Sept. 15, 1936. H. E. McCRERY 2,054,263

PAVEMENT FINISHING MACHINE

Filed Dec. 22, 1933 7 Sheets-Sheet 1

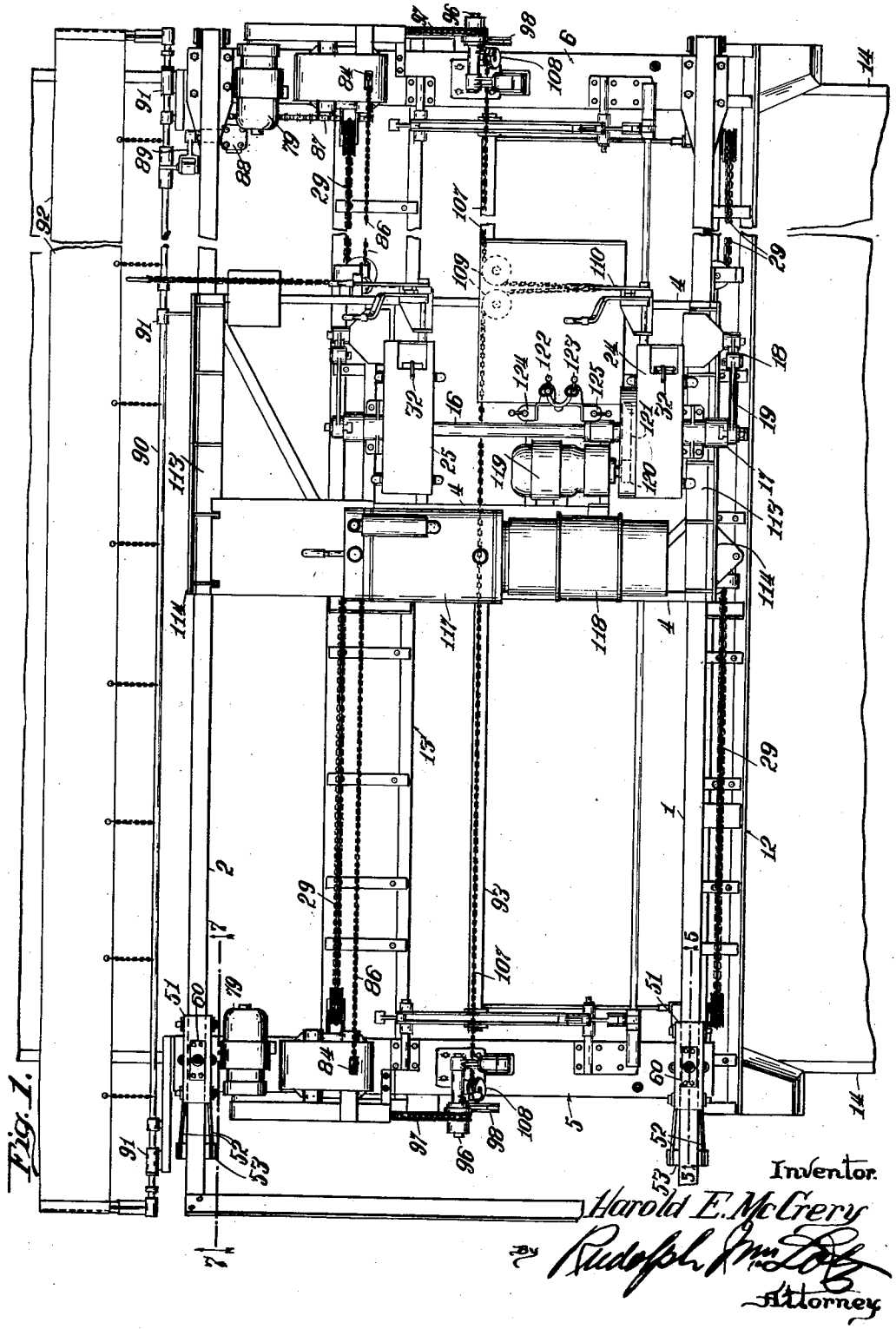


Fig. 1.

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Sept. 15, 1936. H. E. McCRERY 2,054,263

PAVEMENT FINISHING MACHINE

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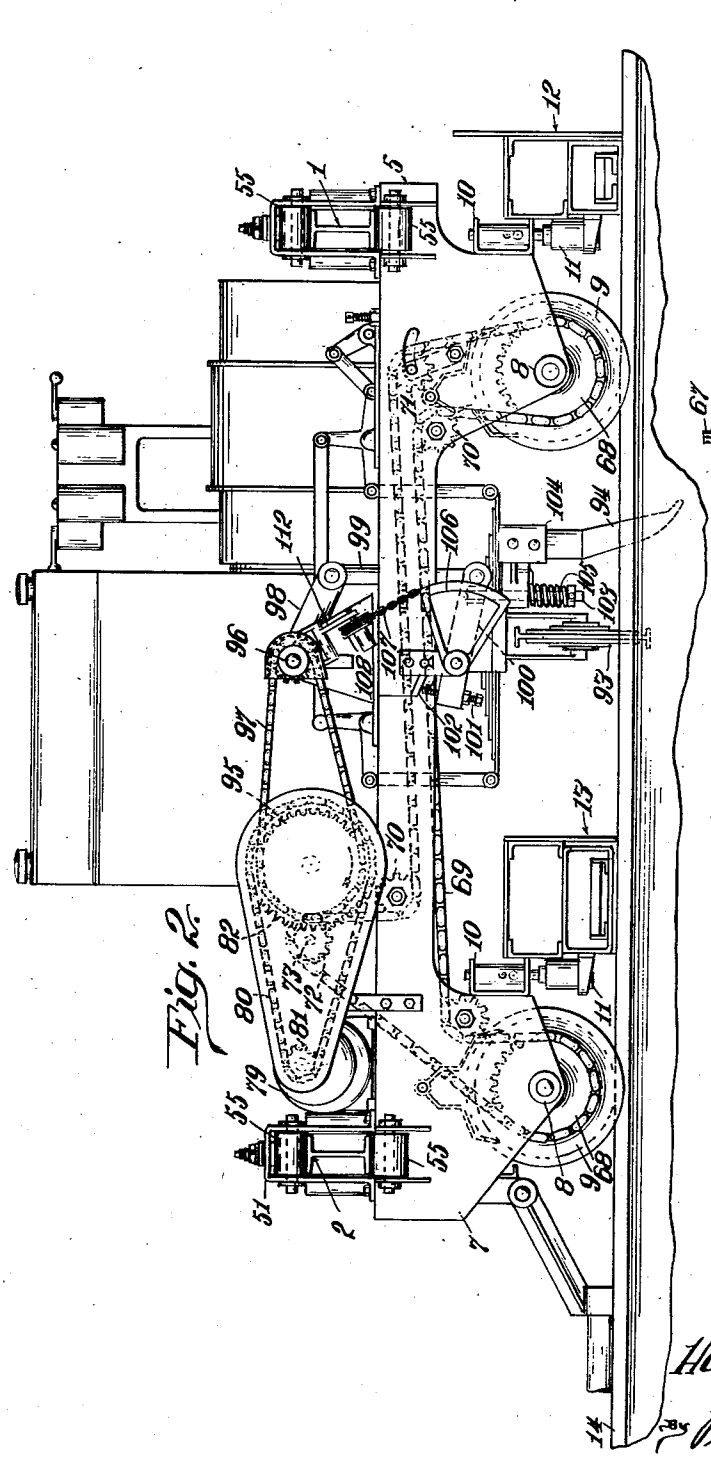


Fig. 2.

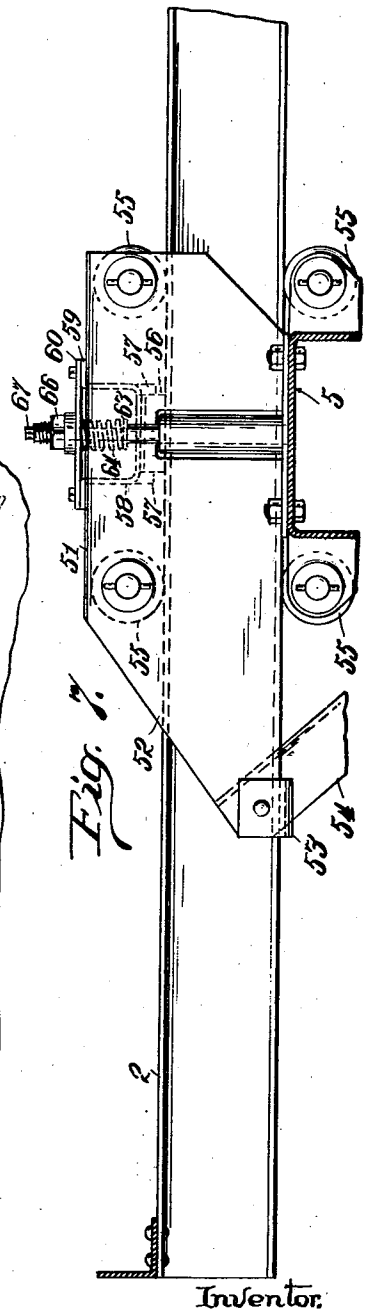


Fig. 1.

