is preferably arranged vertically and with its flat side lengthwise of the machine and mounted in the machine adjacent to the forward right hand corner thereof where its working effect on the asphalt can be observed by the operators and the operation of the machine regulated accordingly. The actual work or cutting effect of the knife is produced by a hammer-blow of the same against the pavement, this being obtained by mounting the knife on a vertically-movable weight or hammer which is raised and then permitted to drop so as to drive the knife into the asphalt. This hammer in its preferred form comprises a body 78 which is provided on its lower part with a laterally-facing seat which engages with one side of the shank of the knife and a clamping plate 79 engaging with the opposite side of this shank and detachably connected with the body of the hammer by means of bolts 80, as shown in Figs. 5 and 6, or by any other suitable means. In order to enable the weight of the hammer to be varied according to the desired depth of cut in the pavement, or to suit the texture or hardness of the same, this hammer may be increased or decreased in weight by placing supplemental weight sections 81 on the upper end thereof or removing the same therefrom, as required. The lifting of the hammer and the parts mounted thereon is preferably effected by means of a hoisting chain, line or cable 82 which has an upper turn passing around an upper elevated guide pulley or sheave 83 and has one of its ends connected with the hammer and its other end connected with a hoisting drum 84. In the operation of the machine, the drum is temporarily connected with the engine through intermediate driving mechanism for causing the hammer to be lifted and when the hammer reaches its highest position, the hoisting drum is disconnected from its driving mechanism, thereby permitting this drum to turn backwardly and the chain to unwind rapidly therefrom and the hammer to drop quickly, so as to drive the knife with a powerful blow into the asphalt and effectively cut the same. In order to cushion the upward jerk or pull of the hoisting chain on the hammer, a yielding connection is provided between these members which preferably comprises a clip 85 arranged either on the uppermost weight section 81 if such are employed, as shown in Fig. 6, or upon the upper end of the hammer body if no added weight sections are used. The clip is provided on its upper side with a pair of eyes 86 to which the lower end of the outer stretch of the hoisting chain is connected by means of a horizontal bolt 87. A yielding connection between this plate and the hammer body and sections is preferably effected by a plurality of upright bolts 88 arranged in corresponding openings in the body and supplemental sections of the hammer and bearing with their heads against the top of the clip, and springs 89 surrounding the lower ends of these bolts within recesses or pockets 90 in the inner and outer sides of the hammer body and bearing with their upper ends against the tops of these recesses while their lower ends bear against screw nuts 91 arranged at the lower ends of these coupling bolts, as best shown in Figs. 5 and 6. A sudden upward pull of the hoisting chain on the hammer is by this means cushioned and the wear and tear on the machine as well as the noise which would otherwise be produced, is thereby minimized.

The means for guiding the hammer in its vertical movements and the means for lifting the same and controlling its operation are mounted on an upward extension 92 of the main frame which is arranged on the front end thereof and preferably has the form of a tower or derrick and constructed of suitable structural steel of skeleton form similar to that of the main frame. The hammer is guided on the right hand part of this tower, the overhead guide pulley 83 is mounted on the top of this tower above the hammer, and the hoisting drum 84 is mounted on a hoisting shaft 93 journaled horizontally and lengthwise in suitable bearings on the tower about midway of its height.

The means for guiding the hammer in its working movement comprise two upright guide rails or tracks 95, 95, which are preferably of T-shaped form in cross section and which have inwardly-projecting flanges arranged vertically and engaging with upright notches or grooves 96 in the front and rear sides of the hammer body and its added weight sections, as best shown in Figs. 1, 5, 6 and 7.

It has been found in practice that if the guide rails are rigidly mounted on the main frame of the machine, that the latter is jarred or shaken unduly when the knife is driven into the asphalt by the hammer, this being due to the irregularity of the surface

