Aug. 12, 1924. 1,504,404

G. E. WEBB

PAVEMENT FINISHING MACHINE

Filed Feb. 14, 1922 8 Sheets-Sheet 1

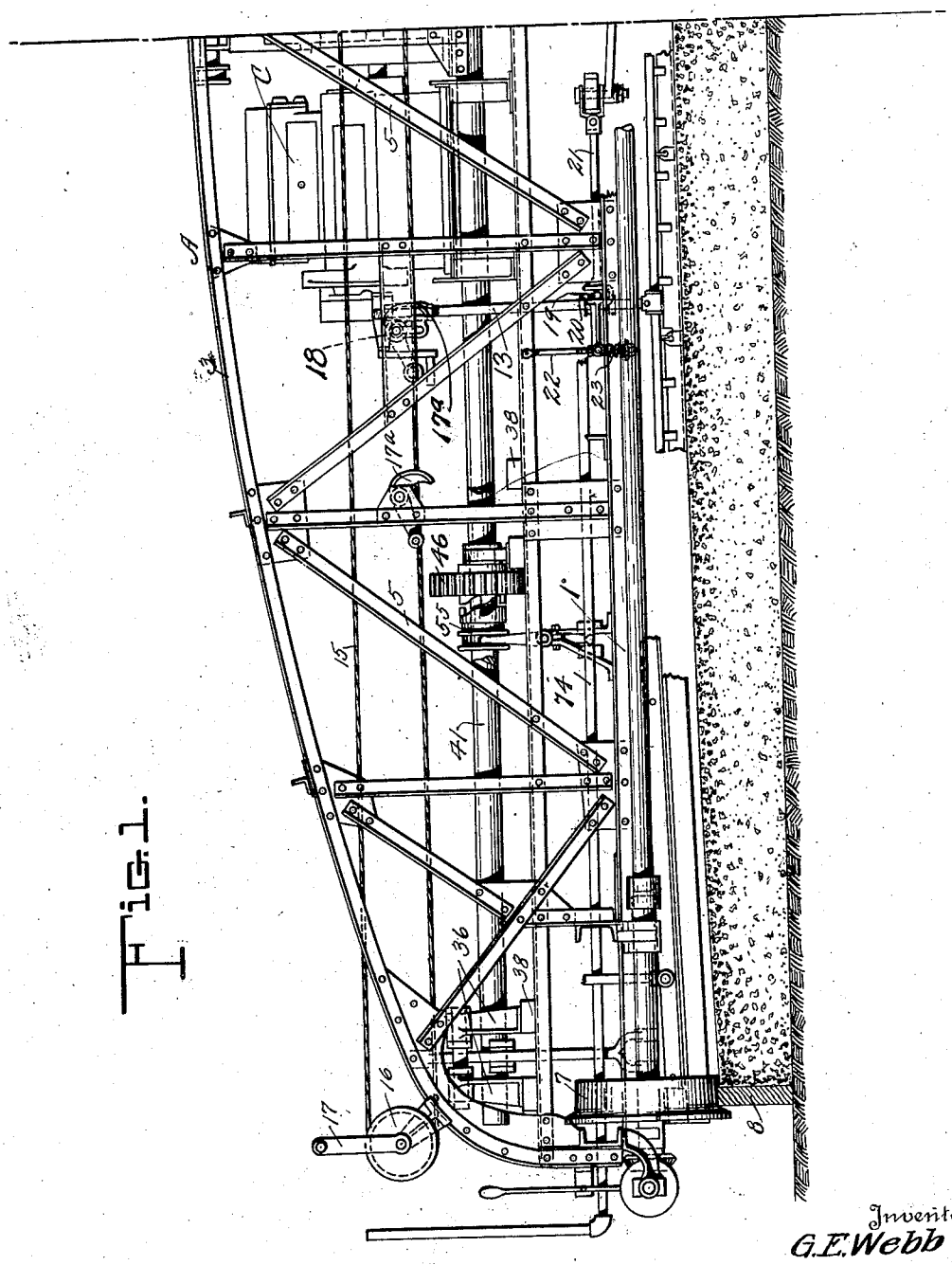


Fig. 1.

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1,504,404

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Filed Feb. 14, 1922

8 Sheets-Sheet 2

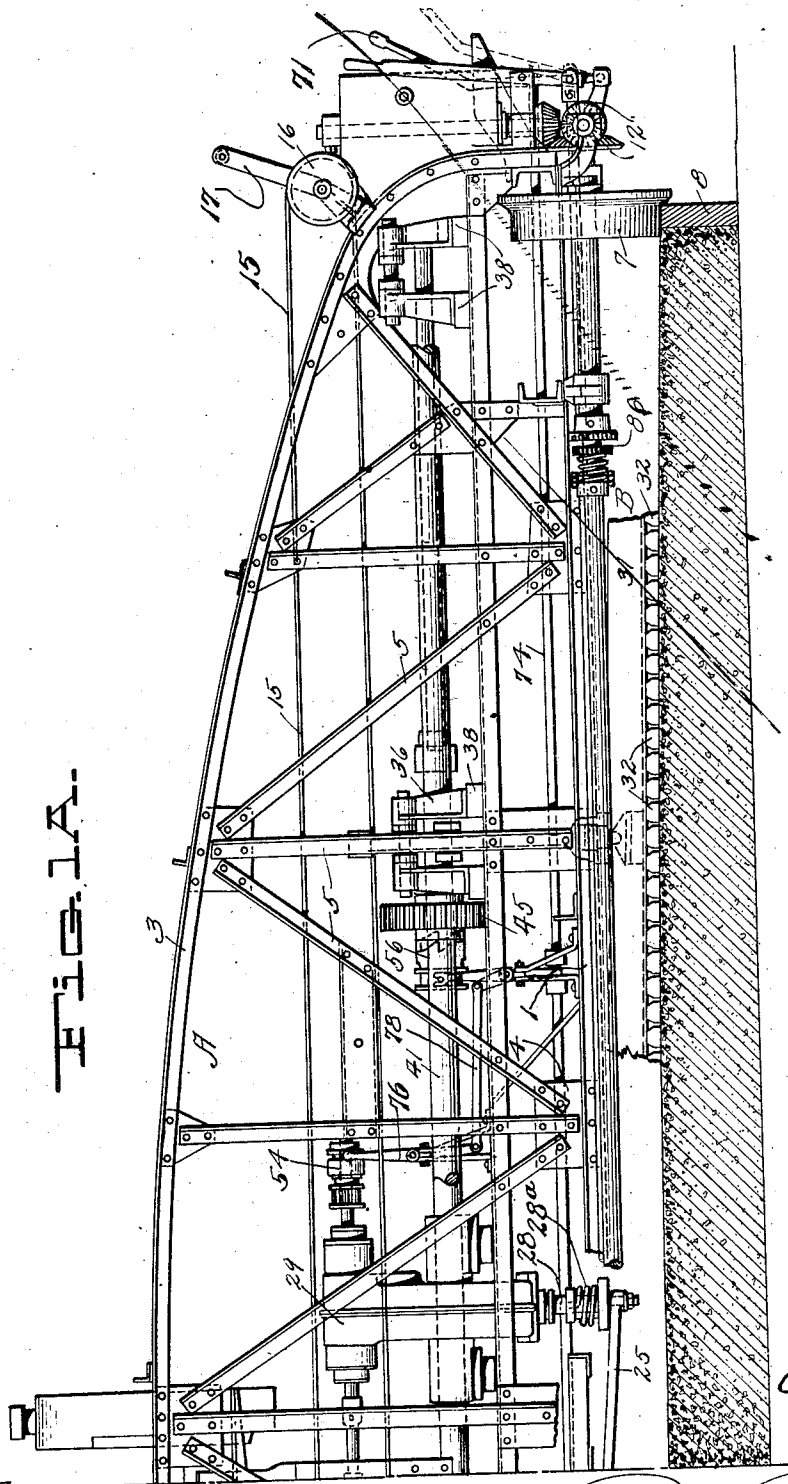


Fig. 1A.