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PAVEMENT FINISHING MACHINE

Filed Dec. 22, 1933 7 Sheets-Sheet 3

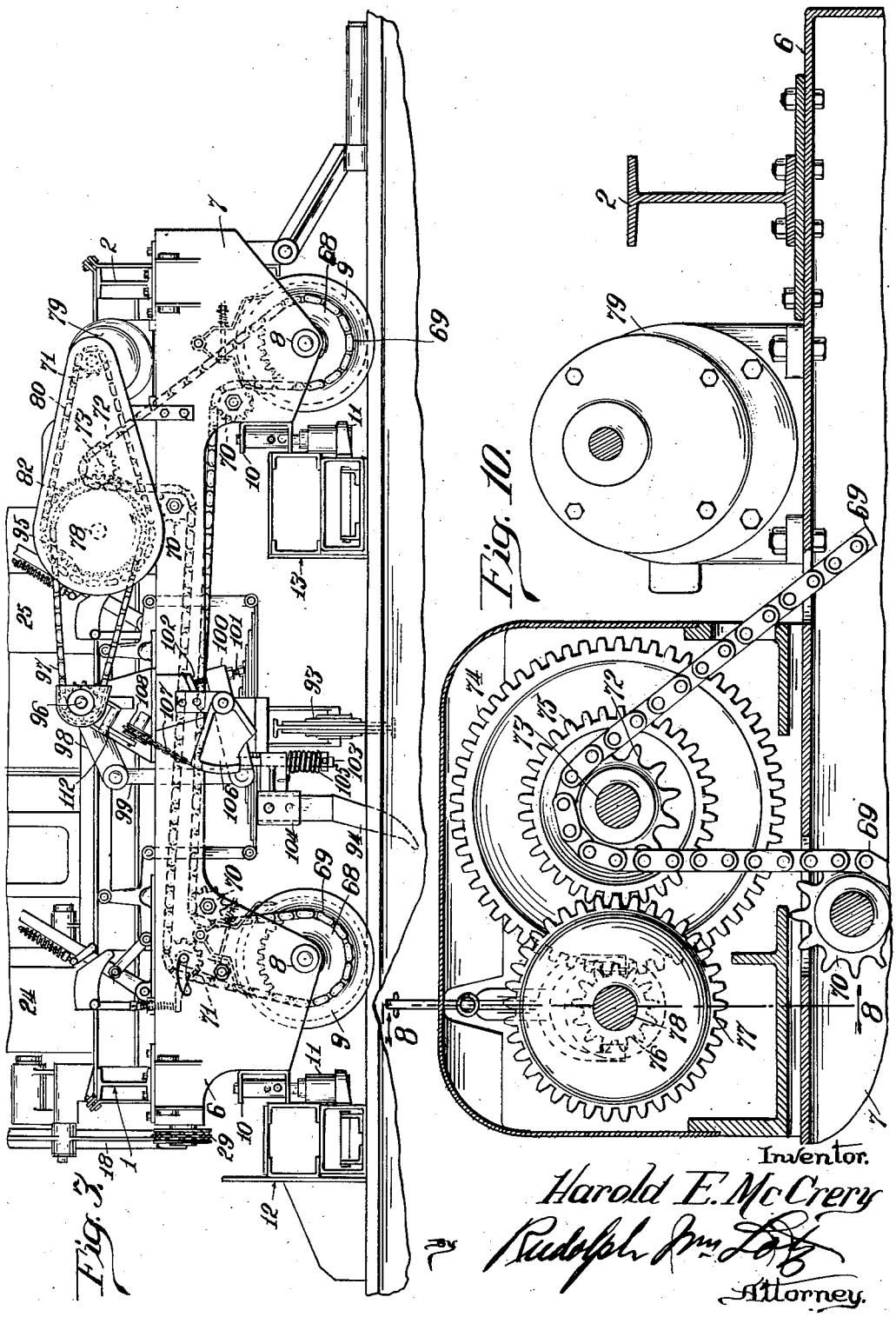


Fig. 9.

Fig. 10.

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Sept. 15, 1936. H. E. McCRERY 2,054,263

PAVEMENT FINISHING MACHINE

Filed Dec. 22, 1933 7 Sheets-Sheet 4

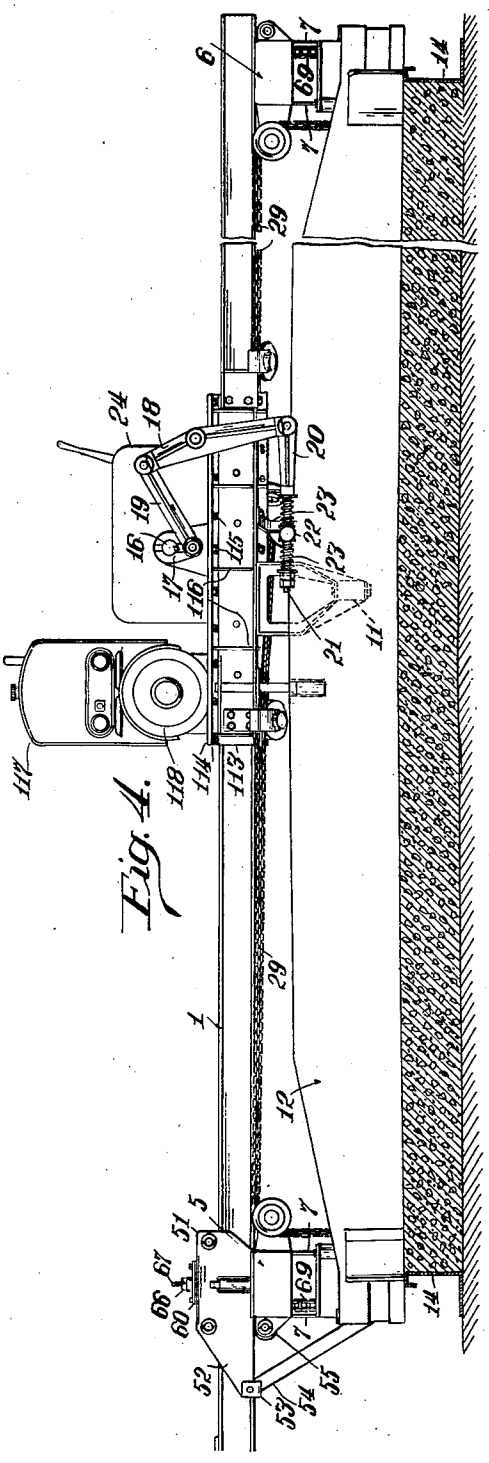


Fig. 4.

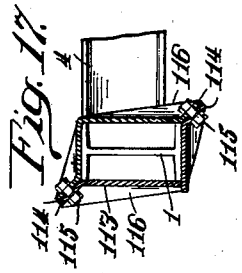


Fig. 17.

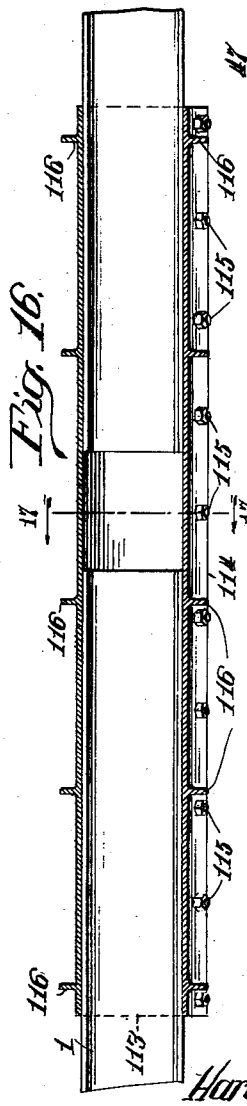


Fig. 16.

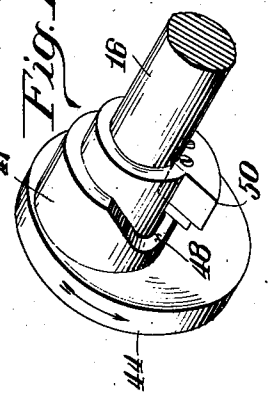


Fig. 15.

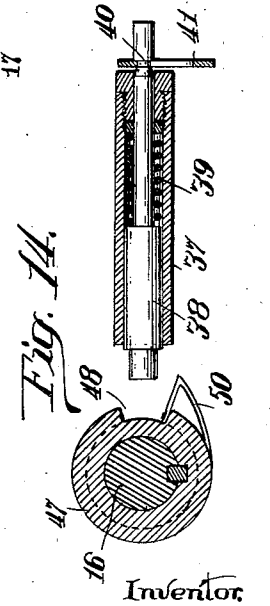


Fig. 14.

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Sept. 15, 1936. H. E. McCRERY 2,054,263

PAVEMENT FINISHING MACHINE

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Fig. 5.

