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A. J. BALTES

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APPARATUS FOR CONCRETE FINISHING

Filed Aug. 5, 1950

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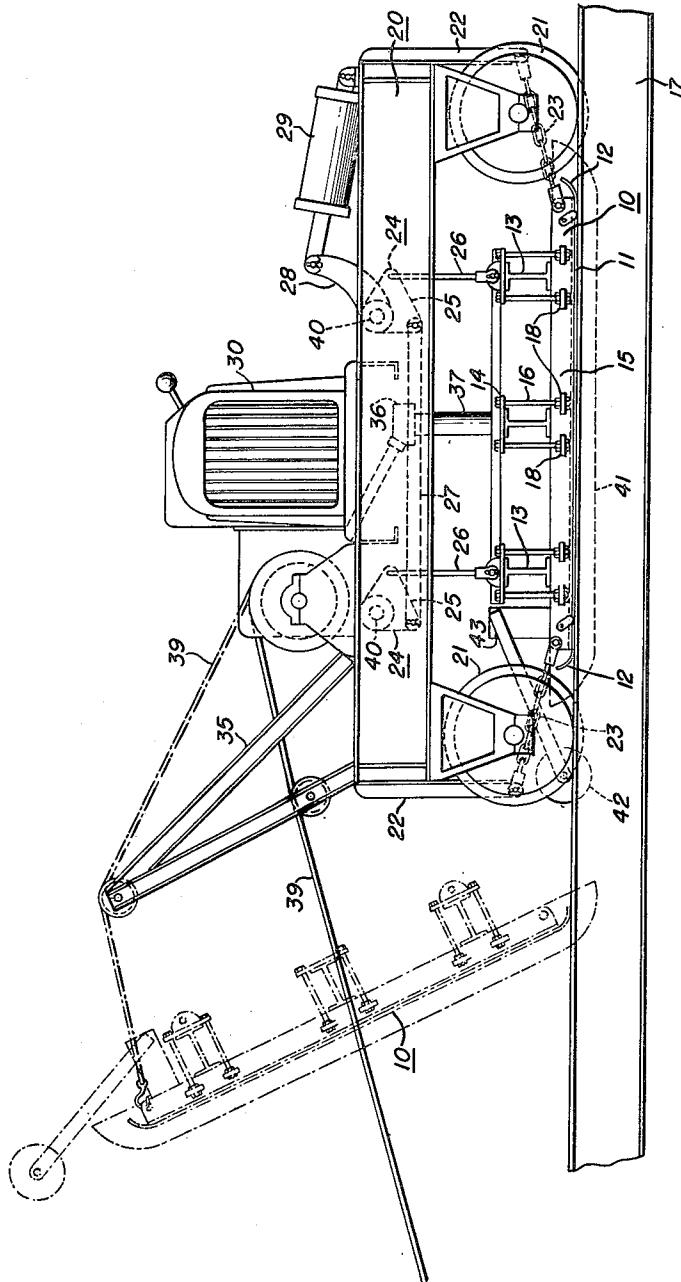


Fig. 1

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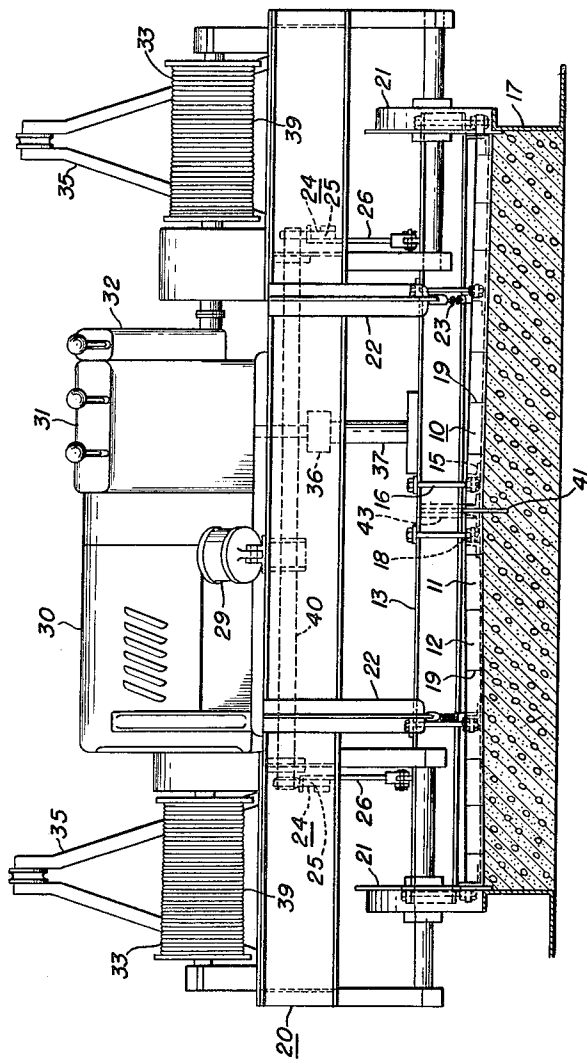


