Nov 1, 1949. G. KIES 2,486,422

COMBINATION LONGITUDINAL MECHANICAL FINISHING MACHINE AND PLANE OF WEAKNESS DEVICE FOR CONSTRUCTING PAVEMENTS

Filed June 23, 1944 4 Sheets-Sheet 1

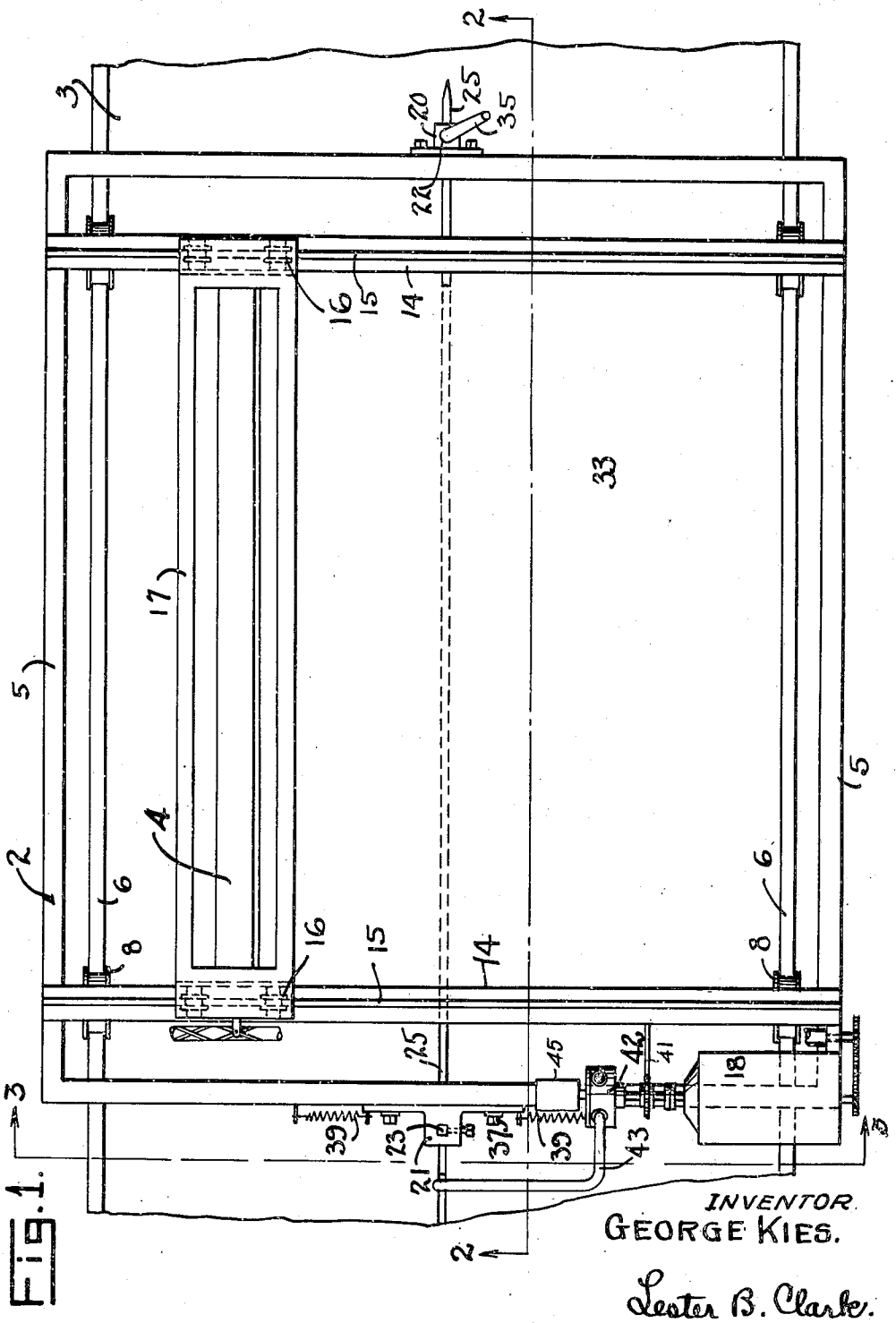


Fig. 1.