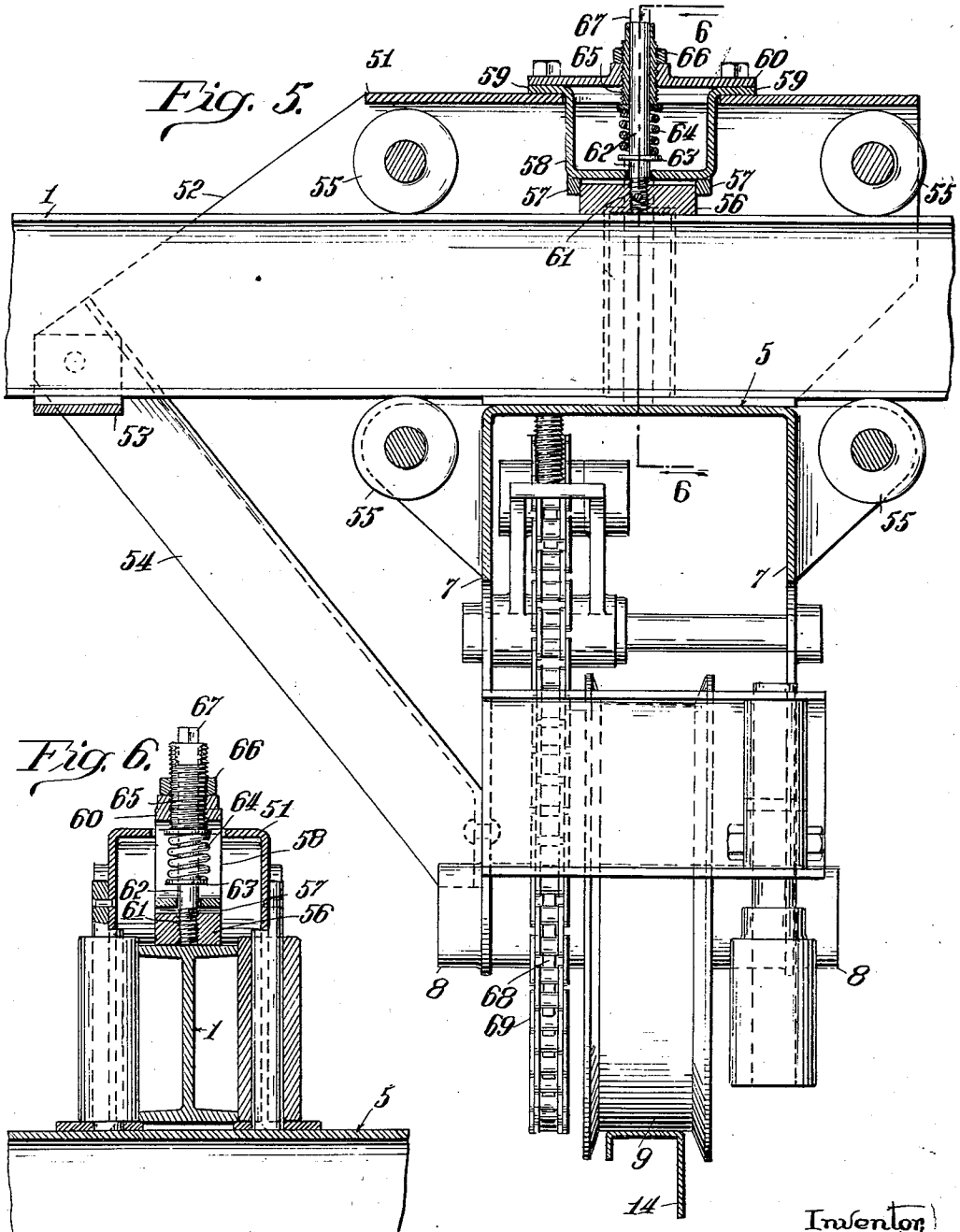


Fig. 6.

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PAVEMENT FINISHING MACHINE

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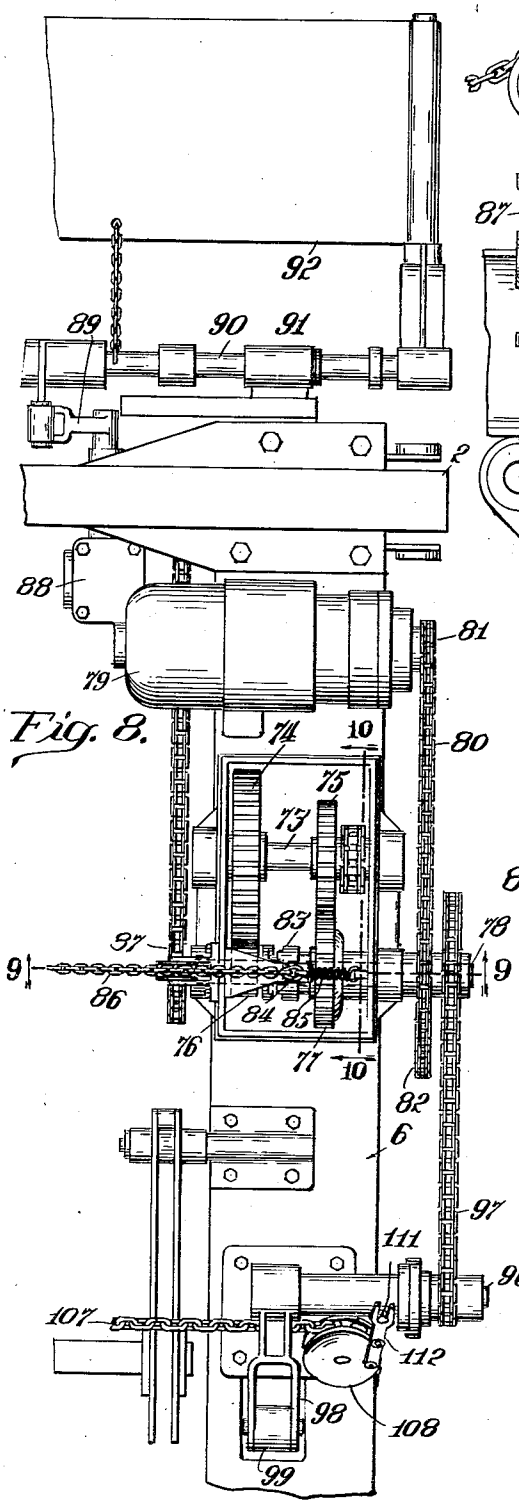


Fig. 8.

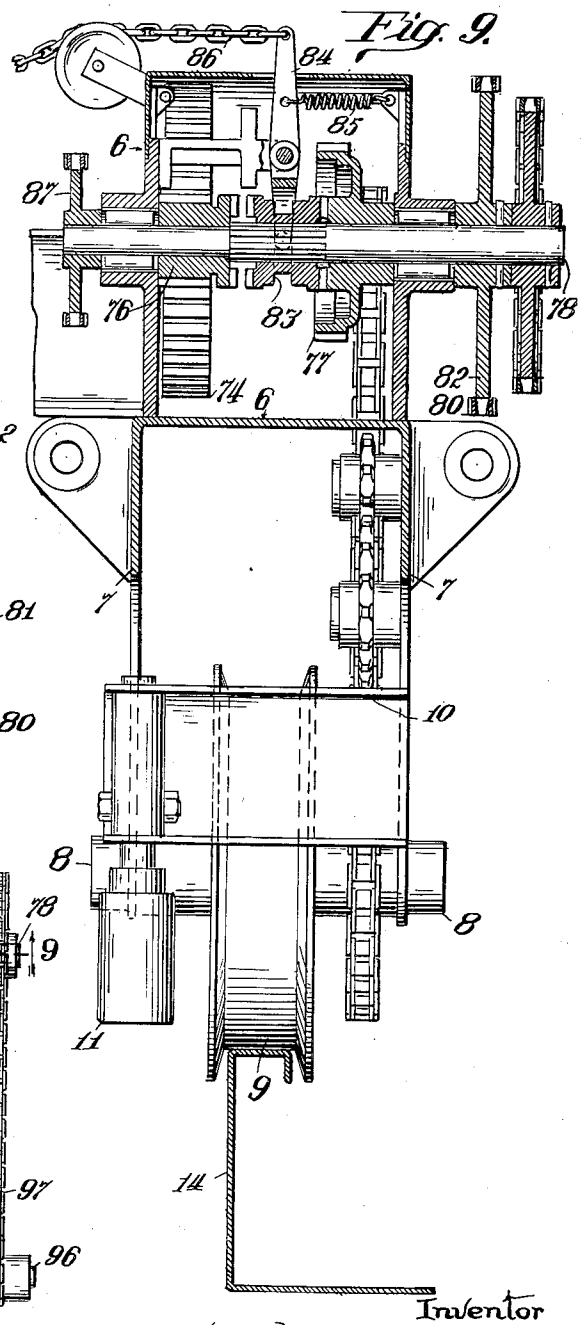


Fig. 9.

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PAVEMENT FINISHING MACHINE

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Fig. 11.