of the pavement, the variation in its texture and also the wedge action of the cutting edge of the knife which operates to force the same laterally as it enters the asphalt. To obviate this objection, the rails are so mounted that the lower ends of the same are capable of moving laterally relatively to the main frame and thereby adapt themselves to any laterally changing position of the knife and hammer as the asphalt is being cut. This is preferably effected by pivotally mounting the upper ends of the hammer tracks or guide rails by means of horizontal longitudinal pivots 97 on the upper part of the right hand side of the tower so that the lower ends of these guide rails can swing in a vertical plane transversely of the machine, this movement of the rails being, however, yieldingly resisted by a tension device which normally holds these rails in a vertical position. In its preferred form this tension device comprises two horizontal tension rods 98 arranged transversely on opposite sides of the hammer and connected at their outer ends with the lower ends of the guide rails while their inner ends pass through openings in an intermediate member 99 of the main frame which member forms an abutment, and two buffer springs 100, 101, applied one to each of the tension rods and bearing with their opposing ends against opposite sides of the abutment 99 while their opposite extremities engage with shoulders 102, 103 on the respective tension rod, as shown in Figs. 6, 7 and 10. The buffer springs 100, 101, are sufficiently stiff to hold the guide rails normally in an upright position so as to properly guide the hammer in its vertical movement, but if the hammer tends to move laterally in one direction or the other as the knife strikes the ground or the pavement, these springs yield the requisite extent in either direction to permit of such lateral movement of the hammer and thereby relieve the remaining parts of the machine of shock and enabling the machine to be operated more efficiently.

Although various means may be employed for alternately connecting the hoisting drum with and disconnecting the same from the driving mechanism for lifting the hammer and then permitting the same to drop, the means which are shown in the drawings are preferred and constructed as follows:

The shaft 93 upon which the hoisting drum is mounted turns continuously in the direction in which the drum turns for winding the hoisting chain thereon when the machine is in operation, this being preferably accomplished by means of a chain belt 104 passing with its lower turn around a driving sprocket pinion 105 mounted on the engine shaft 13 while its upper turn passes around a driven sprocket wheel 106 secured to the hoisting shaft 93, as best shown in Figs. 2, 4, 6 and 7. On its front side the driven sprocket wheel 106 is provided with a clutch disk 107 to which is detachably secured an annular clutch shoe 108 of tapering form in section and adapted to engage with a correspondingly-shaped groove 109 in a clutch disk 110 formed on the hoisting drum. The latter is movable lengthwise together with its clutch disk on the hoisting shaft for the purpose of engaging and disengaging the coöperating groove and shoe of the clutch disks 107, 110. When moving the hoisting drum and clutch disk 110 toward the shoe 108, these parts are coupled and vice versa.

Means are provided whereby when the hammer effects the last part of its downward stroke an automatic coupling of the hoisting drum with the hoisting shaft is effected so that the lifting of the hammer commences immediately after the knife has been driven into the asphalt and when the hammer reaches its highest position, the hoisting clutch is automatically disengaged from the hoisting shaft so as to permit the hammer to again drop by gravity and drive the knife with a powerful blow into the surface of the asphalt pavement below. In its preferred form this automatic coupling and uncoupling mechanism comprises the following elements:

111 represents a hammer-actuated cam sleeve which is rotatably mounted on the hoisting shaft 104 in front of the hoisting drum and provided at its rear end with a straight face which engages through the medium of an interposed thrust bearing 112 with the front end of the hub of the hoisting drum, while its front end is provided with a cam face 113 which engages with a corresponding cam face 114 formed on a sleeve or collar 115 mounted on the hoisting shaft between the cam sleeve 111 and the front bearing of the hoisting shaft, as best shown in Fig. 7. 116 represents an upright shipper rod or bar which is arranged between the front side of the hammer and the adjacent part of the main frame and connected by means of a link 117 with a laterally-projecting arm 118 on the cam-sleeve 111, as shown in Figs. 1, 2, 5, 6, 7 and 12. When this shipper bar is free, the same drops to a limited extent and its weight causes the cam sleeve 111 to be turned so as to produce a wedging effect against the collar or sleeve 115, whereby the hoisting drum and the clutch disk 110 are moved rearwardly sufficiently to cause the groove of this clutch disk to be gripped by the annular shoe 108 of the clutch disk 107 on the driven sprocket wheel. The hoisting drum is coupled with the hoisting shaft and the hammer is lifted by winding the hoisting chain on the hoisting drum. When the hammer has nearly reached its highest po-