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4 Sheets-Sheet 2

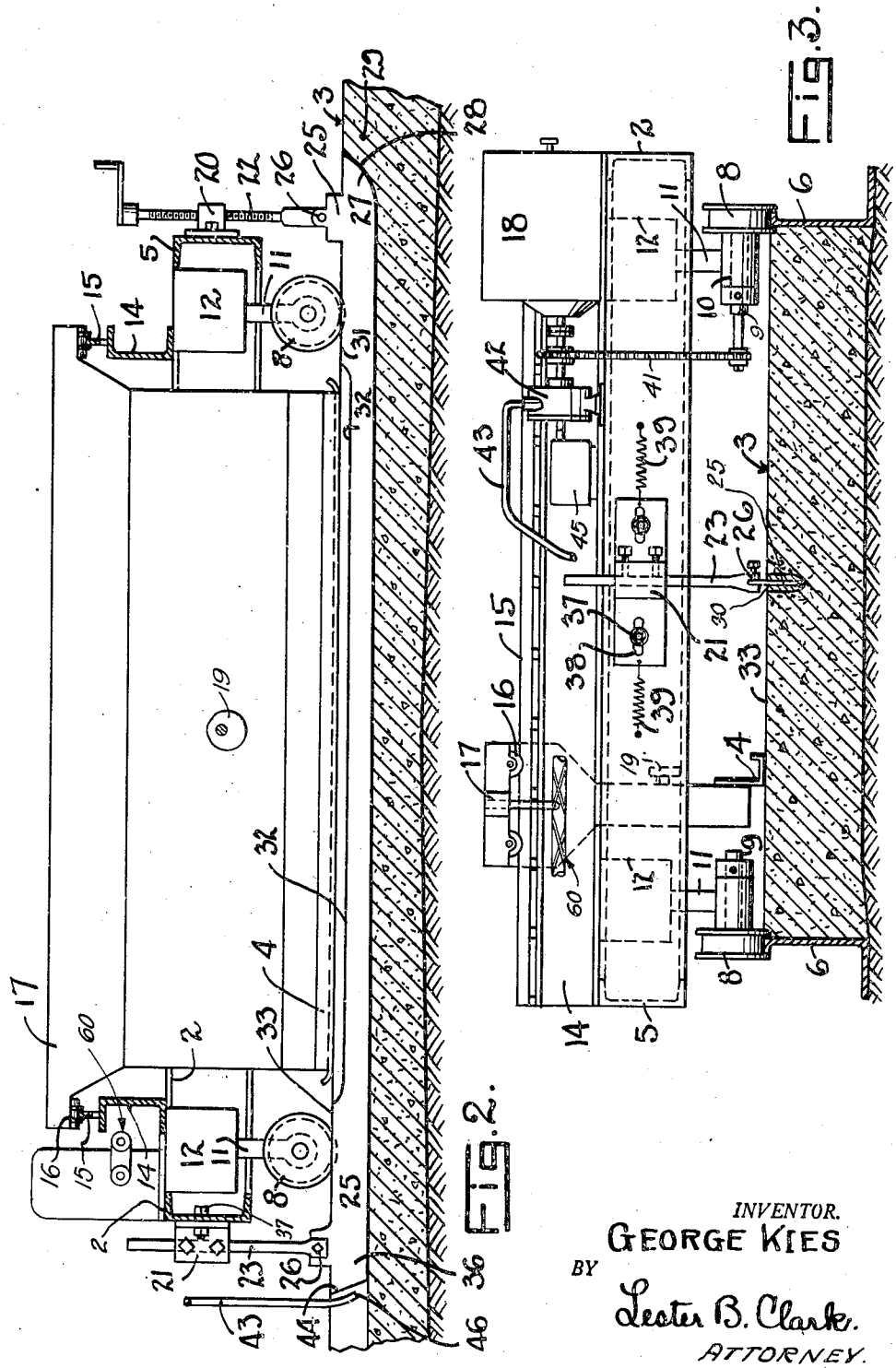


Fig. 2.