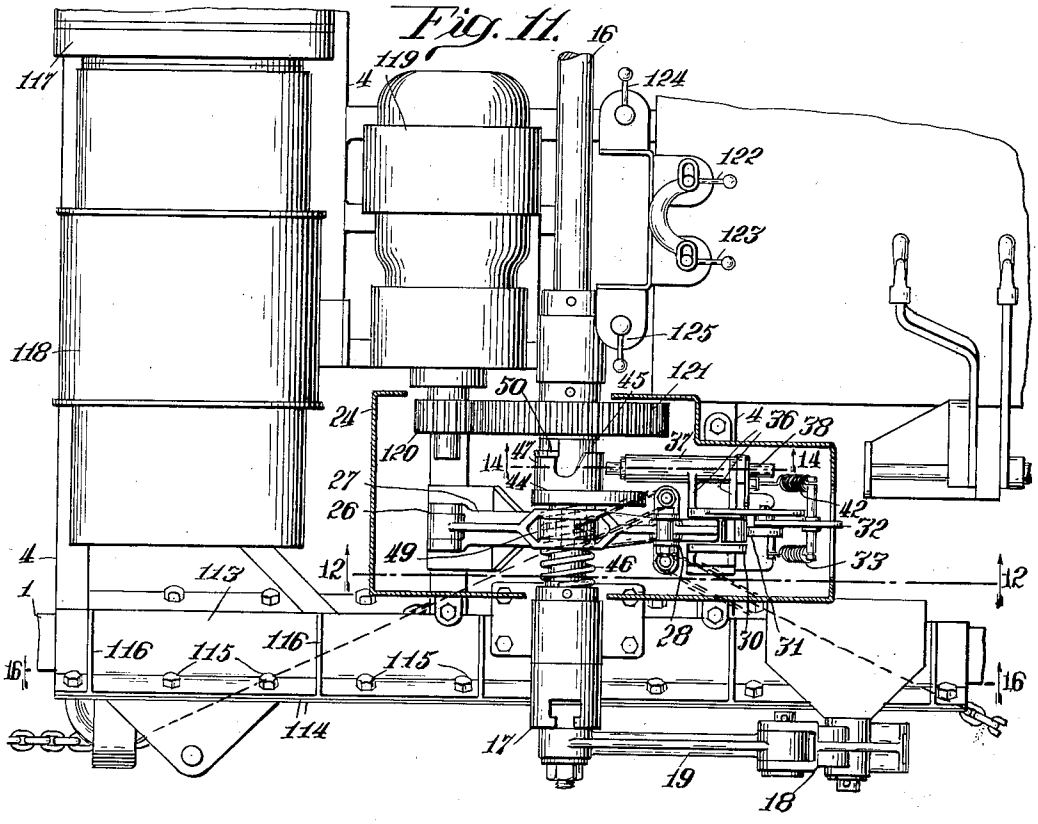


Fig. 12.

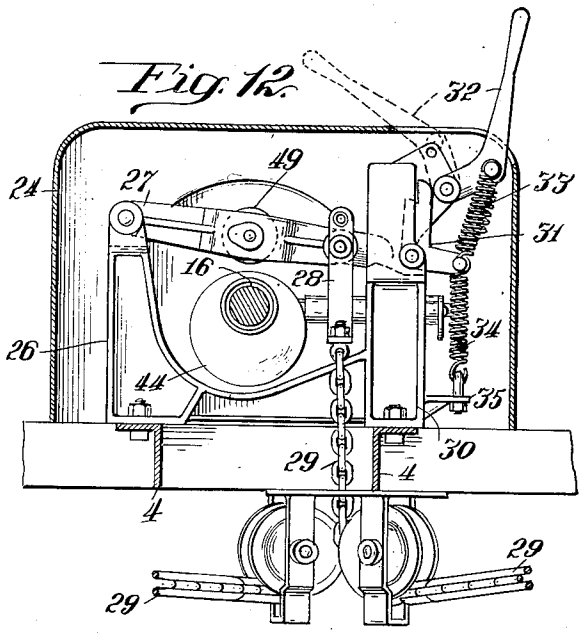
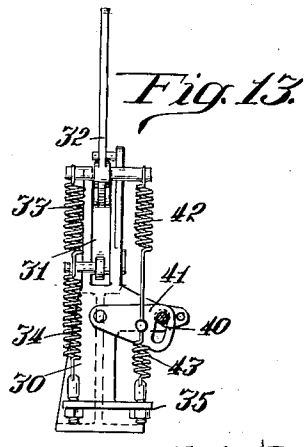


Fig. 13.



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Patented Sept. 15, 1936 2,054,263

UNITED STATES PATENT OFFICE

2,054,263

PAVEMENT FINISHING MACHINE

Harold E. McCrery, Aspinwall, Pa., assignor to Blaw-Knox Company, Pittsburgh, Pa., a corporation of New Jersey

Application December 22, 1933, Serial No. 703,569

20 Claims. (Cl. 94—45)

The present invention relates to improvements in machines for finishing pavements composed of initially plastic materials such as Portland cement concrete and bituminous concrete and has for its general object to provide a machine of this type which presents important advantages over machines commonly used as will be pointed out more particularly hereinafter.

The machines adapted for pavement finishing that are now used almost universally in the United States are propelled and actuated by an internal combustion engine geared to the traction wheels by suitable gearing and clutch mechanisms to permit the same to be caused to travel forward at any selected one of several speeds and to be caused also to travel reversely.

The engine also is geared to so-called screeds and in many instances, a tamping device. The screeds rest at their end portions on the side forms or rails between which the plastic material is poured, and are reciprocated transversely of the pavement strip during forward travel of the machine. The tamping device, when used, is reciprocated vertically and it also spans the pavement strip between the side forms.

During reverse travel of the machine, the screeds, and also the tamper, are elevated and maintained out of operative relation to the plastic pavement strip.

The customary practice is to have the finishing machine operate immediately behind the concrete mixer which dumps the plastic concrete upon the pavement strip between the side forms to a height or level greater than the crowns of the side forms. The finishing machine moves forward at proper intervals to strike off and move forward the excess concrete to the desired contour or crown of the finished pavement and, at the same time, it acts to compact the concrete mass over which it passes and also to draw to the surface a layer or film of cement mortar.

Deposits of fresh concrete effected by the mixer are spread in part by the bucket of the latter and in part by hand prior to first passage of the finisher over said concrete. This initial spreading leaves high and low areas and the first passage of the machine over the freshly deposited concrete leaves low and rough spots or areas. Therefore, it is necessary that the machine shall pass repeatedly over each new area of concrete deposit and as the newly treated surface is exposed to view of the men spreading the freshly deposited concrete, as the travel of the machine is reversed, concrete is projected by hand shovels upon the low and rough spots or areas and thereupon the finishing machine moves forward again to effect further striking off, smoothing and compacting of the concrete.

Thus the finishing machine must be caused to travel short distances forward and back at very frequent intervals and prior to each backward travel, the screeds and tamper must be elevated and likewise prior to each interval of forward travel, the screeds and tamper must be lowered into operative positions.

During initial forward travel of the finishing machine over a freshly deposited mass of concrete, the excess of the latter accumulates sometimes to a height of eight to eighteen inches in front of the front screed and is moved forward by the latter. As this accumulation is not uniform and is frequently greater at one side of the pavement strip, the machine is apt to become displaced or canted on the side forms due to the greater resistance to traction at one side of the machine. When this occurs, the position of the machine must be restored to the normal. Also, in rounding curves, the traction wheels at one side of the machine must rotate faster than those at the opposite side and in the forward and back travel, it becomes desirable that these relative speeds of rotation shall be controllable easily and quickly to keep pace with other paving operations.

The shorter radius curves of a modern paved highway are banked and gradually widened to the middle of the curve and this requires that the machine accommodate itself also to the varying widths of the pavement strip and that it shall be easily adjusted to produce variations in crown of the pavements, the latter being usually devoid of crown along banked curves.

From the foregoing it will be apparent that an efficient pavement finishing machine is one that is capable of meeting every requirement and condition of use with minimum loss of time.

In the machines now commonly used, the gear trains and clutch mechanisms necessary to the manipulations of the machine are not well adapted to effecting quick changes in direction of travel of the machine and do not provide for the different speeds of travel of opposite sides of the machine, to keep pace with other paving operations, the mechanisms of the present machines are subjected to jerks and shocks that cause breakages and heavy wear on the component parts of the same, as well as the frames, which are required to be very rigid and heavy to withstand the stresses to which they are subjected.

The present invention has for its several objects

to overcome the defects and disadvantages incident to the machines now commonly used and to provide a machine which is lighter, more flexible, more easily handled with respect to transportation from one job to another, is devoid of many of the gear trains and clutch mechanisms referred to and is far more easily and quickly responsive to manipulations without being subject to breakages or disrepair to more than a negligible extent as compared to the machines now generally used.

The several specific objects of the machine are as follows:

1. To provide a machine of the kind specified, wherein the traction wheels at opposite sides of the machine are driven at all times independently of each other and are independently controlled by the operator to vary their respective speeds and direction of travel.

2. To provide a machine of the type specified, wherein the concrete manipulating screeds are raised and lowered by power actuated mechanisms.

3. To provide a machine of the type specified, which will widen and narrow itself in travel over widened curves of a pavement strip smoothly and easily and without subjecting the side forms to appreciable lateral stresses.

4. To provide a machine of the type specified, which is easily operated and controlled by one person stationed upon a given part of the machine without requiring change of position of that person except when required to effect adjustments necessary to adapt the same for travel over widened curves and banked curves.

5. To provide a machine of the type specified, which is easily and quickly adjustable to meet the requirements of travel over and manipulation of the concrete within widened and banked curve portions of a pavement strip.

6. To provide a machine of the type specified, which may be widened to an appreciable extent to adapt the same for finishing pavement strips of different widths.

7. To provide a machine of the type specified, which weighs appreciably less than the machines now commonly used without sacrifice of necessary strength and enabling the same to be transported more easily from one job to another, also to be more easily mounted in place on the side-forms of the pavement strip to be finished, and which may be more easily raised for the purpose of changing traction wheels preparatory to rounding curves.