sition, its upper side engages with a tappet 119 secured to the upper part of the shipper bar 116 and projecting into the path of the hammer. During this last part of the upward movement of the hammer, while in engagement with this tappet the shipper bar is lifted sufficiently to turn the cam sleeve 111 so that its cam face rides backwardly on the corresponding face of the sleeve 115 and thereby releases the pressure of the disk 110 against the clutch shoes 108 of the hoisting cap, whereby an automatic disconnection of the hoisting drum and hoisting shaft is effected and the hammer is released and permitted to drop so as to expend the full force of its weight for driving the knife into the surface of the asphalt. In order to prevent the clutch surfaces 108, 109 from again reëngaging each other until the hammer reaches the lower part of its stroke, means are provided which operate to hold the shipper bar 116 in its elevated position during this time, which means, as shown in Figs. 5 and 8, preferably comprise a block 120 arranged on the lower part of the rear side of the shipper bar and having a downwardly-facing shoulder 121 adapted to engage over an abutment or upwardly-facing shoulder 122 on the adjacent part of the main frame, and a pressing device which operates to yieldingly move the lower part of this shipper bar rearwardly toward this abutment 122 and preferably consisting of a vertically-swinging presser lever 123 pivoted on the lower part of the main frame and having its rear arm engaging with the front side of this shipper bar while its front arm is connected by means of a spring 124 with the main frame. As this shipper bar is lifted by engagement of the hammer during the last part of its upward stroke against the tappet 119, the inclined upper side 125 of the block 120 engages with the abutment 122 of the main frame and deflects this shipper bar forwardly until the downwardly-facing shoulder 121 of the block on the same passes above the shoulder 122 of the main frame after which this shipper bar is moved rearwardly by means of the spring-pressed lever 123 so that the shoulder 121 of this shipper bar overhangs the shoulder 122 of the main frame, as shown in Fig. 8. When now the hammer drops by reason of the uncoupling of the lifting mechanism from the driving mechanism and the hammer moves away from the underside of the tappet 119, this shipper bar remains in its elevated position and retains the hoisting drum uncoupled from the hoisting shaft so that the chain is free to turn the hoisting drum backwardly and unwind therefrom as the hammer descends.

During the last part of the downward movement of the hammer, the same operates to move this shipper bar laterally in opposition to the pressure lever 123 so as to disengage the downwardly-facing shoulder 121 of this shipper bar from the shoulder 122 of the main frame and permit this bar to drop and again automatically couple the hoisting drum with the hoisting shaft for lifting the hammer preparatory to beginning another cycle of operations. This automatic disengagement of the shipper bar from the main frame through the medium of the hammer is preferably effected by means of a trigger having an upper inclined arm 126 adapted to be arranged in the lower part of the path of the hammer and pivoted at its upper end on the main frame so as to swing above the shoulder 122 of the main frame and provided with a finger 127 which projects forwardly from its lower end and is adapted to engage with the rear side of the shipper bar 116. Assuming that the hammer has been raised to its highest position, the shipper bar in that case will be elevated and its locking block 120 will be engaged with the upper side of the shoulder 122 on the main frame and the finger of the trigger will engage the rear side of the locking block, as shown in Fig. 8, thereby holding the clutch members 107, 110, in an uncoupled position relatively to each other and permitting the hammer to drop. During the last part of the downward movement of the hammer the front side of the same engages with the inclined arm of the trigger and pushes the same forwardly, whereby the finger of the same engages with the locking block 120 and pushes the latter forwardly off the shoulder 122 of the main frame and permits the shipper bar 116 to drop, as shown in Fig. 5, thereby coupling the hammer hoisting mechanism with the engine.

By this means the hammer is successively raised and then permitted to drop without requiring any manipulation on the part of the operator and during this time the attendant also steers the carriage in its forward or backward movement, as the cutting of the asphalt progresses.

In order to permit of taking up the wear between the coöperating surfaces of the clutch disk 110 and the clutch shoes 108, the cam sleeve or collar 115 is capable of rotatable adjustment, for which purpose the same is provided with a laterally-projecting arm 128 the outer end of which is adjustably connected with the adjacent part of the main frame by means of an upright adjusting bar 129 pivoted at its upper end to the rear end of the adjusting arm 128 while its lower end is provided with a clamping bolt 130 passing through a vertical slot 131 in the adjacent part of the main frame. By loosening the clamping bolt 130 and shifting the same in the slot 131, the cam face on the sleeve 115 can be so adjusted that the proper

grip is produced between the clutch members 108, 110, for coupling the hoisting drum and hoisting shaft, and then the adjusting cam sleeve 115 may be retained in this position by tightening the clamping bolt 130.