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PAVEMENT FINISHING MACHINE

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8 Sheets-Sheet 3

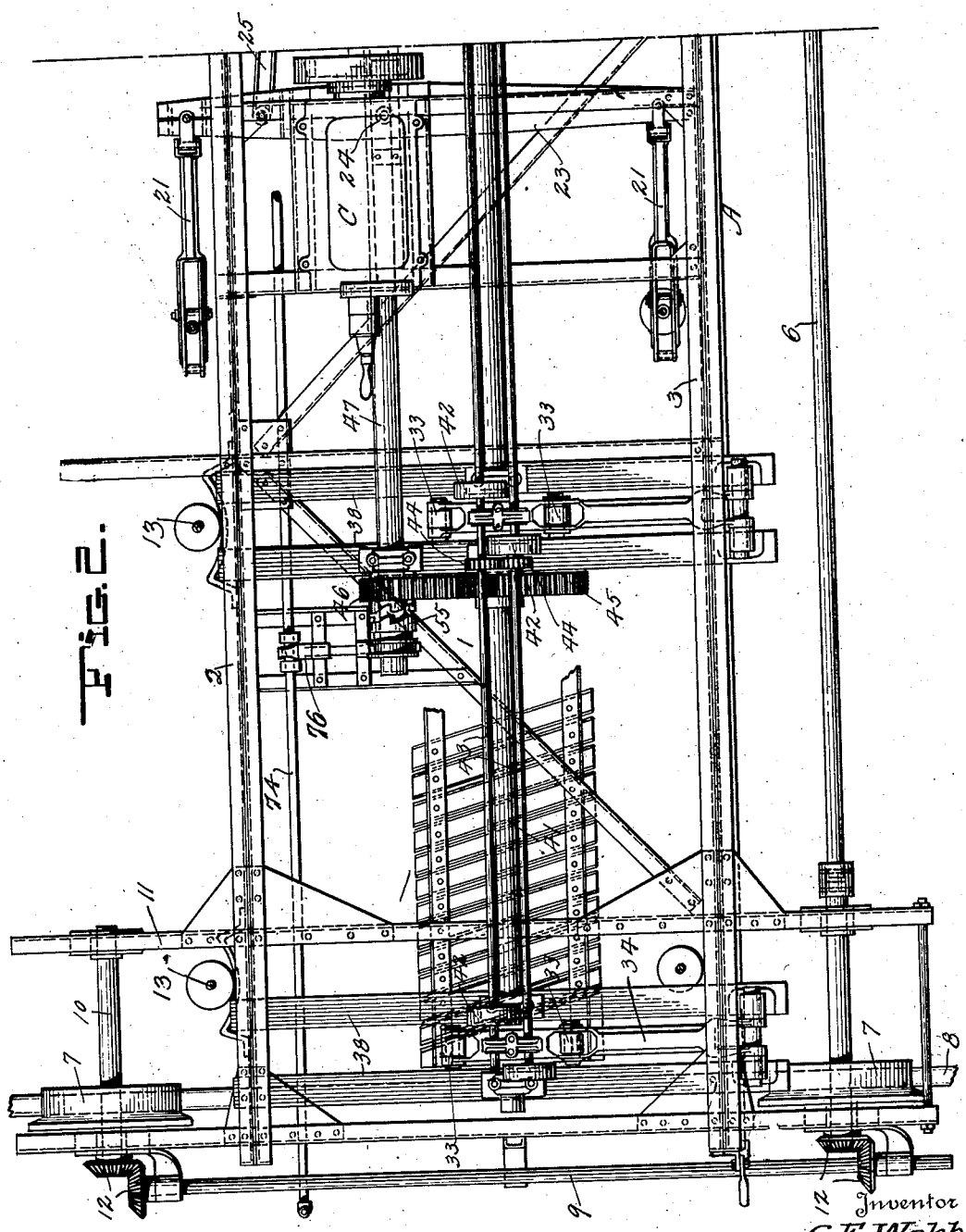


Fig. 2.

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Filed Feb. 14, 1922 8 Sheets-Sheet 4

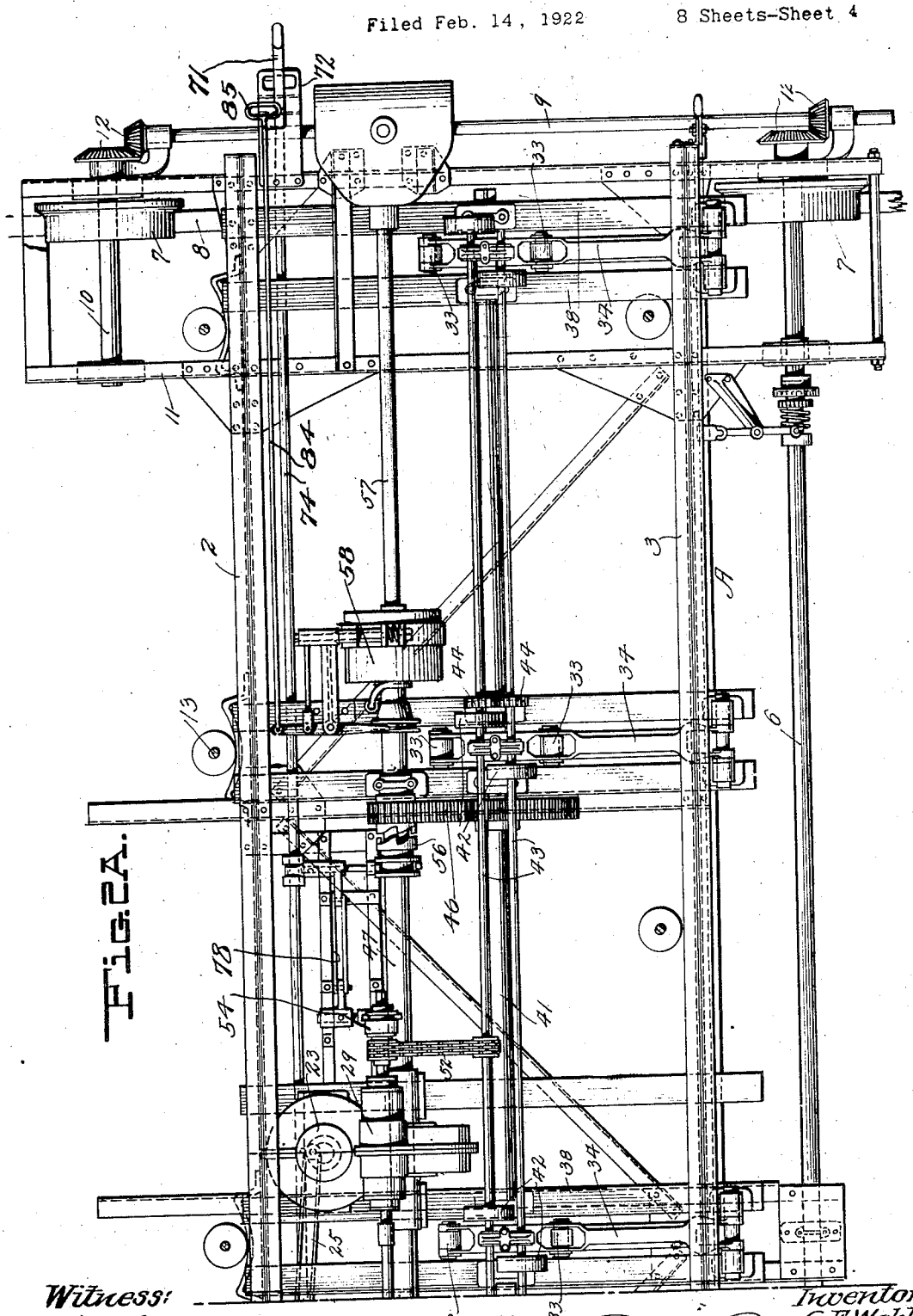


Fig. 24.