Other objects of the invention will be understood from or specifically set forth in the following specification.

A suitable embodiment of the invention is illustrated in the accompanying drawings, wherein:

Fig. 1 is a plan view of a machine constructed in accordance with the invention.

Figs. 2 and 3 are side elevations of the same.

Fig. 4 is a front elevation of the same.

Fig. 5 is a vertical, transverse sectional view on an enlarged scale on the line 5—5 of Fig. 1.

Fig. 6 is a detail, fragmentary section on the line 6—6 of Fig. 5.

Fig. 7 is a fragmentary vertical transverse, sectional view on the line 7—7 of Fig. 1.

Fig. 8 is a fragmentary plan view on an enlarged scale of one of the trucks of the machine.

Fig. 9 is a vertical sectional view on the line 9—9 of Fig. 8.

Fig. 10 is a fragmentary detail, vertical section on an enlarged scale on the line 10—10 of Fig. 8.

Fig. 11 is a fragmentary plan view, the casing in plan section on an enlarged scale, showing the screed lifting mechanism and adjacent parts of the machine.

Fig. 12 is a vertical, transverse, sectional view on the line 12—12 of Fig. 11, showing the screed lifting mechanism in elevation.

Fig. 13 is an end elevation of the screed lifting mechanism showing the means for maintaining the mechanism out of operation.

Fig. 14 is a detail vertical, sectional view on the line 14—14 of Fig. 11.

Fig. 15 is a perspective view of the lifting cam and the throw-out cam of the screed lifting mechanism.

Fig. 16 is a fragmentary, vertical, transverse, sectional view on the line 16—16 of Fig. 11, showing the means for widening the machine frame.

Fig. 17 is a detail vertical transverse, sectional view on the line 17—17 of Fig. 16.

Referring first to Figs. 1, 2 and 3, it will be noted that the body of the machine comprises a frame composed of conventional structural steel units such as I-beams, channel bars and the like, the main frame members being those indicated by the reference numerals 1, 2 and 3, which are parallel with each other and extend transversely of the end or truck members and include cross members 4. The members 1, 2 and 3 are supported upon the truck members 5 and 6. Preferably, one of the truck members is rigidly secured to the first mentioned frame members, and, in the instance illustrated, this is true of the member 6, the member 5 being movable longitudinally of the frame members as hereinafter described.

Each truck member includes a pair of parallel downwardly projecting steel plates, 7, having downwardly projecting end portions equipped with bearings, 8, for the trunnions of the traction wheels, 9. These end portions of the plates, 7, are flexible and this flexibility is of appreciable importance for reasons hereinafter pointed out.

Suitably mounted upon the inner plate, 7, of each truck at the forward edge-portions of the downwardly extending end portions thereof, are brackets, 10, in which anti-friction rollers, 11, are mounted for rotation on vertical axes, as shown in Figs. 2 and 3. The end portions of the rear faces of the screeds, 12 and 13, bear against the rollers 11, as said screeds are pushed forward during forward travel of the machine. The said screeds are reciprocated transversely of the pavement strip and are supported at their end portions upon the side forms, 14, bordering the pavement strip and serve to strike off, compact and smooth the plastic paving material deposited between the side forms as particularly described in the Letters Patent to William Ord, No. 1,522,138, dated January 6, 1925.

The screeds 12 and 13 are very heavy, and in the operation of the machine they are elevated to a height of several inches above the level of the paving material over which they have passed before the travel of the machine may be reversed. This reverse travel occurs very frequently over a distance of six to fifteen feet, more or less, for the purpose of causing said screeds to function several times over the same area. During reverse travel, the hollows and rough spots or areas occurring in the surface of the paving material previously subjected to the action of the screeds, are filled in by hand-shoveling and further passages of the screeds over the said surface following the fill-in work, forces the additional material into the hollows and strikes off surplusage

and thus a smooth surfaced mass of substantially uniform density results from repeated passages of the screeds over successive areas.

Preceeding each interval of forward travel of the machine for the purpose above set forth, the screeds 12 and 13 must be lowered to rest again upon the side-forms and because of their weight, this lowering must be effected gradually to prevent the side forms from being injured or sunk into the earth.

In the machines now commonly used, the screeds are raised and lowered by manual labor, each, independently of the other, and this operation is slow and requires the operator to move from one part of the machine to another to perform the several operations necessary to its functioning, and thus, these machines cause other operations to slow up.

The concrete mixing machine or equivalent means for effecting deposit of concrete upon the pavement strip, sets the pace for all other operations and, accordingly, the finishing machine following immediately behind the mixer, is one of the units that is most apt to slow up operations.

Hence, the object of the invention which relates to power lifting and lowering of the screeds, is directed less particularly to the substitution of power for hand-labor, than to the speeding up of finishing machine operation and includes also, such an application of said power as will cause the screeds to be lowered so gradually as to prevent shock upon the side-forms and upon the concrete underneath the falling screed.

In the instance illustrated, the screeds 12 and 13 are reciprocated by means of the mechanism clearly illustrated in Figs. 4 and 11, which comprises the shaft 16, a crank, 17, at one end of said shaft, the rocking lever, 18, pivotally secured to the machine frame between its ends, and connecting rods 19 and 20, one of which connects one end of the lever 18, to the crank 17, and the other of which connects the other end of lever, 18, with a rod or plunger 21, extending through a bearing 22, mounted upon the top of the screed. Springs 23 are interposed between the bearing 22 and collars at the ends of the rod 21 and constitute cushions for easing the beginning of each stroke of the screed.

One of these mechanisms is disposed at each end of the shaft 16, and the arrangement of said mechanisms is such that the screeds 12 and 13 always move in opposite directions with respect to each other.

Disposed in each of the respective casings, 24 and 25, (Fig. 1) is a screed lifting and lowering mechanism, shown in detail in Figs. 11, 12 and 13. Each of these mechanisms includes a post 25, and an arm 27 pivotally secured at one end to the upper end of said post, a link 28 pivotally secured to the arm 27 between the ends of the latter; chains 28 secured at one end to the link 28 and at their other ends to opposite end portions of the screed 12, said chains being trained over suitably located sheaves on the machine frame, the arrangement being such that when the arm 27 is disposed in the position shown in Fig. 12, the slack in the chains 29 is sufficient to permit reciprocation of the screed 12 without interference by said chains.

An inverted U-shaped post 30 is disposed to receive and guide the free end portion of the arm 27, and is equipped with a latch member or trip lever in the form of a bell-crank lever, 31, which is secured pivotally at its elbow to the post 30. The last mentioned end of the arm 27 and the upper end of the upright arm of the lever 31, are provided with inter-engageable formations causing the arm 27 to be supported upon the lever 31 as hereinafter described.

A second L-shaped lever, 32, is secured pivotally to the upper end portion of post 31 and at its elbow portion is secured to one end of a tension spring 33 which, at its other end, is secured to the other arm of the lever 31. The lever 32 projects through a slot in the casing 24 and when thrown over to the position shown in dotted lines in Fig. 12, rests along its outer end upon the top of the casing 24. A spring 34, acting counter to the spring 33, and which is weaker than the latter, connects the lever 31 with a bracket 35 of the post 30 and is expanded when the lever 32 is thrown to the said dotted line position, the purpose of the spring 34 being to throw the lever 31 to the full line position of Fig. 12 when the lever 32 is restored to its full-line position.

Bracket-arms, 36, integral with one leg of the post 30, support a horizontally disposed sleeve 37 (see Fig. 14) in which a plunger 38 is reciprocably mounted, said plunger being urged in the direction of the shaft 16 by the spring 39 in an obvious manner. In one end portion of said plunger, 38, there is an annular groove, 40, and said end portion projects through an arcuate slot in a rocking plate 41, (Fig. 13) which is secured pivotally at one end to one leg of the post 30. A pair of opposed springs 42 and 43 are engaged with the plate 41 and with lever 32 and bracket 35, respectively, and function as do the springs 33 and 34. The said arcuate slot in the plate 41 is of such width as to permit free passage therethrough, of the outer end portion of the plunger, 38, the upper end wall of said slot engaging in the annular groove 40 of the said plunger to hold the latter at the rearward limit of its movement when said plate is in the position shown in Fig. 13. When the lever 32 is thrown to dotted line position, the plunger, 38, is free to reciprocate.

Keyed to, and slidable on the shaft 16, (Figs. 11, 12 and 15), is a cam or eccentric, 44, which is held normally against a stop formation 45, by the spring, 46. The hub, 47, of said eccentric, 44, presents a cam formation 48 which is engaged by the forward end portion of the plunger 38 when the latter is projected by its spring, after release from the plate 41, to cause said eccentric to be moved against the action of the spring 46 into position to engage the anti-friction roller 49 of the arm 27 to raise the latter. A second throw-out cam formation 50, on the said hub, 47, throws the plunger, 38, out of engaging relation to the cam-formation, 48, following the completion of the lifting stroke of the eccentric 44 and thus permitting said eccentric to be restored to its normal position by the spring 46.