Fig. 3.

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Filed June 23, 1944 4 Sheets-Sheet 3

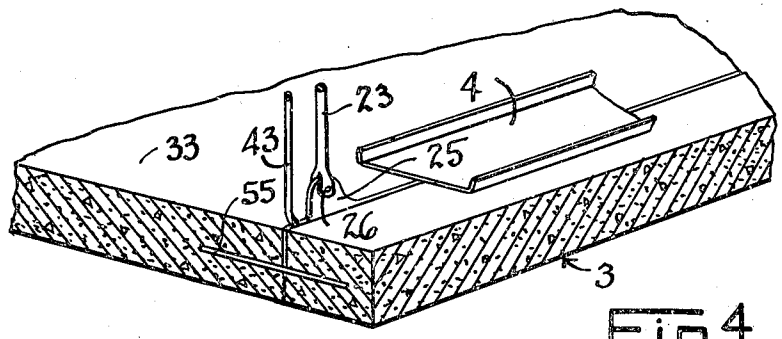


Fig. 4.

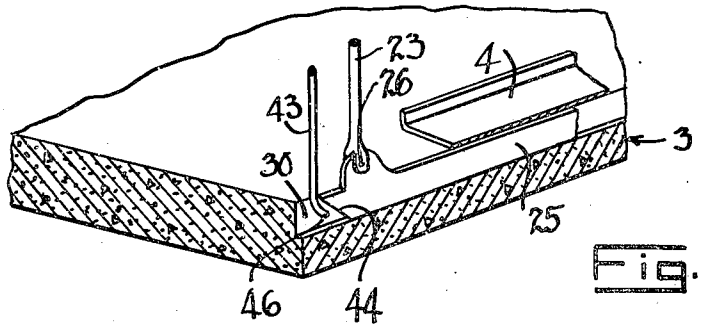


Fig. 5.

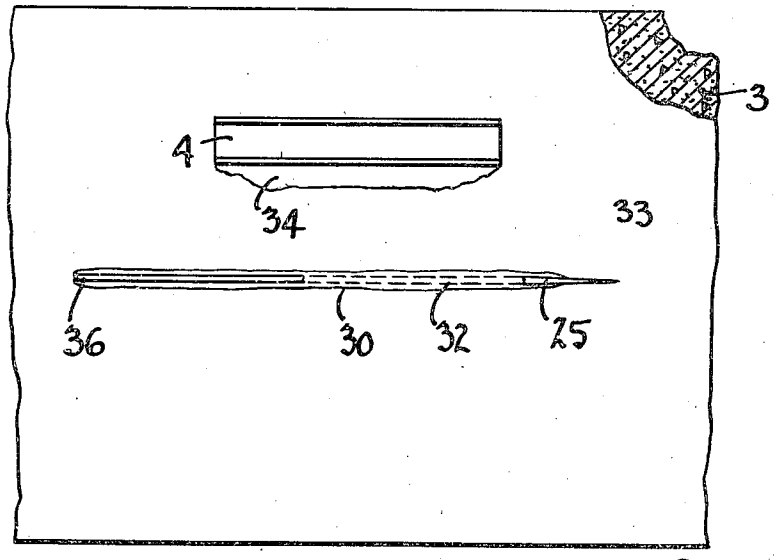


Fig. 6.

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Filed June 23, 1944 4 Sheets-Sheet 4

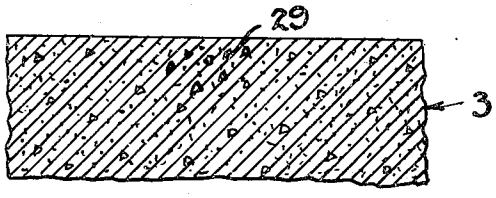


Fig. 8.