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PAVEMENT FINISHING MACHINE

Filed Feb. 14, 1922

8 Sheets-Sheet 5

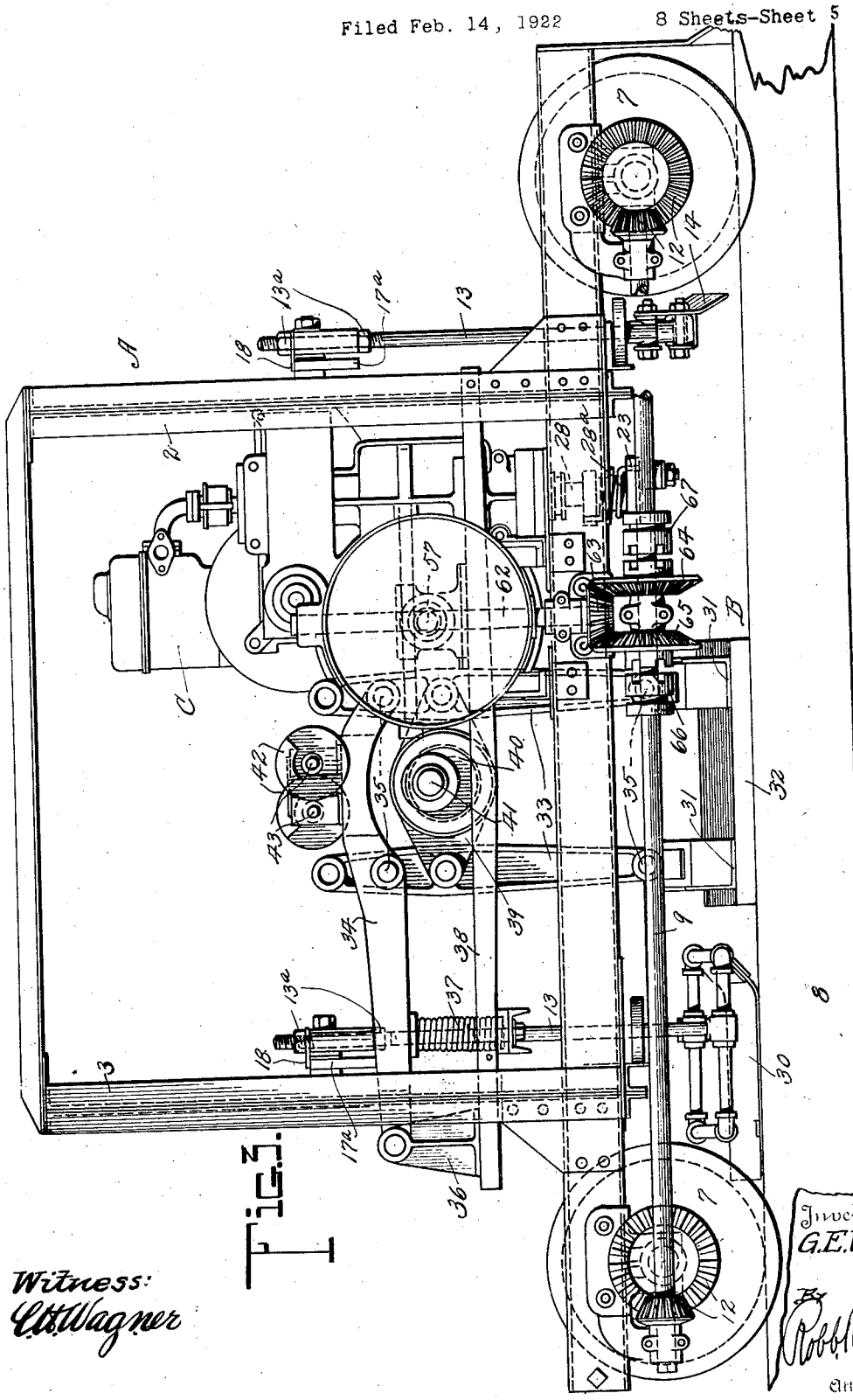


Fig. 1.

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1,504,404

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PAVEMENT FINISHING MACHINE

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8 Sheets-Sheet 6

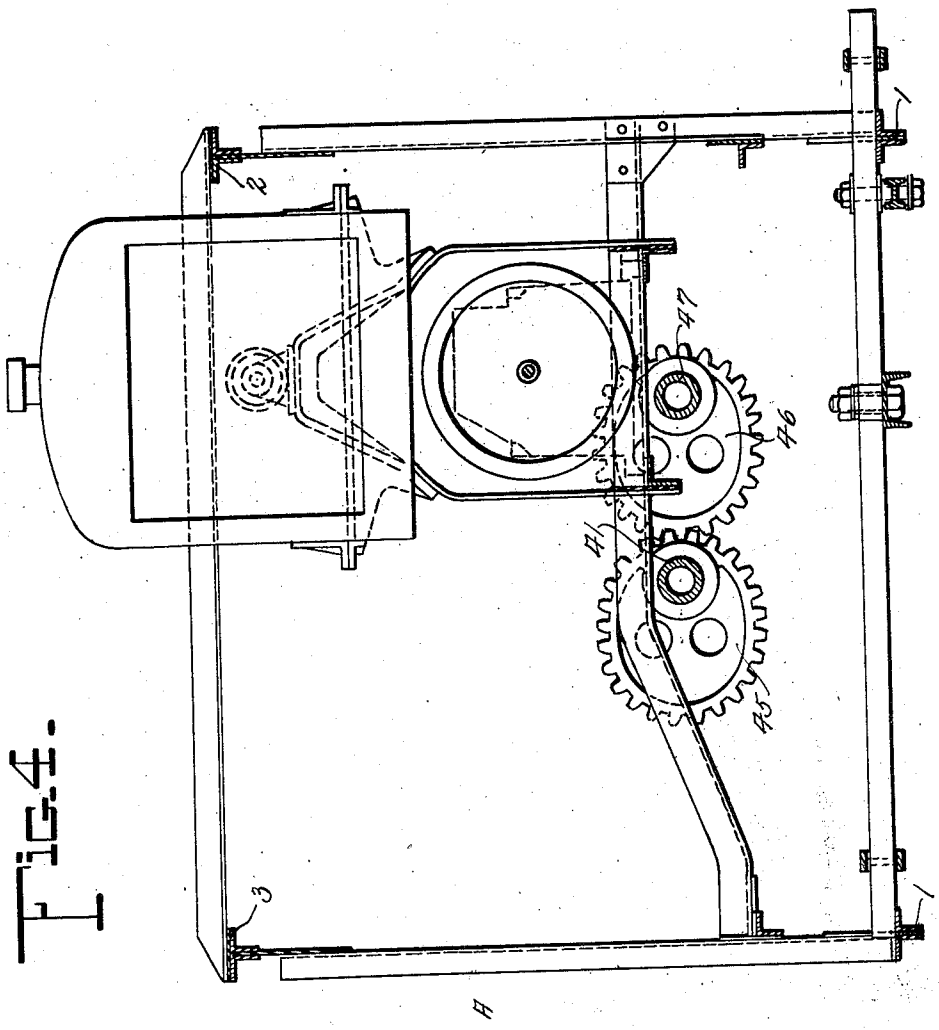


Fig. 4.

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PAVEMENT FINISHING MACHINE

Filed Feb. 14, 1922

8 Sheets-Sheet 7

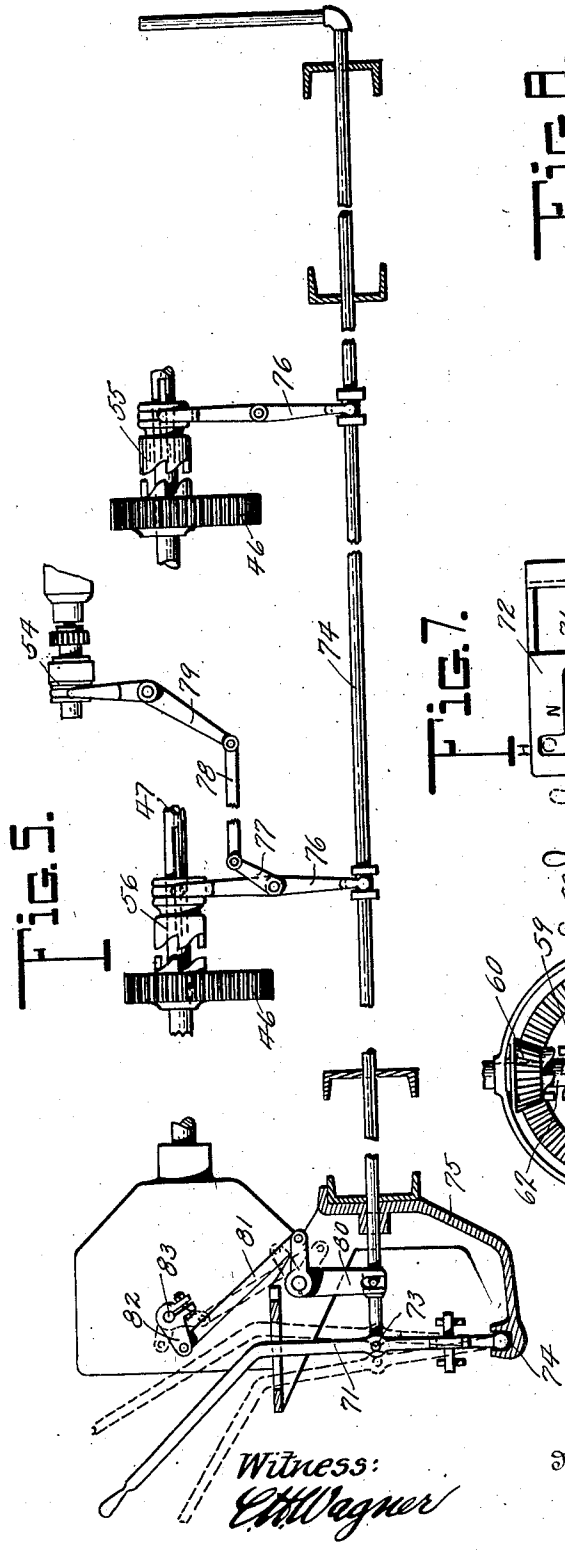


Fig. 5.