Fig. 2

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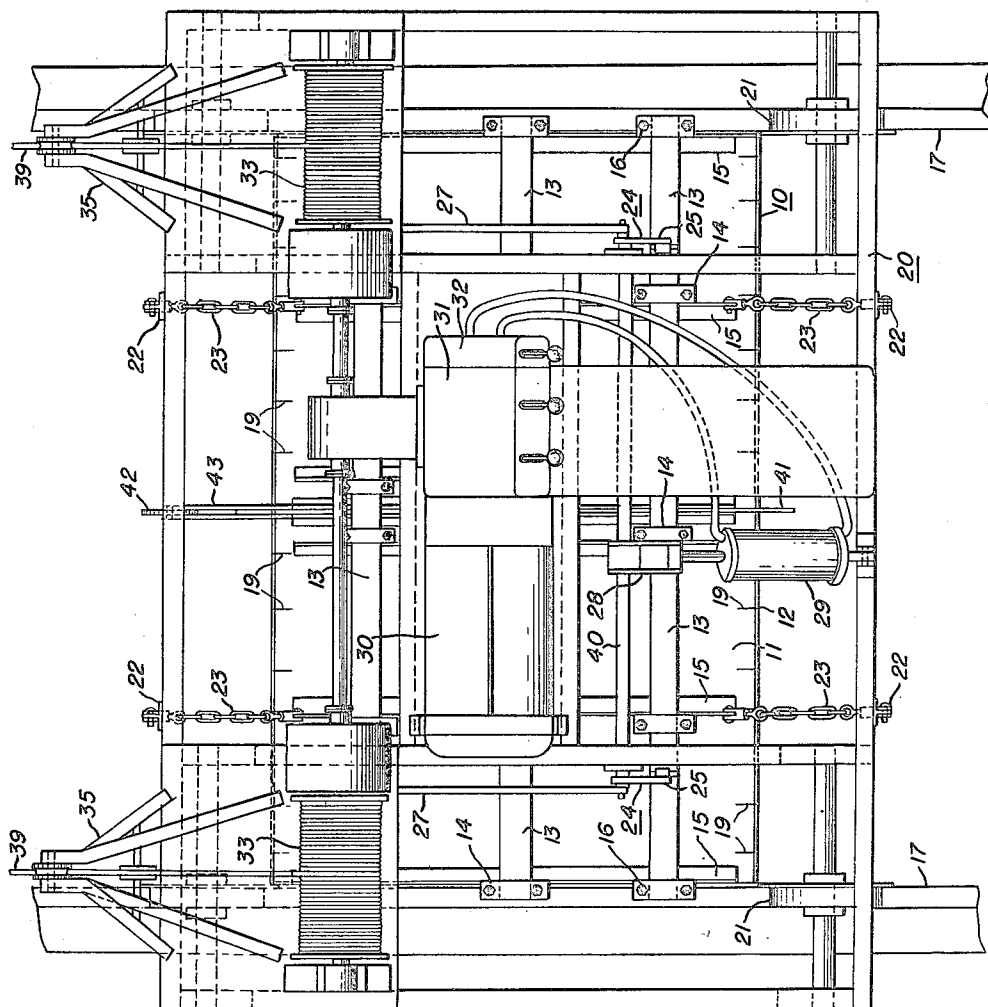


Fig. 3

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2 Claims. (Cl. 94—45)

This invention relates to concrete working machinery in general, and relates particularly to roadway paving equipment for smoothing the roadway surface and improving the physical constitution of a poured strip of concrete.