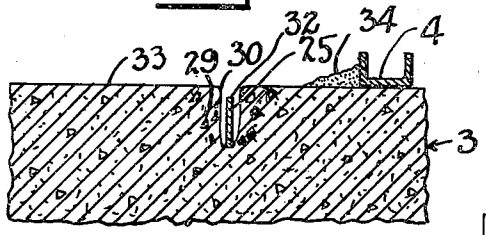


Fig. 9.

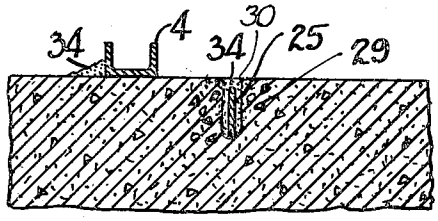


Fig. 10.

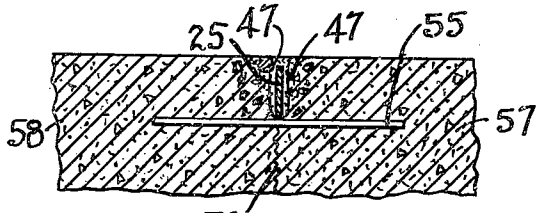


Fig. 11.

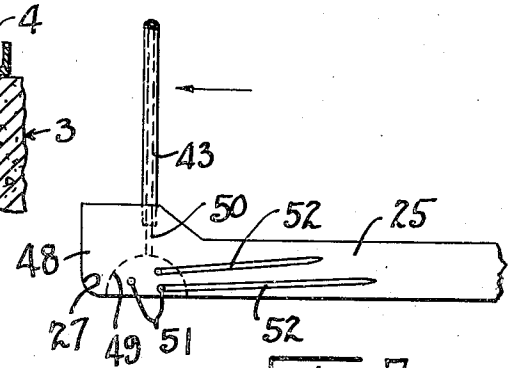


Fig. 7.

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Patented Nov. 1, 1949

2,486,422

UNITED STATES PATENT OFFICE

2,486,422

COMBINATION LONGITUDINAL MECHANICAL FINISHING MACHINE AND PLANE OF WEAKNESS DEVICE FOR CONSTRUCTING PAVEMENTS

George Kies, Austin, Tex.

Application June 23, 1944, Serial No. 541,738

6 Claims. (Cl. 94—39)

1

The invention relates to a combination longitudinal mechanical finishing machine for concrete pavements and the like wherein a plane of weakness can be created simultaneously with the finishing operation. In the forming of concrete pavements, slabs and the like, machines have been designed for mechanically finishing the surface, but where such slabs have substantial length or width and are disposed upon the earth's surface or foundation, considerable difficulty has been encountered in creating a plane of weakness in the pavement or slab so that a crack will occur to permit expansion and contraction of the slab.

In some instances, strips of material have been positioned in the slab so as to create a plane of weakness and various other expedients have been attempted. The present means and method, however, contemplates that a bar can be drawn through the concrete after it has been laid and before it sets so as to push aside the particles of aggregate so that the groove thus formed by the blade will fill with a slurry of cement and water which, of course, does not have a strength equal to or equivalent of the concrete obtained by the bonding of the aggregate together. The creation of such a groove filled with a cement and water slurry, therefore, tends to weaken the plane of such groove so that in this manner a plane of weakness is created without adding any strip of material to initiate the plane of weakness.

The present machine and method contemplates that the blade for creating the plane of weakness can be utilized as an attachment for a standard type of finishing machine and is so arranged that the float of the finishing machine may pass over the plane of weakness blade intermediate of its ends and continually fill the groove being formed by the blade so that, after the blade passes, the groove will contain a cement slurry in the area where the blade has displaced the aggregate.

It is one of the objects of the invention to provide a combination finishing and plane of weakness machine where the finishing and creating of the plane of weakness operations are conducted simultaneously.

Another object of the invention is to provide a combination finishing and plane of weakness machine which is exceptionally light in construction so as to avoid warping and distortion of the side forms for the paving structure.

Another object of the invention is to provide a method of constructing concrete slabs where a longitudinal plane of weakness may be created in the concrete while it is being finished and still in plastic form.