The plunger 38 is caused to be projected into engagement with the cam formation 48 at the same time that the lever 31 is thrown into position to engage and support the lifting arm 27 by throwing the lever 32 over to its dotted line position and, so long as the latter remains in that position, the said eccentric will be caused to move forward and back and, during each rotation, will lift the arm 27 very slightly higher than the position of its support by the lever 31, but as soon as lever 32 is returned to its full line position, the throw-out of plunger 38, from its position to engage the cam formation 48, will occur when the eccentric 44 has raised the arm 27 to its highest point and thus has released the lever 31 for movement by the spring 34 out of engag-

ing relation to the arm 27. As the plate 41 will have been swung back by the return movement of lever 32, so that the upper end wall of its arcuate slot rests upon the outermost end portion of the plunger 38, the throw-back of said plunger by the cam-formation 50, will cause plate 41 to complete its downward swing responsively to the spring 43, to engage in the annular groove of said plunger 38 to retain the same out of cam engaging position.

Obviously, the eccentric 44 acts to raise and lower the arm 27 so gradually as to eliminate shock.

The reciprocation of the heavy screeds 12 and 13 upon the plastic paving material and the side forms tends to cant the latter and, therefore, it is desirable that the traction wheels of the machine shall be held rigidly against lateral movement during periods of travel over parallel side-forms and, also, that during these periods of travel, traction wheels having none but outer flanges shall be used. In rounding widened curves, double-flanged traction wheels must be used in order to prevent the said wheels from leaving the side forms at one or both sides of the machine.

I am aware that machines of the type to which this invention relates have been equipped with means for effecting widening of the machine for travel over widened curves and, therefore, the improvements concerning this feature as illustrated in the accompanying drawings are specifically rather than broadly novel except as hereinafter particularly pointed out.

Referring to Figs. 1, 2, 5, 6, 7, 8, and 9, it will be noted that the truck at the left-hand side of Fig. 1 is movable relatively to the frame members 1 and 4, each end of said truck being equipped with a box-like structure 51 through which one of the said frame members extends, said structure 51 being secured suitably and rigidly to the truck and being provided at one end with an extended portion 52 and a cross-plate 53 which underlies the frame member 4. An angle brace 54 connects the outer end portion of the extended portion 52 at one end of the truck with one of the flanges of the inner side plate of said truck.

The said structure 50, in its main portion, is of greater length than the width of the truck and is equipped with openings or bearings to receive the shafts of rollers 55 which engage the upper and lower faces of the frame members to facilitate movement of said truck relatively to the frame members 1 and 4. The said rollers are mounted in place just prior to travel of the machine around a widened curve.

A clamping and brake shoe 56 also is provided to ride upon the frame member, said block being confined between flanges 57 on the bottom of a U-shaped plate 58 having flanges 59 which are bolted to the top of the box-structure 50 together with a cover plate 60 at each end of a slot in said top of said box structure 50.

The block or shoe, 56, is provided with a threaded opening 61 in which the lower end of a shaft, 62, engages. The latter is provided between its ends with an annular flange, 63, upon which the compression spring, 64, bears, the latter being confined between said flange and the lower end of a sleeve, 65, threaded into the cover plate 60, and held against rotation by the lock nut, 66.

The shaft 62 is movable freely through the sleeve 65 and is equipped with a square end portion, 67, for the application of a wrench for rotating it relatively to the block or shoe, 56. Such rotation of the shaft, 62, affects the degree of pressure exerted on the shoe 56 to vary its brake-effect on the frame member 2; the pressure so exerted by said spring, 64, being controlled also by the sleeve, 65, as will be obvious.

Normally, the shaft 62 is disposed relatively to the shoe, 56, to compress the spring 64 to the extent necessary to cause said shoe to exert sufficient brake power on the frame members 1 and 2 to hold the truck against movement relatively to the machine frame.

In order to mount the rollers, 55, in place, the upper set thereof is first mounted in position while the shoe 56 is most tightly compressed against the frame member on which it bears. This pressure on the shoe is relieved by turning the shaft 62 clock-wise and then jacking up the frame member into close contact with the upper set of rollers while the lower set is mounted in place. Thereupon, the shaft, 62, is rotated anti-clock-wise until the pressure exerted by the shoe, 56, is such as to permit the truck to travel relatively to the frame members against the braking action of said shoe, the resistance to such travel being sufficient to overcome the movement of the truck relatively to the machine frame responsively to the resisted reciprocation of the screeds when the latter are lowered into operative position.

During the time that the machine frame is jacked up to permit the lower set of rollers, 55, to be mounted in place, the single flange traction wheels of the trucks are replaced by the double-flanged wheels shown in Fig. 5.

Each of the trucks (Figs. 2 and 3) is equipped with a pair of traction wheels and rigid with each traction wheel is a sprocket wheel 68. A sprocket chain, 69, is provided for each pair of the said traction wheels and is trained over both sprocket wheels 68 and over idle sprocket pinions 70 and 71, the latter being adjustable for limiting slack in said chain, and also over a driving sprocket pinion, 72, on a shaft, 73, with which the spur-gear wheels, 74 and 75, are rigid. (See Figs. 8 and 9.)

Meshing with the respective spur-gear wheels, 74 and 75, are the spur-gear wheels 76 and 77, respectively, both of which are mounted loosely on the drive-shaft, 78, which is geared to a motive member 79, by means of sprocket chain 80, sprocket pinion 81, and sprocket wheel 82.

Rigid with each of the gear-wheels, 76 and 77, is a tooth-clutch member, and splined to and slidable on the shaft 78, is a tooth clutch member 83, which may be thrown to engage either of the aforesaid clutch members by means of the lever, 84. A spring, 85, maintains said clutch member, 83, normally engaged with the clutch member rigid with the spur-pinion 76, said lever being actuated against the action of said spring by means of the chain 86, to neutral position, or to engage the clutch member rigid with the spur-gear, 77, to drive the sprocket chain, 69, and traction wheels, 68, at higher speed.

Rigid with the drive-shaft, 73, is a sprocket wheel, 87, which drives a countershaft journalled in bearings of a gear box, 88, wherein it is bevel-geared to the crank-shaft, 89, for reciprocating a rod, 90. The latter is slidable in bearings carried by brackets, 91, suitably mounted upon a rear frame member. An arm 90—A rigid with the rod 90 and connected by chain 91—A with hand lever 91—B, is operated for raising and lowering the rod 90 and the fabric strip, 92, carried by the latter and known in the art as a belter. The latter is raised and usually lowered when the

screeds of the machine are raised and lowered, if said belter is to be in operation during forward travel of the machine.

A vertically reciprocable tamper, 93, also is provided between the screeds, the movement of same being substantially vibratory. The said tamper and the means for raising and lowering the same are shown, but are not described herein for the reason that the same constitute no part of the present invention.

The mechanism for propelling the machine includes means for actuating a device known as a spader, shown in Figs. 2 and 3, one of said devices being disposed at each side of the machine. Each, thereof, includes a blade, 94, which is disposed in contact with the inner face of a side form and projects an appreciable distance below the crown of the latter. The purpose of said spader is to manipulate the concrete along the said side forms to release air bubbles and cooperate with the screeds and the tamper to promote compaction of the material.

On the shaft, 78, is mounted a sprocket wheel, 95, which is connected with a sprocket pinion on a countershaft, 96, by means of the sprocket chain, 97 (Figs. 8 and 9). The shaft, 96, carries an eccentric which reciprocates the connecting rod, 98, which is connected with the upper end of a rocking lever, 99. The latter is connected pivotally between its ends with one end of a lever, 100 (Figs. 2 and 3) and the said lever 100 is mounted pivotally between its ends on a frame member, its movement in one direction being limited by the set-screw 101 engaging a stop 102 on the machine frame.

The other end of the lever, 99, carries a rod 103 which affords a vertical pivot for an L-shaped member 104 to which the blade, 94, is secured. Mounted on and anchored at one end to the rod 103, is a spring, 105, which, at its other end, is anchored to the member 104 and acts to maintain the blade 94 in contact yieldingly with the inner face of the adjacent side form.

A segmental member, 106, is rigid with the lever 100 and is connected with one end of the chain 107 which is trained over the sheave 108 and a sheave 109 and connects at its other end with the hand lever 110 (Fig. 1) by means of which the spader is raised to a suitable height during reverse travel of the machine.

The blade, 94, rocks through a short arc at high speed during forward travel of the machine and causes the concrete along the side forms to settle compactly.

A clutch is provided for causing the spur-pinion on the shaft, 96, to drive said shaft and is thrown in and out by means of the pin, 111, (Fig. 8) which is engaged with the forked end of a lever, 112, which is engaged with the sheave 108, so that when the spader is raised as aforesaid, the said clutch will be thrown out and vice versa.

The machine frame and the screeds may be adjusted in width of span to adapt the same for operation on pavement strips of different widths, such adjustment being effected by means independent of the movable truck hereinabove described, by composing the frame members, extending transversely of the roadbed and the screeds, of spliced parts.

In the case of the frame members last referred to, the splicing is effected by making said members of two parts which project at their inner ends into a rectangular sleeve 113 (Figs. 16 and 17), which is composed of a pair of L-shaped members, each of which is equipped along the free edges of its flanges with lip portions 114. The lip portions of each member are opposed to and spaced slightly from the lip portions of the other and are secured together and clamped securely to the frame member portions projecting into said sleeve, by means of the bolts 115. The flanges of said sleeve members are reinforced by means of the ribs 116.