By way of background, in order that a full understanding may be had of the place this invention takes in concrete work, it may be said that this invention is a replacement of one prior type of operation; however, this invention goes beyond the improvement of an old operation and provides a new function which has never been done heretofore to improve concrete.

The old function which this machine improves is the final surface finishing. Prior to this invention, paving of all types from sidewalks to roadways was stricken off with a straight edge, and then finished by hand labor with trowels. There is one machine available which attempts to reduce the hand finishing, but in reality is nothing more than a machine doing just what human labor previously performed. This machine has a small trowel which is oscillated in short strokes while being moved laterally from side to side between the forms.

Hand or machine work of this type has two main disadvantages, namely (1) the uneven surface produced, and (2) as well known to all concrete workers, troweling brings the moisture and fines to the surface, thereby making a surface which will flake easily, and which is easily affected by salt.

The new feature provided by this invention is the improvement of the physical constitution of the concrete. This is accomplished to a satisfactory degree by weight alone, but the improvement is heightened by the addition of vibration to cause the concrete to pack closely to the forms and coarse bed material.

Vibration applied to or near the forms, and even to isolated portions of the concrete body, is well known. The forms are vibrated to prevent "honey-comb" edges. Vibration of the concrete near the forms performs the same function. Vibration rods are extended into random spots into the body of the concrete in an attempt to settle the flowable concrete into the coarse bed material. The following objects of this invention, together with the description and claims of the process and the preferred embodiment of the apparatus to carry out the process, explain the invention and the improved results obtained thereby.

An object of this invention is to improve the physical constitution of concrete paving by the uniform application of one moving weighted surface over a large area of the concrete.

Another object of this invention is to improve the physical constitution of the concrete paving by the uniform application of vibration force over a large surface area.

Another object of this invention is to obtain a superior physical constitution in a concrete strip by the application of a moving surface which is heavy enough to cause concrete in its plastic condition to yield as the surface is moved thereupon, and simultaneously vibrating the surface against the concrete as the surface is moved.

Yet another object of this invention is to smooth the surface of a concrete strip to close tolerances of surface variation, for example, to within one-eighth of an inch variation in ten feet measured in any direction.

A further object of this invention is the provision of an improved process of smoothing the surface of a concrete strip, wherein the excess water and concrete

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are actually squeezed to one side, rather than blended into rolling irregularities.

A still further object of this invention is to provide a machine for carrying a large weighted float, with sling construction for dropping and picking up the float, and for lifting the float on edge for cleaning.

Other objects and a fuller understanding of the invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a side-elevation view of a machine adapted to carry out the principles of this invention;

Figure 2 is a rear elevation of the machine; and

Figure 3 is a top plan view of the machine.

The principles of this invention may be incorporated into various types of actual machines, and carried out with variations in operating techniques, but fundamentally the machine comprises a float 10 having a finishing surface lying in a plane. The surface must be substantially as wide as the width of the strip of concrete to be finished and of sufficient mass to compress concrete which has taken an initial set, or is in a non-flowing plastic condition. The float 10, in the embodiment of the invention illustrated, is fabricated from sheet metal plate 11 to provide the finishing surface for contacting the surface of a concrete strip. In a road-building machine for highway construction, the float 10 should preferably be fully as wide as the distance between the forms. Therefore, the sheet metal plate surface 11 will probably need to be fabricated from several pieces in most instances. The ends of the sheet metal 11 are turned up as illustrated by the reference character 12. The turned ends prevent the plate from digging into the concrete, and materially aid in pushing excess concrete along before the float.

The float 10 is strengthened by a plurality of lateral "I" beam ribs 13 to provide strength and weight. It has been found to be desirable to make the float 10 with the plane of the finishing surface in various curvatures in order to provide a crest in the roadway under construction. In order to make one float serve in all requirements, the sheet metal plate 11 has been connected with the lateral "I" beam ribs 13 by means of adjustment bolts 16 in order to warp or flex the sheet metal plate 11 into the desired surface plane and to hold it in that selected condition. Saddle strips 14 are secured to the upper side of the "I" ribs 13 and a plurality of longitudinal angle brackets 15 are secured to the top surface of the sheet metal plate 11. The bolts 16 are attached to the angle brackets 15 by means of the ears 18, and the bolts also pass through the saddle strips 14. Therefore, the bolts 16 may be caused to draw up on the sheet metal plate 11 in selected spots, and to hold the sheet metal plate fixed in other spots to thereby produce any desired surface contour upon the sheet metal plate 11. The ends 12 are split by a plurality of cuts 19 in order to permit flexing along the curved ends.