2

Another object of the invention is to provide a finishing machine for concrete pavements and the like wherein the supporting wheels have a movable connection to the frame so that the support of the frame relative to the wheels may be had by hydraulic pressure, so that equalization of the weight of the frame on the several wheels will occur, which results in maintaining the finishing machine in a level position irrespective of slight irregularities in the forms upon which the machine is traveling.

Still another object of the invention is to provide a blade for finishing machines whereby a plane of weakness is created in the concrete being finished.

Still another object of the invention is to provide a means and method of creating a plane of weakness by introducing a fluid material between adjacent faces of the concrete material, which are to form a plane of weakness so as to discourage bonding of such faces as the concrete sets.

Still another object of the invention is to distribute a fluid material along a plane in a concrete structure as it is being formed, so as to create a plane of weakness.

Yet another object of this invention is to provide a method of constructing concrete slabs in which a transverse plane of weakness may also be created in the concrete while it is being finished and it is still in plastic form; the structure for accomplishing this object being adaptable for installation on a machine of the class described.

A still further object of the invention is to provide a machine and method whereby a combination finishing and plane of weakness machine is caused to travel on a level bed while performing both the finishing operation and the operation of creating a plane of weakness.

Other and further objects of the invention will be readily apparent when the following description is considered in connection with the accompanying drawings, wherein:

Fig. 1 is a top plan view looking down on a diagrammatic illustration of the machine embodying the invention.

Fig. 2 is a side view illustrating certain parts in section and taken on the line 2—2, Fig. 1.

Fig. 3 is an end elevation illustrating the arrangement, looking at the rear of the machine and taken along the line 3—3 of Fig. 1.

Fig. 4 is a perspective broken sectional view of a slab of concrete illustrating the manner in which the finishing float passes over the plane of weakness blade.

Fig. 5 is a view similar to Fig. 4, with the concrete removed, to illustrate the manner of distributing the anti-bonding material.

Fig. 6 is a top plan view looking down on the surface of the slab being finished and illustrating the float and plane of weakness blade.

Fig. 7 is a side elevation of a modified form of the plane of weakness blade, which illustrates one mode of distributing the anti-bonding material.

Fig. 8 is a section of the concrete slab ahead of the finishing machine.

Fig. 9 is a broken sectional view of the concrete where the plane of weakness blade is traveling in a groove formed thereby and the float is approaching the groove.

Fig. 10 is a broken sectional view of the concrete slab where the groove being formed by the plane of weakness blade has been filled with cement slurry by the finishing float.

Fig. 11 shows the plane of weakness blade passing over a transverse dowel.

Referring to Fig. 1, a frame 2 is shown as substantially rectangular and slightly wider than the pavement slab 3, which is to be laid. It may be, however, of any desired length depending upon the length of the float 4 which is to be used. This frame 2, as best seen in the side elevation in Fig. 2, may be made of channels 5, or any suitable structural member. This frame 2 is suitably supported upon the rails or side forms 6, which are arranged to support and form the slab 3. These forms or rails may be of any desired shape, but are seen in Fig. 3 as of L configuration.

A plurality of wheels 8, each mounted on a shaft 9, carried in a bearing 10, serve to support the frame 2. Each of the bearings 10 is in turn supported by a strut 11, which has a piston on its upper end arranged for sliding movement in the cylinder 12. As seen in Figs. 2 and 3, there are four such wheels and four cylinders. A suitable piping may be used to connect the four cylinders so that a single source of hydraulic pressure can be utilized to maintain a pressure of a like amount in each of the four cylinders. The connecting of all of the piping together is similar to the equalizing of the pressure on four hydraulic brakes on automotive vehicles. In the present instance, however, the purpose of equalizing the pressure on the struts and the wheels is to uniformly support the frame in a level position, because if the frame or trackway 6 should be slightly uneven and say depressed somewhat at a certain point, then as the wheel 8 moved downwardly relative to the frame 2, there would be a reduction in the load of the frame on that wheel.