When the machine is not in use and while being transported from place to place while its cutter mechanism is not working, the hammer is locked in its elevated position so that the knife is held out of contact with the surface of the pavement or the ground. The means for holding the hammer in its elevated position are best shown in Figs. 1, 2, 4, 5, 7, 8, 9 and 11 and are constructed as follows:

132 represents an upright shipper rod or bar arranged between the rear guide rail 95 and the adjacent part of the main frame and adapted to be either locked in its elevated position or permitted to drop into a lowered or depressed position. The lock whereby this shipper bar is held in its elevated position may be variously constructed, but in its preferred form, as shown in Figs. 1, 4, 5, 7 and 9, the same comprises a U-shaped bracket 133 secured to this shipper bar about midway of its height and embracing the adjacent upright member or post 134 of the main frame, a catch 135 pivoted to the rear part of this bracket so as to swing horizontally and passing with its front part through a horizontal slot 136 in the front part of this bracket, and a hook or shoulder 137 arranged on the rear side of the frame post 134 and adapted to coöperate with the catch 135. As shown in Figs. 5 and 9, the shipper bar 132 is elevated and locked in this position by engagement of the catch 135 with the shoulder or hook 137 on the main frame. If it is desired to release the shipper bar and permit the same to drop, the catch together with the bracket and the shipper bar 132 are elevated by hand sufficiently to raise the catch above the lip of the hook and then the catch is moved outwardly sufficiently to clear the lip of this hook, as shown by dotted lines in Fig. 9, after which this shipper bar is free to drop into its lowermost position. This vertical movement of this shipper bar is utilized to operate a clamping device whereby the hoisting drum and its companion clutch member are held against turning. This clamping device in its preferred form comprises a clamping band 138 which encircles a clamping drum 139 on the disk 110 so that upon tightening this band the hoisting drum will be held against turning while upon loosening the same the hoisting drum will be free to turn. The tightening and loosening of this band is effected by means which comprise a rock shaft 140 journaled lengthwise in suitable bearings in the upper part of the main frame and provided with a rock arm 141 which is connected with the free end of the clamping band, the other fixed end of this band being secured to a relatively stationary part of the machine, for instance, by securing the fixed end of the band around the rock shaft 140. Motion is transmitted from the shipper bar 132 to this rock shaft by means of a rock lever 142 secured at one end to the rock shaft 140 and a link 143 connecting the opposite end of this rock lever with the central part of the shipper bar 132, as best shown in Figs. 1, 4, 5 and 11. When this shipper bar is permitted to drop, its weight causes the rock shaft 140 to be turned in the direction for tightening the clamping band on the clamping drum, while upon raising this bar the rock shaft will be turned in the direction for releasing the clamping band from the clamping drum and thereby permit the hoisting drum to turn freely in either direction.

It is desirable to provide means whereby the shipper bar 132 may be dropped at any time during a cycle of operations of the machine, but to prevent holding the hoisting drum against rotation until the hammer has been elevated into its highest position, and to accomplish this automatically so that no further attention is required on the part of the operator. The preferred means for effecting this result are shown in Figs. 1, 2, 5 and 8 and are constructed as follows:

144, 145 represent two sections of a locking or controlling plate which are capable of moving horizontally and lengthwise in guideways on the upper part of the tower of the main frame and connected with each other by means of an intermediate plate section 146 so that they move in unison and in effect form one plate. The front plate section 144 is provided with an opening 147 in which the upper end of the front shipper bar 116 is arranged and the rear section 145 of this plate is provided with an opening 148 which receives the upper end of the rear shipper bar 132. On its front side the front shipper bar 116 is provided adjacent to its upper end with a front shifting block 149 having an inclined upper side 150 and an inclined lower side 151. The rear shipper rod is also provided on its front side adjacent to its upper end with a rear shifting block 152 having an inclined upper side 153 and a downwardly-facing abrupt lower side 154 and on its rear side at a point below the rear shifting block 152 the rear shipper bar is provided with a double-cam block 155 having a rounded or cam-shaped surface.