The float 10, as thus described, is a complete working unit in and of itself for improving the physical constitution of a concrete strip and smoothing the surface thereof, and this float may be moved along a concrete strip by any suitable mechanism. The very size of such a float has proven to produce results beyond expectation, but it has now been found that those results may be improved, and further new results obtained by consideration of the weight of the float. By the application of evenly distributed weight over the entire surface area of the float, it has been found that the physical constitution of the concrete has been greatly improved. The top portion of the strip is considerably stronger and more dense. This desirable weight will normally come about in the usual construction of a float made to carry out the invention. Good engineering practice will require sheet metal 11 to be thick enough to withstand handling in the field without extra care. This weight, in addition to the weight of the "I" beams 13, will result in a float which will have a constant weight per unit of contact considerably greater than applied by a workman using a hand trowel. This weight for the float is feasible because of the size of the finishing surface. Concrete is not able to escape around the edges,

as in the case of a small trowel, to relieve the pressure. The normal resistance of the concrete to flow would produce this high pressure, even if it were not for the confining forms along the edges of the float.

So size and weight appear to be two important factors in the process and apparatus of this invention, although weight becomes secondary to size, and smoothing can be accomplished without the optimum weight. Weight is of considerable importance in producing the best physical constitution in the concrete.

The condition of the concrete is helpful in producing the best results. If the concrete is poured between forms and stricken off to almost exactly the correct height, then it appears that a very light float could be employed to smooth the surface of the concrete strip in one continuous stroke. Concrete, when poured between forms for making a pavement, such as a sidewalk, driveway or highway roadbed, is quite fluid but quickly begins to set. The concrete takes on a non-flowing plastic state which is characterized by retaining an impression without filling in. For example, a man's hand extended into freshly poured paving concrete will be filled in, but after the concrete becomes plastic because of taking on an initial set, the impression will remain. In some instances, concrete having an extremely high slump is used and is therefore in substantially a non-flowing plastic condition initially. However, contrary to expectations, a light float will not do a good smoothing job, even in quite flowable fresh concrete as normally poured for paving walks and roadways. Those acquainted with concrete work know that concrete which will not support a man's foot directly, will quite readily support a length of board with the man standing thereon. Thus, if a light float were used, it would tend to ride over mounds of excess concrete.

The correct amount of weight is not predictable exactly, and accordingly any float for carrying out this process should be provided with means for producing a variable weight per unit of contact, in order that the weight may be fashioned to suit the particular concrete being worked. Usually it is desirable to wait until the concrete has taken at least a slight set, but in many cases it will be best to follow the original smoothing quite closely with the process of this invention.

By using the correct amount of weight, another result is obtained which was unexpected when this invention was contemplated, namely, a surface which is not only smooth, but is also quite nonvariant. It seems at first consideration that smoothness and nonvariance are one and the same, but such is not the case. In prior practice, regardless of whether hand or machine smoothed, a small bead of excess concrete is left here and there. Some workers ignore these small beads, but unfortunately the tire and wheel of a fast moving vehicle do not. Every small imperfection sets up vertical vibration in the wheel which then exerts itself at a spot further down the strip. Countless repetitions of this vibration cause failure.

Those workers who attempt to produce a good quality road surface will smooth out each bead. A good road finisher can spread the material of the bead out until it cannot be seen. But again, the material is still on the surface, and the vehicle tire will react to it. The only way to correct this situation is to have no variations. Some states now require a maximum variation of one-eighth of one inch in any ten feet of roadbed.

By the proper selection of weight for the float 10, it has been found that the excess of water and concrete is squeezed to the sides of the float and will escape there. A light float will not force even quite fluid concrete to flow in this manner. By providing sufficient weight, all of the surface is supported by the concrete, and the excess will be squeezed down into the bed material, or off to the sides. No slight rises remain.