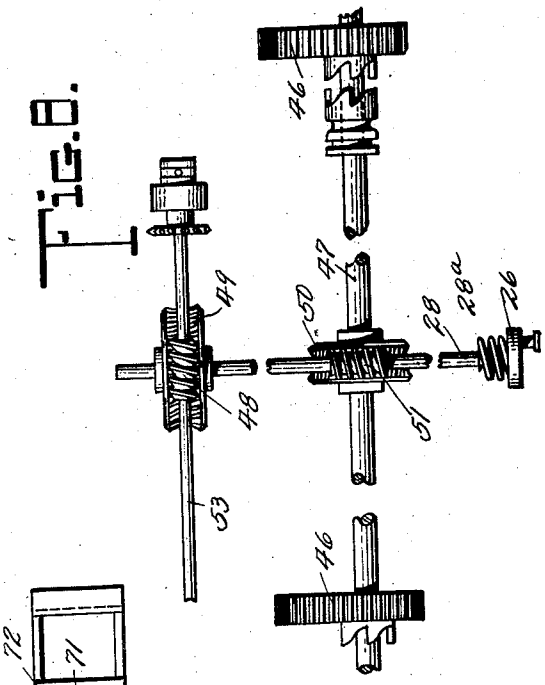


Fig. 8.

Fig. 7.

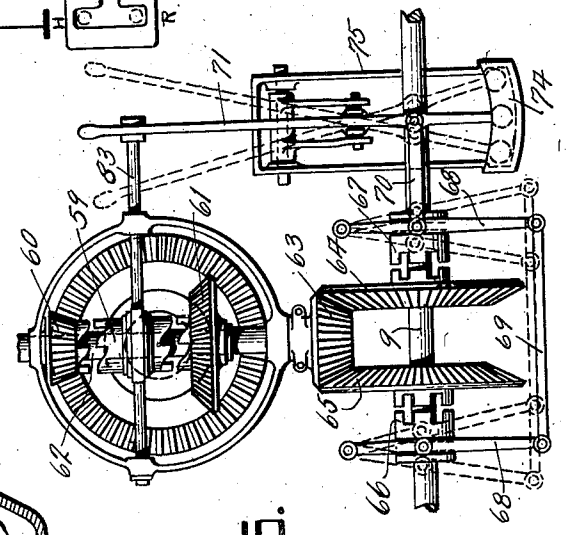


Fig. 6.

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1,504,404

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PAVEMENT FINISHING MACHINE

Filed Feb. 14, 1922

8 Sheets-Sheet 8

Fig. 9.

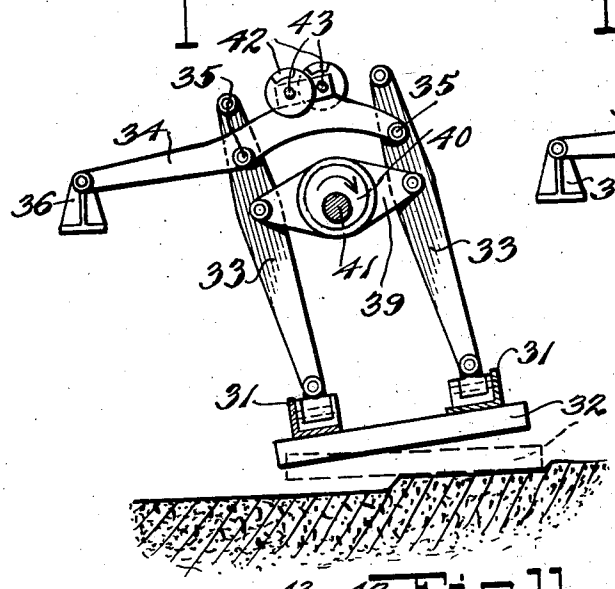


Fig. 10.

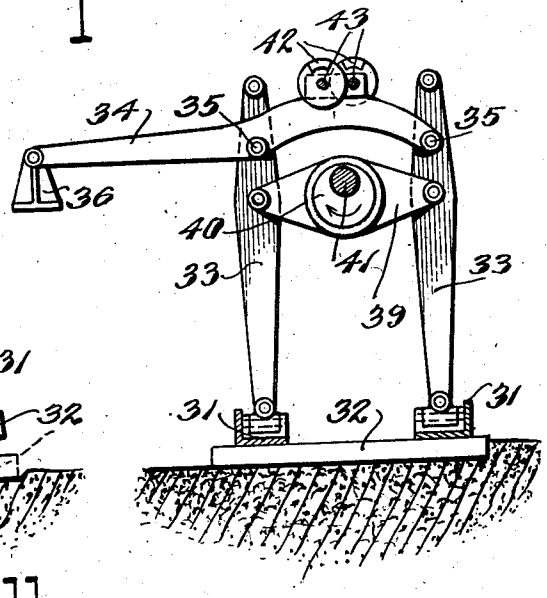


Fig. 11.

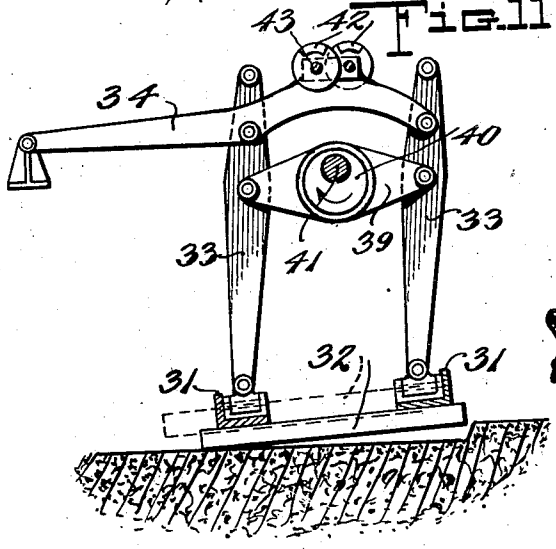
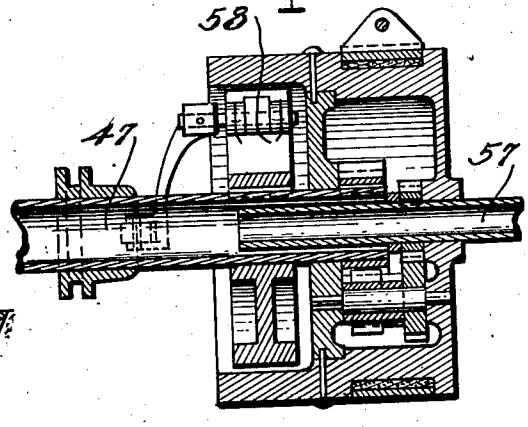


Fig. 12.



Witness:
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Patented Aug. 12, 1924. 1,504,404

UNITED STATES PATENT OFFICE.

GEORGE E. WEBB, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO KOEHRING COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION.

PAVEMENT-FINISHING MACHINE.

Application filed February 14, 1922. Serial No. 536,529.

To all whom it may concern:

Be it known that I, GEORGE E. WEBB, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Pavement-Finishing Machines, of which the following is a specification.

The improved concrete pavement finishing machine hereinafter set forth, represents a continuation in part of my invention of my pending application for patent, Serial #477,779 filed June 15, 1921. In my previous application I have disclosed a finishing machine capable of finishing a road or pavement the entire width thereof by forward progressive movement, a surface contacting pressure apron being utilized as a finishing member and being preferably, though not necessarily, adapted to span the surface operated upon. In the said construction I employ a vibrating and weight device capable of travel lengthwise of the apron and crosswise of the surface operated upon, for the purpose of subjecting said surface composed of concrete aggregates freshly deposited to pressure, and while under pressure to vibration.

In my present machine I have provided improved instrumentalities for the primary objects of subjecting the freshly deposited concrete aggregates to considerable pressure and imparting vibration thereto while under said pressure.

With the foregoing in view, I utilize the pressure apron or member mounted upon a mobile support capable of traveling on the road rails or forms in a manner now well known, which apron has imparted thereto a step by step forward progressive movement to bring it into contact with the surface aggregates, maintain it in contact for a certain period of time, during which it is subjected to vibration to correspondingly vibrate the road or pavement aggregates, thereafter lifted or raised and carried forward to be again brought into contact with the aggregates, deliver very considerable pressure thereto and vibrate them as required by the method of concrete road or pavement construction for which the machine is designed.

An important feature of the present invention resides in so operating the pressure apron or member that the weight of the entire machine, or substantially the whole weight is adapted to be carried by the pressure member and transmitted through the same to the road surface operated upon, at which time the pressure member is susceptible of being vibrated in order to secure the vibratory treatment under pressure, for the concrete aggregates. By the above construction, I obtain a very high degree of efficiency in the operation of the pressure transmitting apron or member, and furthermore, as distinguished from my previous construction, and of considerable advantage thereover, the whole area of the pressure member receives the pressure load at one time, or during the period when said member is contacting with the concrete and the pressure is required upon the latter to bring the surface to the proper grade sbusequently to the striking off of the aggregates, which is the usual preliminary operation.