The conditions pertaining to paved highway construction render it very necessary that the finishing machine shall operate rapidly and efficiently and that its weight shall be limited to a maximum which will not sink the side forms where the latter rest upon soft soil, as in the case of highways extending through marshes and swamps.

Rapid and efficient operation requires that the machine shall be capable of traveling forward and back without appreciable delay in changing from forward to reverse travel, and vice versa, and, likewise, that its position on the side forms shall be quickly adjustable to maintain the screeds and transverse frame members at right angles to the side forms during travel over straight or substantially straight, or only slightly curved portions of the pavement strip and also over the sharply curved and widened portions, thereof.

The last-mentioned functions require that one side of the machine shall travel at times and during very brief intervals, at higher speed than the other side or that one side shall travel while the other side is idle.

Hence, an essential object of the invention is to provide a machine of the type specified which may be caused to travel at one side only, or at greater speed at one side than the other, and to provide means whereby such relative travel of opposite sides of the machine is easily controllable by the operator.

To reduce the weight of the machine to the minimum necessary to provide requisite traction necessitates the elimination of cumbersome gear trains, clutches and other requisite mechanical parts, such as are commonly provided to operate and manipulate the machine wherein the power plant consists of an internal combustion engine, the shaft of which rotates in one direction and is geared to the traction wheels and screeds, etc., by means including clutches which usually are of the friction type and, therefore, far heavier than the tooth type.

It is well known that friction clutches operate most successfully under high speed conditions and decrease in size and weight for transmission of a given power as the speed of rotation of parts associated by such clutches increases. It is also well known that tooth clutches cannot well be thrown out of and into interengagement when under load and that, therefore, the power transmitted therethrough must be shut off in whole or in part during moments of clutch throw-in and throw-out. A very small and light tooth-clutch may be employed on a slow speed power transmission member where a very large and heavy friction clutch would be required.

Hence, the present invention comprehends the inclusion in the machine, of a power generating and transmission plant which lends itself most efficiently to rapid and efficient machine operation and which eliminates most of the cumbersome and heavy parts and mechanisms ordinarily employed and more particularly in providing a separate motive member for each of the trucks of

the machine which are synchronized with each other, and including in the application of power to each truck, means for reversing the travel of the latter.

In the instance illustrated the internal combustion engine 117 actuates the dynamo or generator 118. Suitable electric circuits connect the latter with the motor, 119, driving the shaft, 16, via the spur-pinion, 120, and spur-gear, 121, and also connect the generator, 118, with the motors which actuate the traction wheels and spaders. These motors are of the reversible type and are equipped with the well-known automatic brakes for stopping rotation of the armatures and shafts thereof the instant that the circuits are opened. The use of reversible motors eliminates the necessity for providing reversing gear mechanism for effecting reverse travel of the machine.

Current control mechanism is included in the motor circuits in which the levers, 122 and 123, are included. Two main switches, 124 and 125, are provided, the former controlling the motor, 119, to stop and start the same and the latter controlling the truck motors, 79, to start, stop and reverse the same. A diagram of the electric circuits and controls is omitted from illustration and particular description as, per se, lacking in novelty and therefore constituting no part of the present invention.

By providing the generator and the several motors aforesaid, the advantages common to electric motor operation are obtained, of course, and the mere substitution of electrical for mechanical power is not deemed to be novel, but the use of two independent motors for the several trucks, whereby either one thereof may be actuated independently of the other, as obviously may be done, thus to cause one side of the machine to travel independently of the other, is believed to be novel in the art as accomplishing a new and useful result more efficiently than has been accomplished heretofore.

In the instance illustrated, the circuits for both truck motors are controlled by a single switch and the relative travel of the trucks controlled by the variable speed gearing interposed between each motor and the traction wheels actuated by the same. In the instance illustrated the motors 79 are of the two-speed type as providing ample speed variation in connection with the two-speed gear set employed.

An important advantage obtained by the use of independent truck motors, one of which is mounted on the movable truck of the machine, lies in the elimination of a long enough shaft or an extensible shaft for maintaining the driving gear of the movable truck connected with the engine during periods of travel around widened curves as above described.

The use of two speed reversible motors equipped with the automatic brakes referred to hereinabove, is advantageous, in that it permits the use of light tooth-clutches in variable speed gearing and otherwise for the reason that electric motors are stopped and started very quickly by the mere operations of a switch without imparting shock or undue stress to any part of the machine.

Obviously the predominating advantage of employing two independent motors in connection with variable speed gearing lies in the fact that in rounding curves, both trucks may be propelled, one at higher speed than the other, by providing traction for each of the trucks so that the advancement of accumulated concrete disposed against the apron plate of the forward screed will result. In machines wherein a single motor or engine is employed in connection with clutches to control the driving of the trucks, no provision is made, so far as I am informed, to drive the trucks simultaneously at respectively different speeds, but the arrangement is such that power is cut off from one truck while the other is driven and this necessitates frequent throw-in and throw-out of the clutches controlling the travel of the inner truck on a curve to maintain the machine in travel and the machine frame and mechanism are thus subjected to shock and stress which are avoided in the machine of this invention.

Furthermore, by employing separate motors carried by the respective trucks, the weight of the machine remains more uniformly distributed over the two trucks when they are farther from each other than normally, as in rounding curves, and this preserves the tractive force of the wheels of the outer truck.

The operation of the machine is as follows:

After being upon the side forms and following deposit of plastic paving material in its path, the machine is caused to move forward, the screeds being then in lowered position and reciprocating to manipulate the material.

After initial passage over the fresh material, the forward travel of the machine is stopped, the levers 32 thrown over to cause the screed lifting mechanisms to operate to raise the screeds and the travel of the machine reversed until it reaches a point selected by the operator where it is stopped; the levers 32 are then thrown up to normal position to cause the screeds to be returned to normal position and thereupon the machine is caused to travel forward again.

In the event that the tamper is used, the screeds may be maintained in or out of operation during the period of operation of the tamper and vice versa.

Generally, the belter is maintained in raised position during initial travel of the machine to strike off and compact freshly deposited material and is lowered to operative position during subsequent periods of travel over the initially prepared surface. It is also raised to inoperative position preparatory to and during reverse travel of the machine.

Furthermore, the belter is sometimes the only surface manipulating member of the machine that is used, as for example, in a final passage of the machine over a stretch of pavement after the same has become practically set and a film of water has come to the surface.

In the event that the resistance to travel of the machine has been much greater at one side portion than the other, so that the carriage is not positioned properly on the side forms, the operator effects readjustment by stopping rotation of one of the motors 79 for a very brief period while the other continues in operation until the machine is again in proper position on said forms and, thereupon, the other motor is started so that the machine continues to travel as a whole either forward or reversely as the case may be. This mode of operation appertains during periods of travel of the machine around curves, whether the same be of the same width as straight portion of the roadway, or are widened.

Obviously, the operation of the respective motors 79 may also be such that the motor shafts rotate simultaneously in opposite directions, though this is rarely, if ever, necessary or desirable.

It is preferable and the present practice is, to manipulate both clutches 83 in unison to change the speed of travel of the machine during travel over straight stretches.

It will be understood that the invention is not limited to the mode of operation hereinabove described, nor to specific details of construction incident thereto, but comprehends such changes and variations as are readily made by persons skilled in the art to suit the mode of operation selected as best fitted for the purposes of the machine or which fall within the scope and meaning of the appended claims.

I claim as my invention:

1. In a machine of the type specified, a pair of relatively movable side trucks, each equipped with traction wheels, pavement material manipulating means, a single power generating plant, a pair of reversible variable speed motors carried by said respective trucks, a third motor for actuating said means, means for controlling said several motors independently of each other, said several motors connected with the power generating plant, manually controlled gearing between each of the first mentioned motors and the traction wheels of the truck carrying the same, mechanism for throwing said means into and out of operative relation to the paving material, and manually controlled gearing between the said mechanism and the third motor.

2. In a machine of the type specified, screed lifting and lowering mechanism comprising a lever connected with a screed, a constantly rotating shaft, a lever actuating cam slidable and non-rotatable on said shaft, a spring normally maintaining said cam out of engaging relation to said lever, a reciprocable plunger associated with said cam and normally disengaged therefrom, means on the cam for cooperation with said plunger to move said cam into engaging relation to said lever when said plunger is thrown into engaging relation to said means, opposed springs operatively engaged with said plunger, one thereof normally stronger than the other and maintaining said plunger out of engaging relation to the said means, and a manually operable lever engaged with the other of said springs for increasing the force exerted thereby to a degree overcoming the other spring for causing said plunger to move into engagement with said means.

3. In a machine of the type specified, screed lifting and lowering mechanism comprising a lever connected with a screed, a constantly rotating shaft, a lever actuating cam slidable and non-rotatable on said shaft, a spring normally maintaining said cam out of engaging relation to said lever, a reciprocable plunger associated with said cam and normally disengaged therefrom, means on the cam for cooperation with said plunger to move said cam into engaging relation to said lever when said plunger is thrown into engaging relation to said means, opposed springs operatively engaged with said plunger, one thereof normally stronger than the other and maintaining said plunger out of engaging relation to the said means, and a manually operable lever engaged with the other of said springs for increasing the force exerted thereby to a degree overcoming the other spring for causing said plunger to move into engagement with said means, and latch mechanism operatively associated with said first-named lever and said manually operated lever for causing the former to be maintained at the limit of its movement at which the said screed is raised so long as said plunger is maintained in engaging relation to said means by said manually operable lever and the spring connected therewith.