The pressure on the other wheels would be increased and the hydraulic liquid would then flow into the cylinder, where the wheel had moved downwardly, lifting the frame somewhat in order to balance the load. It has been found that with an arrangement of this sort, the frame 2 moves along the trackway in the substantial level position irrespective of irregularities in the trackway, so that as a result thereof, the surface being finished on the concrete is level, even though there may be irregularities in the form or trackway. The particular piping and master cylinder have not been shown in the drawing because it is believed that such structures are well known and the novelty consists in the application of such structure to the operation of supporting a frame in a level or equalized position.

The frame 2 carries the cross channels 14, both front and back, upon the longitudinal centers of the frame, and these cross beams each carry a rail 15, which receives the wheels 16 for supporting the float carrier 17. This construction is best seen in Fig. 2. The float is thus mounted for transverse movement on the paving slab 3, so as to carry the float back and forth across the pavement to perform the finishing operation. Any suitable mechanism can be utilized to move the float and its carrier laterally, or it may be manually moved; the driving unit 60 for this purpose as best indicated in Fig. 1 being any conventional device designed to move the float carrier 17 back and forth along the rails 15 from one side of the frame 2 to the other side thereof.

The float 4, as best seen in Fig. 3, is L-shaped in cross section and suitably affixed to the carrier 17. It is usual practice to provide a vibrator 19 of a sort connected to the float so as to assist in its finishing operation and to work the slurry of cement and water into a smooth surface due to such vibration and movement.

The movement of the finishing machine and the float can be accomplished by any suitable chain or shaft drive arrangement 41 from a motor 18 mounted on one corner of the frame, as seen in Fig. 1. Such drive connections have not been shown in great detail in the drawing since in some instances, the finishing machine is towed by some other power mechanism ahead of it.

In order to create a plane of weakness in the concrete simultaneously with the finishing operation, an attachment for the finishing machine is best seen in Fig. 2, where the front bracket 20 and the rear bracket 21 serve to support the spindle 22 and the support rod 23, respectively. These brackets are suitably supported on the frame 2, and the back bracket 21 may be slidable transversely of the frame as seen in Fig. 3 so as to permit alignment of the attachment with a predetermined line or plane extending along the concrete.

The rod and spindle serve to support a plane of weakness blade 25, which is shown as pivoted at 26 to the spindle and rod, respectively. This blade 25 is shown as having a substantially length with the forward end 27 rounded so as to plow through the concrete, as at 28, causing the particles 29 of aggregate to be pushed aside, as seen for instance in Fig. 9. In this manner, a groove 30 is formed by the plane of weakness blade as the finishing machine travels along the concrete. Actually, however, this groove may be at least partly filled with a slurry composed of cement and water which remains when the particles 29 of aggregate are pushed aside by the blade 25 plowing along the concrete. This blade 25 is shown as being of substantial length and extending beyond the rear of the frame 2 for a particular purpose, namely, that the movement of such a long blade insures that the particles 29 of aggregate will be more or less gouged out of their position in the path of the blade, and pushed aside, so that when settling takes place subsequently, the groove 30 is filled with only hardened cement and water, from which the aggregate has been removed, with the result that a weakened plane has been created along the groove.

Another reason for desiring to extend the blade for a substantial length is so that the float may be used for the filling of the groove 30 and, to this end, the upper surface 31 of the plane of weakness blade is recessed as at 32 in Fig. 2, so