Regarding the vibratory phase of action of my machine, an important improvement has been effected in that I have so designed the construction that the vibratory apron, or pressure member, is subjected to vibration throughout its entire area during the pressure period. Under these circumstances, of course, the efficiency of the vibration phase of my invention has been increased materially as it is not now necessary to maintain the apron in a certain position any great period of time to enable the operation of a vibrator upon different surface portions of said apron, as was incident to the operation of my previous invention.

In addition to the broader phases of novelty of my improved construction, I have provided certain specific improvements in the strike off member and finishing float or member, by which the operation of these parts is effectively performed, together with automatic contrivances for throwing said parts out of action when the travel of my machine is reversed preliminary to a successive finishing operation upon a particular section of the concrete pavement.

Additionally, I utilize special flexible

drive means for the strike off member and finishing float or member, especially adapted to absorb shocks incident to the putting into action of these members after their operation has been temporarily, or for the time being, discontinued.

I have furthermore designed special control mechanism for my machine possessing novel advantages, in that by the operation of a single lever I am enabled to render operative the actuating devices for my pressure member or surface contacting apron, the operating means for the vibrator devices, and the controlling drive gearing by which the travel of the machine forwardly and rearwardly over the work, is compelled and discontinued. Furthermore, I utilize subsidary to the foregoing, an interlocking system for my main control lever mechanism such that upon setting the same for reversal of travel of the machine, the operating mechanism for stepping forward, or actuating my pressure distributing member, or apron, is thrown out of operation; and likewise, the same effect is simultaneously obtained in respect to the vibrating devices.

My invention involves certain other detailed features of construction which will appear more fully hereinafter. However, I do not wish to be limited to the special embodiment of the different mechanisms of my machine as disclosed herein, because within the purview of the broader phases of invention referred to above, I contemplate very considerable modification in the particular contrivances by which the various effective operations upon the concrete surface are secured. In so far as I am advised, I am the first to design a machine capable of subjecting a section of road or pavement to pressure and vibration throughout its entire width, and in this connection I destinguish from such machines as comprise primarily road width tampers vibrated at greater or less speed into and out of contact respecting the road surface; at the same time I distinguish between what may be characterized by impact action, and a definite contacting pressure over a predetermined period as transmitted to the surface aggregates.

Brief Description of Drawings.

In the accompanying drawings, similar reference characters denote similar parts, and:

Figure 1 is a front elevation of the left hand half of my machine.

Figure 1A is a corresponding elevation of the right hand half.

Figure 2 is a top plan view of the portion of the machine shown in Figure 1, and Figure 2A is a top plan view of that portion shown in Figure 1A.

Figure 3 is an end elevation looking toward the end of the machine having the main propulsion drive gearing and control levers.

Figure 4 is a sectional view through the machine at a point which shows more clearly the arrangement of the elliptic gears by which the pressure distributing member or apron is stepped forward in the travel of the machine.

Figure 5 is a sort of fragmentary view showing more particularly the main control lever and its operative connections leading to the elliptic gear clutches and the vibrator control clutch; also the connections to the propulsion gear devices.

Figure 6 is an end elevation showing more particularly the speed change and driving gears of the propulsion gear mechanism.

Figure 7 is a plan view of the slotted plate controlling the movement of the main control lever.

Figure 8 is a view showing more clearly the worm gearing which is enclosed in the reduction gear casing illustrated in other figures of the drawings.

Figures 9, 10 and 11 show diagrammatically the range of movement of the pressure and vibrating member as it steps forward, contacts with the road surface and raises from said surface.

Figure 12 is a sectional view through the planetary control clutch.

Specific Description of Machine.

Portable support.

The machine as illustrated in Figures 1 and 1A is complete, and likewise respecting Figures 2 and 2A considered together. My portable support for the pressure and vibrating member, or apron, comprises primarily a frame A made up of longitudinal angle beams 1, channels, or other fabricated units, together with the spaced front and rear trusses 2 and 3 respectively, suitably connected by plates 4 and braces 5 with the members 1. Journalled in a suitable manner at the rear portion of the frame A is a two-part propelling shaft 6 forming virtually an axle carrying the drive wheels 7 which are adapted to travel on the road rails or forms 8. Leading forwardly from the shaft 6 are the transverse shafts 9 located at opposite ends of the machine and geared to short gear shafts 10 at the front end of said machine, the latter shafts 10 forming axles suitably journalled in extensions 11 of the frame A and carrying the front wheels 7 operating like the rear wheels 7 on the road forms 8. Suitable bevel gears 12 are utilized to connect the shafts 6, 9 and 10, in a self evident manner.

Strike off and finishing float.

At the front of the machine and suitably

supported by suspension rods 13, as best seen in Figure 3, is mounted the strike off board or blade 14. This strike off may be raised or lowered and is adapted to have imparted thereto a reciprocating movement as the machine travels forwardly in its operation. The suspension rods 13 permit of variation in the operating adjustment of the strike off, by means of nuts 13^a, and vertically relatively to the machine and the road surface. Any suitable mechanism may be utilized to raise and lower the strike off, but I preferably utilize a cable device shown best in Figures 1 and 1^A at 15. The cable device 15 comprises a cable passing about small operating wheels 16 located at opposite ends of the machine, and secured to said wheels so that when the latter are operated by handles 17 projecting therefrom, longitudinal movement may be imparted to the cable. The cable is connected at its lower portion with a series of cam levers 17^a so disposed as to engage beneath laterally extending plates 18 on the upper ends of the suspension rods 13, of which a suitable number is provided. It will be quite clear that by turning either of the wheels 16 from the adjacent end of the machine, the cable 15 may be actuated to turn the cams 17^a so as to either raise or lower the strike off 14, at the will of the operator. The foregoing provides for the adjustment of the strike off to throw it into and out of action respecting the road surface operated upon. For reciprocating the strike off 14 there is provided adjacent to its middle portion a laterally extending pin 19 adapted to move into and out of a notch 20 of a drive link 21, one end of which is resiliently supported by a vertical swinging link 22 and spring 23 at the lower end of said link, the opposite end of the drive link 21 being connected with a lever 23 which is pivoted at 24 and extends from the front to the rear portion of the machine, said lever 24 has a drive member for the strike off and is operated by a pitman 25 with a pitman wheel 26 which is resiliently connected by a spring 28^a with the lower end of a vertical shaft 28, see Figure 8, forming a member of the speed reduction unit enclosed in the casing 29, seen best in Figures 1^A and 2^A. Obviously motion may be transmitted from the shaft 28 through the pitman rod 25 to the lever 23 and by the link 21 directly to the strike off 14. When the strike off is raised the pin 19 will be lifted out of the notch 20 of the link 21 and reciprocation of the strike off by the link 21 will be discontinued under such condition.

The finishing board or member is located at the rear portion of the frame in advance of the rear wheels 7 and is designated 30. This finishing member may be a board, float, piece of canvas, or the like. For driving it reciprocally I utilize means corresponding identically with the drive link 21, pin 19, and slot 20 features of the operating means for my strike off 14. Since these driving parts are the same, they are similarly numbered on the drawings. The purpose of the resilient drive established by the spring 28^a between the pitman 25 and shaft 28 is to cushion the shock incident to the sudden engagement of the pins 19 of the parts 14 and 30 with the driving links 21 previously described.

The supporting means for the finishing member 30 comprises parts which are substantially like those which support the strike off 14 including suspension rods 13, nuts 13^a, and cams 17^a. Likewise a cable device 15 corresponding to that previously described is employed for the raising and lowering of the finishing member 30 by a substantially identical operation.

Pressure and vibrating means.

As before premised, the pressure member is designed to exert its working pressure throughout its whole area, upon a comparatively large portion of the surface of the paving being constructed, and for the entire width of the said paving, over which my machine travels longitudinally. My pressure member comprises, as seen best in Figure 3, an angle iron frame 31 which has secured to the under side thereof bars 32 of wood, or the equivalent, the said bars being spaced apart so as to permit surplus water and cement, forced through the pressure member by the operating pressure and vibration thereof, to escape through the spaces between said bars. The pressure member is generally designated at B and includes the parts 31 and 32 described. To support the pressure member B I utilize levers 33 arranged in pairs at intervals in the length of the machine, the said levers being hung from the equalizing levers 34, one of which is provided for each pair of levers 33, the connections between the levers 33 and the pressure member B, and the equalizing lever 34 having pivotal connections, being designated 35. The equalizing levers 34 are pivoted to standards 36 and are resiliently supported by means of coiled springs 37. The standards 36 are carried by cross supports 38 which are of wood and possessed of certain resiliency in no way interfering with the transmission of vibratory impulses caused by vibrating means carried by the levers 34. It is notable that the levers 33 of each pair are connected by a yoke 39, said yoke in conjunction with the lever 34 and the lowermost pivotal connections 35 compelling a parallel motion of the pressure member B in operation. A series of eccentrics 40 are provided longitudinally of a driven shaft 41 and engage

the yokes 39 for actuation of the latter to cause the pressure member B to move forwardly and downwardly upon the surface aggregates of the pavement to be finished, engage in contact with said aggregates, and after a predetermined time become raised from the road surface, moved rearwardly, upwardly, and again forwardly and downwardly into engagement with the said surface. In other words, the pressure member B has a sort of forward stepping movement, during which time, as will later be described, the machine has a bodily forward movement that may be interrupted slightly only when its weight is carried by the pressure member B rather than its traction wheels. Owing to the method of connecting the parts 32, 33, 34 and 39, establishing certain linkages between said parts, the peculiar stepping movement of the pressure member is obtained and by proper designing of these connections. the forward end portions of the bars 32 of the pressure member B may be caused to lift from the road surface before the body portion of the said bars, so as to eliminate tendency of suction of the pressure member B as it separates from or moves from contact with the road surface.