If the operator removes the catch 135 of the rear shipper bar from the main frame while the hammer is in its lower position, this bar will be prevented from dropping sufficiently to cause the hoisting drum to be held against turning by the clamping band and drum, because at this time the two sections of the locking plate are moved rear-

wardly by engagement of the cam block 155 with the rear end of the opening 148 during the first part of the downward movement of the rear shipper bar, whereby the lower or abrupt face of the rear shifting block 152 on the rear shipper bar will engage with the upper side of the plate section 145 in front of its opening 148, and thereby hold the rear shipper bar in a sufficiently elevated position to prevent the clamping band 138 from gripping the clamping drum 139. As the hammer during the last part of its upward movement lifts the front shipper bar 116, the inclined upper side of the shifting block 149 on this bar engages with the front end of the opening 147 in the plate section 144 and shifts the plate sections 144, 145, 146, forwardly, thereby releasing the rear plate section from the underside or the abrupt face of the shifting block 152 of the rear shipper bar and permitting the latter to drop to its full extent, as shown in Fig. 8, so that the clamping band 138 and clamping drum 139 become effective and hold the hoisting drum against turning when the hammer is in its elevated position.

When it is desired to again put the cutter mechanism in working condition, the operator raises the rear shipper bar 132 and then locks the same in this position by engaging the catch 135 with the shoulder 137 on the frame, whereby the clamping band 138 and drum 139 are disengaged and the hoisting drum is free to turn for operating the hammer. During this upward movement of the rear shipper rod its upper shifting block 152 by engaging the front end of the opening 148 moves the locking plate sections forwardly and immediately thereafter the cam block 155 engages with the rear end of this opening 148 and shifts the locking plate backwardly into the path of the abrupt lower shoulder on the shifting block 152, as shown in Fig. 5. During the next following upward stroke of the hammer and the corresponding movement of the front shipper bar the inclined upper side of the front shifting block 149 engages with the front end of the opening 147 and moves the locking plate forwardly so that the rear section of the same clears the path of the shifting block 152 but stands in the path of the cam block 155, thereby restoring the parts to their normal positions which they occupy when the cutter mechanism is in operation.

In order to prevent the shipper bars from descending too far and hold the same in their elevated position, particularly when assembling the machine, the upper ends of both these bars are provided with stop pins 156 which are adapted to engage with the upper sides of the controlling plates 144 and 145.

This machine is very compact in construction, it can be very easily and quickly controlled and permits of rapidly cutting asphalt either along straight lines or irregular lines so that repairing of a pavement in patches or the lifting of strips of pavement preparatory to excavating trenches can be done at very low cost.

I claim as my invention:

1. An asphalt cutter comprising a carriage provided with an upright guideway, a hammer slidable vertically on said guideway and provided with a knife, a hoisting shaft journaled on said carriage, a prime mover mounted on said carriage and operatively connected with said shaft shaft, a hoisting drum mounted on said shaft, a hoisting line connecting said drum with said hammer, a clutch adapted to connect and disconnect said hoisting drum and shaft, means coupling and uncoupling said clutch by motion derived from said hammer, comprising a vertically movable shipper bar provided with a tappet adapted to be engaged by said hammer during the last part of its upward movement for raising said shipper bar and also provided with a shoulder adapted in its elevated position to engage a shoulder on said carriage and hold said bar in its elevated position, a trigger mounted on the carriage in position to be engaged by the hammer during the last part of its downward stroke and adapted to shift said bar for disengaging its shoulder from that of the carriage, and means for transmitting the motion of said bar to said clutch.

2. An asphalt cutter comprising a carriage provided with an upright guideway, a hammer slidable vertically on said guideway and provided with a knife, a hoisting shaft journaled on said carriage, a prime mover mounted on said carriage and operatively connected with said shaft, a hoisting drum mounted on said shaft, a hoisting line connecting said drum with said hammer, a clutch adapted to connect and disconnect said hoisting drum and shaft, means coupling and uncoupling said clutch by motion derived from said hammer, comprising a vertically movable shipper bar provided with a tappet adapted to be engaged by said hammer during the last part of its upward movement for raising said shipper bar and also provided with a shoulder adapted in its elevated position to engage a shoulder on said carriage and hold said bar in its elevated position, a trigger mounted on the carriage in position to be engaged by the hammer during the last part of its downward stroke and adapted to shift said bar for disengaging its shoulder from that of the carriage, means for transmitting the motion of said bar to said clutch, and yielding means for shifting said bar in a direction for holding its shoulder in engagement with said shoulder on the carriage.