that the surface **32** will be slightly below the elevation of the surface **33** of the slab **3**, which is being finished. The upper surface **32** is thus best seen in Figs. 9, 10 and 11 as being below the finished surface **33**. It is well understood that as the float moves transversely of the pavement, any excess material on the surface will accumulate as a wave **34** of slurry in front of the float **4**. Such a wave is seen in Fig. 9. When the float **4** passes across the groove **30**, the wave of slurry will flow into the groove and substantially fill it, as seen in Fig. 10, where the float is shown as having passed over the groove **30** and having filled the groove with the wave **34** of slurry. Such slurry is, of course, quite liquid, and will fill in around the blade **25**, so that as the blade passes on, the groove will remain filled with slurry, but there will be insufficient agitation or pressure to cause the particles **29** of aggregate to fall back into the groove. As a result of this operation, a considerable portion of the thickness of the slab of concrete will be made up merely of slurry with no aggregate in it, which is well known to be weaker than a concrete slab having aggregate therein. As a further result of this operation, therefore, the slab of concrete is weakened along the plane of the groove **30** where the blade has traveled, because of the fact that the blade has displaced the aggregate and there is no bond with any aggregate in the grooved area in the finished concrete. It seems obvious that the front end of the blade **25** may be raised and lowered by turning the handle **35** thereon, but, generally, the rear end of the blade is once adjusted by tightening the bolts **61** and the bracket **21** against the rod **23** and then is left fixed as to elevation so that it will result in a groove of the desired depth, depending upon how weak a plane is desired.

In order to allow the rear end **36** of the blade **25** to align itself and follow the machine around curves, the bracket **21** is shown in Figs. 1 and 3 as having a limited sliding lateral movement with respect to the cross beam **5** of the frame, by having the bolts **37** arranged in slots **38** and by providing the opposed springs **39** to exert an equal opposite lateral tension on the bracket, and, consequently, there is an equalization of the position of the blade relative to the concrete slab.

Figs. 1 and 3 show that the motor **18** has a pump **42** connected therewith and to be driven thereby, and it is intended that a suitable fluid or liquid will be picked up from a suitable container **45** and discharged through the pipe **43** under pressure. Fig. 2 shows the pipe **43** as being disposed in alignment with and directly behind the rear edge **44** of the blade **25** and with the nozzle portion **46** thereof arranged in the groove **30** directly behind the rear edge of the blade. It seems obvious that, if a suitable fluid is discharged from this pipe into the groove, it will be distributed against the faces **47** on the opposite sides of the blade, which faces constitute the contacting surface or area of the slurry which has been worked into the groove **30**. The purpose of introducing a suitable fluid in this manner is to distribute it on the faces **47** which will come together behind the blade as the blade moves along the groove. In actual practice, it may be found that a lubricant or any non-setting material, such as an emulsion, is suitable for this purpose. For instance, a grease has been so discharged and it tends to discourage bonding of the faces on the one hand and insures a definite plane of weakness so cracking of the slab will occur after the slab is set and is subjected to the stresses of operation and construction.

Fig. 7 shows another form of distributing the anti-bonding material, wherein the forward end **48** of the blade **25** is provided with a central cut-out area or pocket **49** which is connected by a passage **50** to the pipe **43**. This pocket has a plurality of openings **51** extending outwardly through the sides of the blade and, if desired, distribution grooves **52** may extend along the side of the blade in the form of longitudinal recesses into which the anti-bonding material will be wiped as it is extruded or discharged from the openings **51**. In this manner, a complete distribution of the anti-bonding material will be obtained.

Figs. 8, 9, 10 and 11 show the various steps of creating the plane of weakness by passing the blade **25** through the concrete, and Fig. 12 shows a transverse dowel rod **55** as spanning the plane **56**, which will be the plane of weakness after the concrete sets. Dowel pins may be placed in this position so that the concrete slab will be bonded therewith, and while the concrete will be permitted to crack along the plane of weakness due to expansion and contraction, the two portions **57** and **58** which then make up the slab will be held closely together due to the bonding of the concrete with the dowel rod **55**. Any desired number of these rods may be provided at spaced intervals along the concrete.

If it is desired to form a transverse plane of weakness across the slab **3**, it seems obvious that a short plane of weakness blade could be drawn transversely across the slab **3** in any desired manner. For instance, it could be hooked to the float carriage and moved transversely of the slab by any conventional means. Such blade could also be hooked to the float and fitted thereunder. The longitudinal movement of the machine would have to be stopped while the float made a transverse trip. If desired, the longitudinally extending blade hereinabove described could be notched where the transverse blade is to cross. The transverse blade could also be attached by a movable lever so as to be turned upwardly as it engaged the side form.