It is evident that by reason of the mounting of the pressure member B and the mode of operating the same, this member may so engage with the road aggregates as to bear firmly downward thereon. In fact in practice, the action of the pressure member B is so positive and its arrangement in relation to the tractive areas of the wheels 7, is such that when the pressure member engages the aggregates it is capable of lifting very slightly substantially the whole weight of my machine. In this way I utilize such weight to assist in obtaining the proper pressure upon the surface aggregates, and to be supplemented by the action of vibration of the pressure member, in order to compact and vibrate the aggregates in the desired manner until the proper surface has been formed at the predetermined required grade.

For vibrating the pressure member B I mount upon the equalizing levers 34 a series of rotating weights 42, said weights being disposed in pairs and carried by weight shafts 43 mounted in suitable bearings on the levers 34. The shafts 43 are geared together, as shown at 44, so as to maintain the weights 42 in proper relation such that as they revolve they will be balanced in a horizontal direction and unbalanced in a vertical plane. Under the above conditions the weights 42 tend to transmit vibratory motion to the levers 34, and parts supported by said levers, including principally the pressure member B in up and down directions only.

It being understood that the stepping movement, so to speak, of the pressure member B is effected by the driving of eccentrics 40 on the shaft 41, the actuating means for said eccentrics will now be described. The said actuating means are of peculiar construction. In order that the motion imparted to the pressure member B may be relatively slow, whilst said member is in engagement with the road surface and fast as it lifts from said surface and travels to make renewed engagement therewith. The shaft 41 is shown in Figure 4 as carrying an elliptic gear 45. Two or more of said gears are mounted on said shaft and are arranged to mesh with corresponding gears 46 upon a drive shaft 47. The shaft 47, as seen in Figure 8, is driven by the speed reduction gear set, including the gear and worm parts 48, 49, 50 and 51, from the engine C which is suitably supported upon the frame A of my machine, the reduction in the speed being such as to preferably operate the shaft 47 at 3 R. P. M. This is a slow motion, the time to be transmitted to the elliptic gears 46 and 45 and to the shaft 41 which is the driven shaft directly operating the pressure member B for its stepping and progressing movement. The rotary weight shafts 34 are driven by a high speed chain 52 connecting one of the shafts 43 with the shaft 53 of the gear set shown in Figure 8, and which is enclosed in the casing 29 previously referred to. A suitable friction clutch 54 is utilized to connect the shaft 53 and the drive wheel for the chain 52 to transmit motion to the revolving weight shafts 43. The vertical shaft of the speed reduction gear set of Figure 8, previously described as 28, is the shaft also hereinbefore set forth as the driving means for the lever 23 which operates to reciprocate the strike off 14 and the finishing float 30. Normally the elliptic gears 46 are loose on the shaft 47 and may only be thrown into operation by shifting suitable clutches 55 and 56 to connect the gears so as to be driven from the shaft 47.

Propulsion means for machine.

The propelling of my machine forward and backward is effected through the drive shaft 57 which is operated in any suitable way from the engine C under the control of a friction clutch 58, adapted to be thrown in to enable driving of the traction wheels of my portable support, and to be thrown out to discontinue the drive and permit the machine to remain stationary. The drive gearing from the shaft 57 to the shaft 9 by which the axle shafts 6 and 10 are operated, is best shown in Figures 6 and 7, and comprises the speed changing clutch member 59 movable upwards to engage the high speed gear 60, and downwards to engage the low

speed gear 61, the parts 59, 60 and 61 being carried by a vertical shaft 62 on which the gears 60 and 61 are loose and the member 59 fixed. The shaft 62 is adapted to drive, through its bevel gear 63, the larger bevel gears 64 and 65 loose on the shaft 9 previously described. A forward high speed clutch member 66 on the shaft 9, is adapted to connect said shaft with the gear 65, and a reverse clutch member 67 is adapted to connect the gear 64 with the shaft 9. The members 66 and 67 are alternately engageable with matching jaw clutch members of the gears by actuation of clutch levers 68 connected together by a link 69, one of the levers 68 being connected by a link 70, see Figure 6, with the main controlling lever 71.

Lever controlling mechanism.

The lever 71 is mounted for suitable cooperation with a slotted control plate 72, see Figure 7, said lever 71 having a handle at its upper end and being pivotally connected between its ends, as shown at 73, with the slide rod 74, seen best in Figure 5. The lower end of the lever 71 is adapted to operate in a socket 74 in the adjacent casing 75, said socket forming a fulcrum for the lever to facilitate various shifting operations thereof. The slide rod 74 is connected by levers 76 with the clutch members 55 and 56, and the fulcrum of one of the levers 76 has a fixed arm 77 connected by a link 78 with the clutch lever 79 by which the friction clutch 54 is thrown in and out.

As shown in Figure 5, the rod 74 is connected by a bell crank lever 80 with a pull link 81 attached to a rocker arm 82 on a shaft 83, see also Figure 6, and said shaft 82 carries a part adapted to lift and lower the double jaw clutch member 59, previously described.

The friction clutch 58 by which the power plant is connected with the shaft 57 of the propulsion mechanism, is controlled by a rod 84 provided with a handle adjacent to the lever 71. The clutch member 58 forms a part of a planetary gear set involving a three to one gearing, preferably though not necessarily, by which motion is transmitted from the power plant to the shaft 57 by shifting the planetary gear devices by means of a rod 85 equipped with a handle adjacent to the lever 71. Regular and normally available forward speeds of 3 feet per minute and 16 feet per minute, and a reverse speed of 16 feet per minute may be changed to travel at speeds of 9 feet and 48 feet per minute forward and 48 feet per minute rearward. I have designated the speeds which I have preferably employed myself, but of course, mere change in gear ratios permits alteration of these selective speeds, and I may reasonably vary the same dependent upon the size of the machine, character of work, and possibly other considerations which may arise, and which greater experience than I now have in the use of my machine may warrant or render expedient.

Miscellaneous features.

I note that Figure 7 illustrates the high speed, low speed, reverse and neutral positions of the lever 71.

There is shown in Figure 2A a plurality of openings in the disk 23 by which the pitman rod 25 is operated enabling adjustment of the connection between said parts to vary somewhat the throw of the crank pin so that the movement of the strike off 14, and likewise the movement of the finishing member 30 may be increased or decreased at will.

In looking at the machine from the front, it is to be noted that the pressure member B is curved to conform with the contour of the desired finished road surface, as known to be a requirement, to those versed in the art.

The number of eccentrics 40 and yokes 39 with corresponding connecting parts may be changed depending upon the size of the machine, which of course is required to correspond with the width of the particular road operated upon, at least preferably so. In the present construction of my machine, my pressure member B is so designed that it makes a forward step of ten inches in each cycle of its operation. This is not necessarily a fixed feature of my design for obvious reasons. Owing to the formation of my elliptic gears, I maintain the pressure member B in contact with the concrete aggregates of the road surface for a period of substantially fourteen seconds, whereupon the member is lifted and six seconds are consumed in its movement and the time of successive engagement with the road surface. Under these conditions, for approximately two-thirds of a complete cycle of operation of the pressure member, said member is in contact and exerting pressure and vibration upon the road aggregates to bring them toward the point of finished road surface construction. The whole cycle of movement of the pressure member in contact and out of contact with the road surface consumes a little less than twenty seconds, so that there are some three cycles, these adapted to be increased to some four cycles by speeding up the motor of the power plant. By way of example, I might state that due to the weight of my present machine the approximate unit pressure on the road surface may reach 325 pounds per square foot. The size of the revolving weights which do the vibrating work is such that they set up a force, by centrifugal action, equivalent to some 90 pounds per unit, or a total of 450 pounds, transmitted by the five units to the pressure member and

acting on the road surface while the pressure is being exerted by said pressure member.

GENERAL OPERATION OF MACHINE.