4. In a machine of the type specified, screed lifting and lowering mechanism comprising a lever connected with a screed, a constantly rotating shaft, a lever actuating cam slidable and non-rotatable on said shaft, a spring normally maintaining said cam out of engaging relation to said lever, a reciprocable plunger associated with said cam and normally disengaged therefrom, means on the cam for cooperation with said plunger to move said cam into engaging relation to said lever when said plunger is thrown into engaging relation to said means, opposed springs operatively engaged with said plunger, one thereof normally stronger than the other and maintaining said plunger out of engaging relation to the said means, and a manually operable lever engaged with the other of said springs for increasing the force exerted thereby to a degree overcoming the other spring for causing said plunger to move into engagement with said means, and latch mechanism operatively associated with the said respective levers for holding said first-named lever in position to maintain the screed in raised position so long as said manually operative lever is maintained in position to cause the last mentioned spring to overcome the first mentioned spring.

5. In a machine of the type specified, pavement material manipulating devices, power means for actuating the same, and mechanism for throwing the said devices into and out of operative position, including a member connected therewith, a rotatable cam geared to said power means and normally maintained out of engaging relation to said member, manually controlled means operable to cause said cam to be moved into engaging relation to said member for throwing the same from a position wherein said devices are operative to a position wherein they are inoperative, said manually controlled means including an automatic latch mechanism for holding said member in the last mentioned position after actuation by said cam and until the return of said manually operable means to initial position.

6. In a machine of the type specified, equipped with a power actuated reciprocable screed, a mechanism for raising and lowering said screed, including a rocking member, normally slack devices connecting the same with the screed, a rotatable cam geared to the means actuating said screed and normally disposed out of engaging relation to the said member, manually operable means adapted to be thrown to a position for causing said cam to move into engaging relation to said rocking member to raise the same and including an automatic latch for supporting said member in raised position after engagement with the said cam and for causing release of said latch as said manually operable means is thrown back to its initial position.

7. In a machine of the type specified, equipped with a power actuated reciprocable screed, a mechanism for raising and lowering said screed, including a rocking member, normally slack devices connecting the same with the screed, a rotatable cam geared to the means actuating said screed and normally disposed out of engaging relation to the said member, manually operable means adapted to be thrown to a position for causing said cam to move into engaging relation

to said locking member to raise the same, and including a spring urged latch member adapted to spring into position to support said member after the same has been raised by said cam, the weight of said member and said screed holding said latch in said supporting position and causing said cam to effect release of said latch after said manually operable means is released manually for restoration to normal position.

8. A machine of the type specified including a vehicle frame, a pair of side trucks each equipped with a plurality of wheels adapted to ride upon and engage rails on which the vehicle travels, a separate variable speed motor for and mounted upon each truck and geared to the wheels thereof for driving each truck independently of the other, and means cooperating with the rails for causing the trucks to move relatively to each other as the distance between the said rails varies.

9. A machine of the type specified including a vehicle frame, a pair of side trucks each equipped with a plurality of wheels adapted to ride upon and engage side forms on which the vehicle travels, one of said trucks being movable laterally of the vehicle frame, a separate variable speed motor for each truck for driving the wheels of one truck independently of the wheels of the other truck, one of said motors being mounted on said laterally movable truck and manually controlled variable speed gearing between each motor and the wheels driven thereby.

10. A machine of the type specified including a vehicle frame, a pair of side trucks each equipped with a plurality of double-flanged wheels adapted to ride upon and engage rails on which the vehicle travels, one of said trucks being movable laterally of the vehicle frame, a separate motor for driving the wheels of one truck independently of the wheels of the other truck, one of said motors being mounted on said laterally movable truck, and manually controlled variable speed gearing between each motor and the wheels driven thereby.

11. A machine of the kind specified comprising a vehicle frame, trucks at respectively opposite sides thereof, one of which is movable laterally of said frame, traction wheels on each truck arranged for travel on the side forms, a variable speed motor carried by the movable truck and geared to the wheels thereof, a motor carried by the frame and geared to the wheels of the other truck, manually operable means controlling said motors for driving each truck independently of the other for steering said machine in rounding curves, a third motor, a reciprocable screed operated thereby, mechanism for raising and lowering said screed, and manually controlled means for throwing the last-named motor into and out of operative relation to said mechanism.

12. A machine of the type specified comprising a vehicle frame, side trucks supporting said frame equipped with double flanged traction wheels adapted to ride upon side forms, means connecting one of said trucks with said frame for lateral movement relatively thereto, a variable speed motor for each truck geared to the traction wheels thereof for driving said trucks independently of each other, one of said motors mounted upon said laterally movable truck, a screed spanning the distance between and engaged with said trucks for travel therewith, a third motor on the frame and operatively connected with said screed for reciprocating the latter, and manually controlled mechanism actuated by said third motor for throwing the screed into and out of operation during travel of the frame and trucks without disengaging said screed from said trucks, said wheels cooperating with the side forms to vary the width of the machine to coincide with variations in distances between the side forms.

13. A machine of the kind specified comprising a vehicle equipped with a pair of side trucks movable relatively to each other to span side forms bordering pavement strips varying in width, said trucks equipped with double-flanged traction wheels for travel on side forms and for cooperation with the latter to impart said relative movement to said trucks, variable speed and reversing drive means for the wheels of the respective trucks and respectively rigid with the latter, a screed of greater length than the maximum spacing apart of said trucks during travel over the side forms of the pavement strip engaged by said respective trucks in all relative positions of the latter, mechanism for throwing said screed into and out of operating relation to paving material deposited between the said side forms, a motor on the vehicle operatively engaged with said screed to reciprocate the same, manually manipulable means for throwing said motor into and out of actuating relation to said mechanism and manually operable means for controlling the respective driving means each independently of the other and independently of said motor for maintaining said screed in substantially predetermined position relatively to the side forms, said manually manipulable and control means being disposed for use by a single operator on the machine from a given position occupied by him.

14. In a machine of the type specified, a pair of trucks disposed at opposite sides of the machine frame, traction wheels carrying said respective trucks, means for actuating the traction wheels of each truck independently of the other comprising a variable speed motor for each of the respective trucks, variable speed gearing between each of said motors and the traction wheels driven thereby, and manually operable means for controlling the motor speeds and the variable speed gearing aforesaid.

15. In a machine of the kind specified, a machine frame, a truck at each side of said frame for carrying the same, traction wheels on each of said trucks carrying the latter, means adapted to cooperate with the side forms of a pavement strip to cause said trucks to move toward and from each other, a variable speed motor mounted upon each of said trucks and each operable independently of the other, variable speed gearing between each of the said motors and the traction wheels of the truck carrying the same, and manually controlled means for controlling the respective motor speeds and the said variable speed gearing.

16. In a machine of the kind specified, a machine frame, trucks mounted at opposite sides thereof, traction wheels on each truck, independently operable reversible and variable speed motors carried by the respective trucks, gearing between each of said motors and the traction wheels of the truck carrying the same, and manually operable means for controlling the respective motors, each independently of the other.

17. In a machine of the kind specified, a machine frame, trucks mounted at opposite sides thereof, traction wheels on each truck, independently operable reversible, variable speed motors carried by the respective trucks, variable speed gearing between each of the said motors

and the traction wheels of the truck carrying the same, and manually operable means for controlling the respective motors, each independently of the other and independently of said variable speed gearing.

18. In a machine of the kind specified, a machine frame, trucks mounted at opposite sides thereof, traction wheels on each truck independently operable reversible variable speed motors carried by the respective trucks, manually controlled speed gearing between each of the said motors and the traction wheels of the truck carrying the same, manually operable means for controlling the respective motors, each independently of the other and independently of said variable speed gearing and means for causing said trucks to move automatically toward and from each other to accord with variations in the spacing apart of side forms of the pavement strip at various points in the length of said strip, the said motors tending to maintain substantially equal loads on said trucks in all relative positions of the latter.

19. In a machine of the kind specified, a machine frame, trucks mounted at opposite sides thereof, means for causing at least one of said trucks to move relatively to the frame passing over widened portions of the pavement strip, a variable speed motor for each truck geared to the wheels thereof, and one thereof carried by said movable truck, a reciprocable screed, a third motor for actuating the same, gearing between said screed and said third motor for reciprocating the latter, mechanism associated with said screed and said third motor for raising and lowering said screed and separate manual controls disposed within easy reach of an operator stationed on the machine for controlling the several motors and said last-named mechanism, each independently of the remainder thereof.

20. In a machine of the kind specified, a machine frame, trucks mounted at opposite sides thereof, means for causing at least one of said trucks to move relatively to the frame passing over widened portions of the pavement strip, a variable speed motor for each truck geared to the wheels thereof, speed varying means included in said gearing, and one of said motors carried by said movable truck, a reciprocable screed, a third motor for actuating the same, gearing between said screed and said third motor for reciprocating the latter, mechanism associated with said screed and said third motor for raising and lowering said screed, and separate manual controls disposed within easy reach of an operator stationed on the machine for controlling the several motors and said last-named mechanism, each independently of the remainder thereof.

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