Broadly, the invention contemplates a means and method of finishing a concrete slab or pavement simultaneously with the creating of a plane of weakness, either longitudinally or transversely, or both longitudinally or transversely, of the pavement, and will provide a machine which will accomplish a level or horizontal finished surface irrespective of irregularities of the trackway upon which the machine is supported.

What is claimed is:

1. A slow speed floating machine for concrete surfaces adapted to travel along side forms, a transverse track supported on said machine, a carrier movable on said track, a float longitudinally disposed with respect to said machine and supported by said carrier, means for reciprocating said float longitudinally of said machine, means for moving said carrier on said track to carry said float back and forth over the concrete surface while said float is reciprocated, and an elongated plane of weakness cutting blade supported below said machine, said blade being recessed along its upper edge below said float whereby as said float moves transversely over said blade, slurry will flow into the space between said float and said blade and down the sides of said blade.

2. A slow speed floating machine for concrete surfaces adapted to travel along side forms, a transverse track supported on said machine, a

carrier movable on said track, a float longitudinally disposed with respect to said machine and supported by said carrier, means for reciprocating said float longitudinally of said machine, means for moving said carrier on said track to carry said float back and forth over the concrete surface while said float is reciprocated, and an elongated plane of weakness cutting blade supported below said machine, said blade being spaced below said float whereby as said float moves transversely over said blade, slurry will flow into the space between said float and said blade and down the sides of said blade.

3. A slow speed floating machine for concrete surfaces adapted to travel along side forms, a transverse track supported on said machine, a carrier movable on said track, a float longitudinally disposed with respect to said machine and supported by said carrier, means for reciprocating said float longitudinally of said machine, means for moving said carrier on said track to carry said float back and forth over the concrete surface while said float is reciprocated, and an elongated plane of weakness cutting blade supported below said machine, said blade being recessed along its upper edge below said float whereby as said float moves transversely over said blade, slurry will flow into the space between said float and said blade and down the sides of said blade, said carrier being movable at a higher speed than said machine travels.

4. A slow speed floating machine for concrete surfaces adapted to travel along side forms, a transverse track supported on said machine, a carrier movable on said track, a float longitudinally disposed with respect to said machine and supported by said carrier, means for reciprocating said float longitudinally of said machine, means for moving said carrier on said track to carry said float back and forth over the concrete surface while said float is reciprocated, and an elongated plane of weakness cutting blade supported below said machine, said blade being spaced below said float whereby as said float moves transversely over said blade, slurry will flow into the space between said float and said blade and down the sides of said blade, said carrier being movable at a higher speed than said machine travels.

5. A slow speed floating machine for concrete surfaces adapted to travel along side forms, a transverse track supported on said machine, a carrier movable on said track, a float longitudinally disposed with respect to said machine

and supported by said carrier, means for reciprocating said float longitudinally of said machine, means for moving said carrier on said track to carry said float back and forth over the concrete surface while said float is reciprocated, and an elongated plane of weakness cutting blade supported below said machine, said blade being spaced below said float whereby as said float moves transversely over said blade, slurry will flow into the space between said float and said blade and down the sides of said blade, means on said frame for discharging fluid behind the rear portion of said blade, and means on said machine for supplying anti-bonding fluid to said fluid discharge means.

6. A slow speed floating machine for concrete surfaces adapted to travel along side forms, a transverse track supported on said machine, a carrier movable on said track, a float longitudinally disposed with respect to said machine and supported by said carrier, means for reciprocating said float longitudinally of said machine, means for moving said carrier on said track to carry said float back and forth over the concrete surface while said float is reciprocated, and an elongated plane of weakness cutting blade supported below said machine, said blade being recessed along its upper edge and said edge being spaced below said float whereby as said float moves transversely over said blade, slurry will flow into said recessed portion and down the sides of said blade, fluid discharge means on the front portion of said blade, and means on the machine for supplying anti-bonding fluid to said fluid discharge means, said blade having grooves communicating with said fluid discharge means through which grooves the material may flow from the blade.

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