My finishing machine is of course customarily operated in conjunction with a paving machine which mixes and deposits freshly mixed concrete aggregates upon the sub-grade of a road or a pavement. The paving machine progresses as the concrete is laid, and my finishing machine operates upon the aggregates after they have been distributed to the sub-grade, the purpose of the machine being of course to produce by mechanical treatment of the aggregates, a denser and stronger concrete, with the aggregates so disposed in the bed of concrete that a superior wearing surface is assured. In the use of the machine a very "dry mix," something which is deemed highly desirable by engineers of road construction, may be availed of, the pressure and vibration of my pressure and vibrating member having a tendency to bring to the surface surplus water and grout enabling a good finish to be obtained.

My machine being in position over the road-bed and fresh aggregates having been deposited thereon, the strike off 14 and finishing float 30 are raised to their inoperative position, if not already so adjusted. The machine is now ready to be started into action, for which purpose the operator will move the lever 71 to the right, as shown in Figures 6 and 7, shifting it from its midway neutral position. This preliminary causes a sliding of the slide rod 74 so as to engage the jaw clutches 55 and 56, putting into action the elliptic gears 46 and 45, and thereby starting the movement of the pressure member B. Simultaneously with the sliding operation of the clutch members 55 and 56, the clutch lever 79 for the friction clutch 54 is actuated to thereby start the transmission of motion to the vibrator shafts 43.

The above movement of the lever 71 simultaneously with the shifting of the clutches referred to, causes the operation of the bell crank 80 and rocking of the clutch shaft 83 to engage the double clutch member 59 with the coacting clutch member 61 which does not yet operate anything because the shaft 57 is still idle, the drive not being transmitted thereto until later. Next the operator moves the lever 70 to the right to occupy the low speed extension of the slot of the plate 72 in Figure 7, thereby engaging the jaw clutch member 67 with the gear 64, through the actuation of the link 70 by lever 71.

The machine is now set with the pressure member B in motion and the vibrating devices also in action, together with the drive gearing adjusted to impart slow speed forward at approximately three feet per minute. The next operation is to render operative the strike off 14 and the finishing float 30, and this is done by actuation of the handles 17 by which the cables 15 are adapted to be operated for the said respective parts 14 and 30, the latter being thus lowered to bring their pins into engagement with the driving links 21, which thereupon start the reciprocation of the strike off 14 and the finishing member 30. The operator now pulls upon the handle of the rod 84, and engages the planetary clutch which causes the motion of the engine to be transmitted to the shaft 57 and from said shaft to the wheel driving shafts and axles 9, 6, and 10, thereupon the machine slowly progresses forwardly at the rate stated above, and during its progression the pressure member B will be in engagement with the concrete for two-thirds of the cycle of its pressure and vibrating contact with the concrete, lifting and stepping forward movement to start a successive cycle, in a manner which will be readily understood from the foregoing description. I have designed my machine so that preferably the forward movement of the pressure member B and the stepping forward of the machine are practically the same. Under these conditions, there is no slippage or relative scraping or grinding action between the member B and the concrete surface; to the contrary, the pressure member B acts with a straight downward pressure, increased somewhat in the proportions outlined before herein by the vibrations which are imparted thereto by the revolving weights 42. Obviously the tremendous pressure exerted by the machine and the vibration of the pressure exerting member, has a very efficient action to create a dense solid concrete bed and surface from which the surplus water and mortar is squeezed and adapted to pass off by flowing to the sides of the road, owing to the curved contour of the latter. Under actual test my machine is effective to strike off the concrete properly when the strike off board 14 is disposed one-half inch above the concrete, and the action of the pressure and vibrating means will bring down the surface to the proper grade. The effect of the finishing member 30 is to seal the surface with the grout which is brought to the surface by the pressure and vibrating mechanism.

The operation of stopping the machine is a reverse of that previously described, the operator taking care to throw out the planetary clutch 58 first, by operating the rod 84. Therefore, the lever 71 may be actuated to discontinue the operation of the pressure member B and vibrating mechanism, whereupon the lever may be shifted to its reverse position as shown in Figure 7, in which the high speed clutch 59 co-operates with the gear 60, Figure 6, and the reverse

gear 64 is thrown into action by the effective operation of the clutch member 67 in co-operation therewith. The machine will then travel at higher speed, as for instance, say sixteen feet per minute as per my design, back to a desired starting point and the first mentioned operation may be put into effect by proper shifting of the lever 71 again.

The reversal of the machine compels the rendering of the pressure member and vibrating devices inactive for the time being, and this is an advantageous co-operation of the parts for evident reasons.

In moving the machine from place to place, or a considerable distance, or in other words along the track which is comprised of the road rails or forms 8, the high speed gearing may be availed of by proper adjustment of the lever 71, under which conditions of course the high speed clutch member 66 will be thrown into action.

If even higher speeds than those above set forth are required, I may resort to the operation of the rod 85 by its handle adjacent to the lever 71, and this will put into action "the planetary three to one gear" whereby all speeds are multiplied by three. This would enable me, in the example given, to move forward at nine feet per minute and forward and rearward at forty eight feet per minute. The particular advantage in the use of the high speed planetary gearing is that it is available for striking off at a more rapid rate than usually necessary, and the foregoing also applies to the finishing phase of operation. In other words, the machine could be used for striking off and finishing work alone by the highest speed action.

At or near one end of the two part shaft 6 is a clutch 86 which disconnects one end of the shaft from the other. The clutch is operable by a suitable lever near the operator. By shifting this clutch the drive on one end alone of the machine may be produced in forward or reverse directions, and the machine thus properly adjusted crosswise of the work.

Certain control lever mechanism may be in duplicate at opposite ends of the machine so the progress of the latter may be regulated from either end, as conditions require.

The members 33 have the additional openings at their upper ends so that an adjustment involving the lowering of the pressure apron approximately 4 inches may be obtained, an arrangement desirable to prepare a concrete surface for the reception of a brick pavement. All that is required is the shifting of the bearing pins into the proper openings.

In respect to the planetary gear and clutch, it is notable that the same is especially designed for the particular service of my machine. The clutch is of the expansion ring type and very powerful. One lever is used to control the gearings, and the clutch and the drum brake are interconnected. The forward movement of the lever will throw out the clutch and tighten the drum brake, stopping the drum. The power is then transmitted through the gearing in a three-to-one ratio without changing the direction of rotation.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a concrete finishing machine of the class described, the combination of a pressure apron adapted to be disposed over the road surface, means for subjecting said apron to pressure throughout its whole area at one time and while the apron is in contact with concrete aggregates, and means for vibrating the apron while subjected to such pressure.

2. In a concrete finishing machine of the class described, the combination of a pressure apron having a relatively large surface contacting area adapted to be placed in contact with a considerable surface area of concrete aggregates, means for subjecting the said apron to uniform pressure throughout its whole area at one time, and means for imparting bodily vibration to the apron throughout its whole area while under pressure.

3. In a concrete finishing machine of the class described, the combination of a pressure apron adapted to overlie and contact with concrete aggregates and possessing a considerable area for the distribution of pressure upon the said aggregates, and means for simultaneously subjecting the apron to pressure and to vibration over its entire area of operative contact while pressed upon with the concrete aggregates, whereby the pressure and vibrating action may be transmitted to the aggregates.

4. In a concrete finishing machine of the class described, the combination of a portable support adapted to travel over the subgrade concrete aggregates laid in the formation of pavement, a pressure apron of considerable area carried by said support and adapted to be disposed in contact with the surface aggregates upon the road, means for subjecting said apron to pressure and while under pressure vibrating it, a vibrating pressure action, and apron moving means together with means for advancing the portable support operating in synchronism therewith.

5. In a machine of the class described, the combination of a portable support adapted to travel over a roadbed, a pressure member carried by said support and disposed to contact with the surface of concrete aggregates upon the road, said member being adapted

to overlie a considerable portion of the aggregates at one time, means for pressing the said pressure member down on the aggregates and vibrating it at such time throughout its entire area, and means for advancing the pressure member progressively over the surface of the concrete aggregates for performing pressure and vibrating actions at one time but in successive order in respect thereto.

6. In a machine of the class described, the combination of a traveling support adapted to advance over concrete aggregates upon a road-bed, wheels adapted to support said support in its travel, a pressure member carried by said support, and operating means for said pressure member acting to cause such engagement with uniform pressure thereof on the concrete aggregates on the road that substantially the weight of the entire traveling support may be received on the pressure member.

7. In a machine of the class described, the combination of a support mounted on wheels and adapted to travel over concrete aggregates upon a road-bed, a pressure member of considerable area carried by said support and adapted to contact with said concrete aggregates, and means to move said pressure member into engagement with the concrete aggregates, maintain said engagement an appreciable length of time, disengage said pressure member from the concrete aggregates, and reengage said pressure member by successive actions.

8. A machine as claimed in claim 7, combined with driving means for the wheels of the support to move the same during the engaging and disengaging operations of the pressure member.