3. An asphalt cutter comprising a carriage provided with an upright guideway, a hammer movable vertically on said guideway and comprising a body having a laterally-facing seat, a clamping plate arranged opposite said seat, bolts connecting said plate and hammer, and a knife provided with a shank which is gripped between said plate and said seat.

4. An asphalt cutter comprising a carriage having a frame, an upright track mounted on said frame so as to be capable of lateral movement, means for yieldingly holding said track in its normal position, a hammer movable vertically on said track, and a knife mounted on said hammer.

5. An asphalt cutter comprising a carriage having a frame, an upright track pivotally connected at its upper end with said frame and capable of moving laterally at its lower end, a hammer movable vertically on said track, and a knife mounted on said hammer.

6. An asphalt cutter comprising a carriage having a frame, an upright track pivotally connected at its upper end with said frame and capable of moving laterally at its lower end, means for yieldingly resisting lateral movement of the lower end of said track, a hammer movable vertically on said track, and a knife mounted on said hammer.

7. An asphalt cutter comprising a carriage having a frame, an upright track pivotally connected at its upper end with said frame and capable of moving laterally at its lower end, means for yieldingly resisting lateral movement of the lower end of said track comprising a tension rod connected with the lower part of said track and passing through a member of the main frame, and springs mounted on said rod and engaging their opposing ends with opposite sides of said frame members while their opposite extremities engage with shoulders on said rod, a hammer movable vertically on said track, and a knife mounted on said hammer.

8. An asphalt cutter comprising a carriage, an upright track on said carriage, a hammer movable vertically on said track, a knife mounted on said hammer, means for moving said hammer vertically, comprising a hoisting drum and line connecting said drum and hammer, means for holding said hammer in its elevated position comprising a clamping drum connected with the hoisting drum, a clamping band adapted to engage said clamping drum, a rock shaft provided with a rock arm, one end of said clamping band being connected with said arm and the other end with a relatively fixed part on the carriage, means for rocking said shaft comprising a vertically movable shipper bar, a lever connected with said rock shaft, and a link connecting said bar and lever.

9. An asphalt cutter comprising a carriage, an upright track on said carriage, a hammer movable vertically on said track, a knife mounted on said hammer, means for moving said hammer vertically, comprising a hoisting drum and line connecting said drum and hammer, means for holding said hammer in its elevated position comprising a clamping drum connected with the hoisting drum, a clamping band adapted to engage said clamping drum, a rock shaft provided with a rock arm, one end of said clamping band being connected with said arm and the other end with a relatively fixed part on the carriage, means for rocking said shaft comprising a vertically movable shipper bar operatively connected with said rock shaft, and a detent device for holding said bar in its elevated position.

10. An asphalt cutter comprising a carriage, an upright track on said carriage, a hammer movable vertically on said track, a knife mounted on said hammer, means for moving said hammer vertically, comprising a hoisting drum and line connecting said drum and hammer, means for holding said hammer in its elevated position comprising a clamping drum connected with the hoisting drum, a clamping band adapted to engage said clamping drum, a rock shaft provided with a rock arm, one end of said clamping band being connected with said arm and the other end with a relatively fixed part on the carriage, means for rocking said shaft comprising a vertically movable shipper bar operatively connected with said rock shaft, and a detent device for holding said bar in its elevated position and comprising a bracket mounted on said carriage and embracing an adjacent upright member of the carriage, a shoulder arranged on said member, and a horizontally-swinging catch pivoted on one end of said bracket and guided on the other end of the same and movable into and out of engagement with said shoulder.

11. An asphalt cutter comprising a carriage, an upright track on said carriage, a hammer movable vertically on said track, a knife mounted on said hammer, means for elevating said hammer, coupling means controlled by the movement of the hammer for automatically rendering said elevating means operative during the last part of the downward movement of said hammer and inoperative during the last part of the upward movement of said hammer, and detent means for holding said hammer in its elevated position and operatively related to said coupling means so as to become effective only during the last part of the upward movement of said hammer.