9. Means substantially as claimed in claim 7, combined with mechanism for vibrating the pressure member while engaged with the concrete aggregates.

10. Means substantially as claimed in claim 7, combined with mechanism for vibrating the pressure member throughout its whole area at one time and while in engagement with the concrete aggregates.

11. Means substantially as claimed in claim 7, wherein the last means set forth is characterized in that as it moves the pressure member into engagement with the concrete aggregates substantially the entire weight of the traveling support may be caused to be received on the pressure member and said weight thus transmitted to the concrete aggregates on the road-bed.

12. In a machine of the class described, a portable or traveling support adapted to move over a road sub-grade upon which are laid freshly distributed concrete aggregates, the said support being adapted to span the entire width of the sub-grade, a pressure apron carried by said support and likewise spanning the sub-grade so as to be engaged with the surface of the concrete aggregates throughout the whole width of a road being formed thereby, and means for subjecting said pressure apron to vibration and while vibrating pressing it throughout its whole area at one time into engagement with the concrete aggregates.

13. A machine substantially as set forth in claim 12, combined with wheels for supporting the same and enabling it to travel upon the road forms at opposite sides of the road, the pressure subjecting means being adapted to operate the pressure apron so that during its period of engagement with the road-bed aggregates a material portion of the whole weight of the machine may be transferred to the pressure apron from the said wheels.

14. In a machine of the class described, the combination of a portable support adapted to travel over concrete aggregates upon a road sub-grade, means for treating said aggregates carried by said support and comprising a pressure member, means for operating said pressure member to cause a step by step progressive movement thereof, during which movement said member engages and disengages itself in relation to the aggregates and applies pressure to the latter over a considerable area thereof.

15. Means substantially as claimed in claim 14, wherein the operating means for the pressure member is capable of transferring a material portion of the weight of the machine to the pressure member when the latter is engaged with the aggregates.

16. Means substantially as claimed in claim 14, combined with driving means for moving the portable support at a rate of speed corresponding with the speed of step by step progression of said pressure member.

17. Means substantially as claimed in claim 14, combined with driving means for moving the portable support at a rate of speed corresponding with the speed of progression of said pressure member, and means for vibrating said pressure member while in engagement with and under pressure down upon the concrete aggregates.

18. Means substantially as claimed in claim 14, combined with mechanism for imparting vibration to the pressure member during that portion of its cycle of movement wherein it is engaged and pressed down upon the concrete aggregates.

19. Means substantially as claimed in claim 14, combined with means for causing relatively slow movement of the pressure member while it is engaged with the concrete aggregates, and accelerated movement when it is disengaged from said aggregates.

20. Means substantially as claimed in claim 14, characterized in that the moving means for the pressure member comprises elliptic gearing operating to maintain the

pressure member an appreciable period of time in engagement with the concrete aggregates, shift said pressure member forward in its progression of its stepping movement at an accelerated speed to bring it into successive engagement with the concrete.

21. Means substantially as claimed in claim 14, characterized in that the moving means for the pressure member comprises elliptic gearing operating to maintain the pressure member an appreciable period of time in engagement with the concrete aggregates, shift said pressure member forward in its progression of its stepping movement at an accelerated speed to bring it into successive engagement with the concrete, combined with vibrating mechanism mounted upon the pressure member and operable to vibrate the same during the period of its engagement with the concrete aggregates.

22. In a concrete finishing machine of the class described, the combination of a traveling support adapted to operate over a road sub-grade having freshly laid concrete aggregates thereon, a resiliently mounted pressure apron upon said support, means for engaging and disengaging said pressure apron by the progressive forward movement with the surface aggregates on the road sub-grade, and means for controlling the movement of the pressure apron to maintain it in engagement with the concrete aggregates a greater time than consumed in bringing it into successive progressive engagement with said aggregates.

23. Means substantially as claimed in claim 22, combined with vibrating mechanism for bodily vibration of the pressure apron whilst in pressure engagement with the concrete aggregates, the operating means for the apron being adapted to subject it to pressure while it is in contact with the aggregates.

24. In a machine of the class described, the combination of a support adapted to travel over freshly laid concrete aggregates for finishing treatment thereof, a pressure member mounted on said support, means for bringing said pressure member into engagement with the aggregates, maintaining said engagement an appreciable length of time and simultaneously subjecting the pressure member to a substantial pressure, thereafter lifting the pressure member and causing successive engagement, pressure, and lifting operations, in regular cycles, and means for vibrating the pressure member during the portion of the cycle of its action aforesaid when pressure is applied thereto as it is engaged with the concrete.

25. In a finishing machine of the class described, the combination of a traveling support adapted to span a road-bed, a pressure apron for spanning said road-bed for engaging concrete aggregates thereon, means resiliently supporting the pressure apron upon the traveling support, vibrator shafts mounted upon said pressure apron, vibrating devices carried by said shafts for imparting their vibrations to the apron, and a prime mover connected with the apron to impart successive cycles of movement thereto in each of which cycles the apron is engaged with the concrete aggregates subjected to pressure transmitted to said aggregates, and disengaged from said aggregates, with driving connection from the prime mover to the operating shafts to operate the vibrating devices so that the vibrations thereof may act on the pressure member while in engagement with the aggregates.

26. In a concrete finishing machine, the combination of a travelling support, a pressure apron thereon, vibrating means for said apron, driving means for advancing the support including change speed gearing, and a prime mover common to said means, together with a controlling device for simultaneously controlling the operations of said means and operable to set said change speed gearing and at the same time render operative or inoperative the pressure member and the vibrating mechanism therefor.

27. In a concrete finishing machine, the combination of a travelling support, a pressure apron thereon, vibrating means for said apron, driving means for advancing the support, a prime mover common to said means, together with a controlling device for simultaneously controlling the operation of said means, combined with a strike off, moving means leading from the prime mover to said strike off and including a driving link, and means for raising and lowering the strike off, and a member carried by the strike off to engage the driving link when the strike off is lowered and become automatically disengaged therefrom when the strike off is raised.

28. In a finishing machine of the class described, the combination of a traveling support adapted to operate over a surface of freshly laid concrete aggregates, a finishing device for performing a finishing operation upon said aggregates and hung to move back and forth across the surface of said aggregates, driving means for said device including a driving link and a pin on the device interengaging said link, together with raising and lowering means for the device for disengaging and engaging said pin with the link respectively.

29. In a concrete finishing machine, the combination of a travelling support, a pressure apron thereon, vibrating means for said apron, driving means for advancing the support, a prime mover common to said means, together with a controlling device for simultaneously controlling the operation of said means, said driving means including gear-

ing adapted to be set for operation by the controlling means, and a separate device for causing operation of the gearing to effect the advancing movement and to discontinue such movement at will.

30. Means substantially as set forth in claim 26, combined with a clutch for connecting the gearing aforesaid with the prime mover to control the driving of the machine for effecting its travel, and for discontinuing such travel.

31. In a finishing machine of the class described, the combination of a traveling support, operating means for advancing said support in forward and reverse directions and including low speed gearing for the forward direction movement and high speed gearing for the reverse direction movement, concrete aggregate treatment mechanism mounted on the support, and a controlling device common to said treatment mechanism and said gearing for discontinuing operation of said treatment mechanism during rearward movement of the traveling support, and throwing the treatment mechanism into action during forward movement of the support.

32. Means substantially as claimed in claim 31, combined with a controlling device adapted to discontinue the movement of the support at any time during its forward or reverse travel.

33. In a finishing machine of the class described, the combination of a traveling support, a pressure apron, means supporting the pressure apron upon the support comprising sets of spaced relatively vertical levers pivotally connected with the apron, a horizontal equalizing lever pivotally connected with the vertical levers of each set and carried by the support and yoke connecting each set of vertical levers, a series of eccentrics operating on said yokes of the sets of levers, and driving means for said eccentrics whereby to operate the pressure apron to engage and disengage it from the concrete aggregates disposed below the support in such a way as to apply pressure to said aggregates.

34. A machine as claimed in claim 33, combined with vibrating devices mounted upon the said equalizing levers for communicating vibration therethru and through the vertical levers to the pressure apron.

35. A machine as claimed in claim 33, combined with vibrating devices mounted upon the said equalizing levers for communicating vibration therethru and through the vertical levers to the pressure apron, and gearing arranged to operate the eccentrics so as to cause relatively slow movement thereof during the time they are operated to exert pressure upon the apron, and accelerate said movement to quickly lift the pressure apron and bring it in a successive engagement with pressure and vibrating action upon the aggregates.

36. In a finishing machine of the class described, the combination of a traveling support, operating means for advancing said support in forward and reverse directions, concrete treatment mechanism mounted on the support, a strike off also mounted on the support, and special drive gearing for driving the support at low, forward, and high reverse speeds, for the use of the treatment mechanism, and higher speed, for the use of the strike off.

In testimony whereof I affix my signature.

GEORGE E. WEBB.