12. An asphalt cutter comprising a carriage, an upright track on said carriage, a hammer movable vertically on said track, a

knife mounted on said hammer, means for elevating said hammer, coupling means controlled by the movement of the hammer for automatically rendering said elevating means operative during the last part of the downward movement of said hammer and inoperative during the last part of the upward movement of said hammer comprising a vertically movable coupling shipper bar which is adapted to be raised by said hammer during the last part of its upward stroke, detent means for holding said hammer in an elevated position comprising a vertically movable detent shipper bar and a catch for holding said detent shipper bar in its elevated inoperative position, and controlling means for rendering said detent means operative only during the last part of the upward movement of said hammer.

13. An asphalt cutter comprising a carriage, an upright track on said carriage, a hammer movable vertically on said track, a knife mounted on said hammer, means for elevating said hammer, coupling means controlled by the movement of the hammer for automatically rendering said elevating means operative during the last part of the downward movement of said hammer and inoperative during the last part of the upward movement of said hammer comprising a vertically movable coupling shipper bar which is adapted to be raised by said hammer during the last part of its upward stroke, detent means for holding said hammer in an elevated position comprising a vertically movable detent shipper bar and a catch for holding said detent shipper bar in its elevated inoperative position, and controlling means for rendering said detent means operative only during the last part of the upward movement of said hammer comprising a horizontally-movable locking plate provided with two openings which receive said shipper bars, shifting blocks arranged on the corresponding sides of said shipper bars, the block on the coupling shipper bar having an upper inclined face adapted to move said controlling plate in one direction and the shifting block on the detent shipper bar having an upper inclined face adapted to shift said controlling plate in the same direction and having an abrupt lower face adapted to engage the top of said plate and hold this bar in its elevated position, and a double cam block arranged on the opposite side of said detent shipper bar and adapted to shift said locking plate in the opposite direction.

14. An asphalt cutter comprising a carriage provided with traction wheels, a knife mounted on said carriage and movable toward and from the surface to be cut, a prime mover arranged on the carriage, and two transmission systems for conveying power from said prime mover to said traction wheels, one of said systems being comparatively low geared and the other relatively high geared.

15. An asphalt cutter comprising a carriage provided with traction wheels, a knife mounted on said carriage and movable toward and from the surface to be cut, a prime mover arranged on the carriage, and two transmission systems for conveying power from said prime mover to said traction wheels, one of said systems being comparatively low geared and the other relatively high geared, each of said transmissions containing a clutch whereby the same may be rendered operative and inoperative, and also a speed changing and reversing gearing.

16. An asphalt cutter comprising a carriage provided with traction wheels, a vertically movable knife mounted on said carriage and adapted to engage the surface to be cut, a prime mover mounted on the carriage, and power transmission means interposed between said prime mover and said traction wheels and containing a speed changing mechanism which comprises a forward clamping drum, a forward clamping band engaging said forward drum, a rear clamping drum, a rear clamping band engaging said rear drum, two shifting rods each capable of longitudinal and rotary motion, each of said rods being provided with a movable abutment and each of said clamping bands having one of its ends engaging the movable abutment on one of said rods while its opposite end engages a relatively fixed abutment, springs arranged to spread the ends of the clamping bands, respectively, means for causing said rods to rock in unison in the same direction, and means for causing each of said rods to move lengthwise independently of each other.

17. An asphalt cutter comprising a carriage provided with traction wheels, a vertically movable knife mounted on said carriage and adapted to engage the surface to be cut, a prime mover mounted on the carriage, and power transmission means interposed between said prime mover and said traction wheels and containing a speed changing mechanism which comprises a forward clamping drum, a forward clamping band engaging said forward drum, a rear clamping drum, a rear clamping band engaging said rear drum, two shifting rods each capable of longitudinal and rotary motion, each of said rods being provided with a movable abutment and each of said clamping bands having one of its ends engaging the movable abutment on one of said rods while its opposite end engages a relatively fixed abutment, springs arranged to spread the ends of the clamping bands, respec-

tively, means for causing said rods to rock in unison in the same direction comprising a rock lever, rock arms arranged on said rods and links connecting said lever and arms, and means for causing said rods to move lengthwise independently of each other comprising fixed cams arranged on the carriage and rotatable cams mounted on said rods and engaging the fixed cams, the coöperating faces of one pair of cams being arranged reversely to the coöperating faces of the other pair of cams.

FRANK V. E. BARDOL.