It has been found that in addition to the packing by the very weight of the float 10, the smoothing of the entire pavement surface in one pass will produce a uniform smooth surface and does not draw the fine materials and moisture to the surface of the strip. Those who have worked with concrete will readily appreciate the fact that hand troweling of a concrete surface to finish that surface will tend to draw the moisture and fine material up to the surface of the concrete where it floats in pools of water. Upon drying and hardening, this fine material forms the top surface of the pavement. Such fine material and excess of cement is an inferior top surface and will succumb

quickly to the action of weather and chemical de-icing agents. It has been found that after passing this heavy float over the surface of a concrete roadbed, a smooth surface resulted as expected, but in addition it was found that the surface was of a normal mixture of concrete ingredients, rather than a concentration of fines and cement. This surface is far superior to surfaces heretofore produced in roadways which have been made by the prior method of hand troweling.

Upon investigation it was found that the entire cross-section of the roadbed produced by this improved process and machine was far more dense and more closely associated with the bed material than had even been produced before the conventional methods. Therefore, the weight for the float 10 is preferably such that non-flowing plastic concrete will yield under and before the float as the float is dragged along the surface of the concrete strip.

Those acquainted with the construction of concrete pavement are familiar with the practice of vibrating the forms 17 to reduce the "honeycombing" tendency of the concrete along the forms. Furthermore, long vibration rods are probed into the body of the freshly poured concrete in random spots in an attempt to settle the concrete well upon the bed material. Upon the addition of a vibrator 36 connected to the top surface of the sheet metal by means of a rod 37, the entire surface of the float 10 vibrated upon the surface of the concrete strip and not only settled the concrete firmly against the form 17, but materially improved the settling of the entire mass of concrete into the bed structure. Therefore, upon the addition of vibrator 36 to this improved float, it was possible to produce a dense pavement cross-sectional structure which was completely uniform and solid in all areas. The hand vibration methods previously used in random spots never have acquired the uniformity of cross-sectional density that has been produced by the combination of this heavy float with vibration.

A carriage 20 has been constructed to conveniently carry the float 10. The carriage has wheels 21 which are adapted to ride upon forms 17. The wheels are laterally adjustable, and even reversible, in order to accommodate the carriage 20 to any width of pavement or to place the flanges on either side of the forms, as required. Tow brackets 22 are provided at both ends of the carriage 20 and are provided to draw a chain 23 which is suitably attached to the float 10. Thus, the float 10 is equipped with tow chains at both ends, and therefore, regardless of which direction the carriage 20 may travel, the float 10 is dragged along by the chains 23. Obviously, the chains 23 will not carry the weight of the float 10, but only provide forward towing force.

A sling construction 24 is provided to lift the float 10 into an elevated position under the carriage 20 whenever it is desired to carry the float without contacting the roadway surface, such, for example, as when the machine is being moved into or away from its place of work. The sling 24 includes eccentric brackets 25 mounted upon the carriage and tie rods 26 extending from the brackets to the float 10. In the drawings the tie rods 26 are suitably attached to the tops of two of the I ribs 13. A crank arm 28 and a hydraulic cylinder 29 are provided to rotate the links 25 and cause lifting or lowering of the float 10. The brackets 25 are carried on the four ends of two suitable rods 40. One rod 40 is directly driven by the crank arm 28, and the other rod 40 is caused to rotate at the same time by connecting two or more of the brackets 25 together by means of links 27. By means of the sling construction thus described the float 10 may be raised above the surface which supports the wheels 21, or may be released to rest upon that surface. Of course, if there were no surface to stop the downward movement of the float 10, the float would still be supported upon the sling 24, but normally the float is not lowered until it is above the surface to be smoothed, and therefore will be supported upon the concrete strip rather than upon the sling. The sling does not normally provide any downward force upon the float 10. However, if some extra weight is required, it is practical to use the cylinder 29 in reverse to force the float 10 down, or in other words to cause the carriage to "ride" on the float to some controlled degree.

The carriage 20 may be powered by any suitable means, but it has been found desirable to make the apparatus self-containing. Therefore, a power unit 30 is mounted upon the carriage and is adapted to drive through a transmission 31, and also to drive a pump 32 for delivering

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hydraulic pressure to the cylinder 29 for operation of the sling 24. The operator of this machine may therefore very easily lift and lower the float 10 without manual effort.

Two cable drums 33 are mounted at opposite sides of the carriage 20 and are driven through the transmission 31. In the embodiment of the invention illustrated, it has been chosen to drive the carriage 20 by means of cables 39 rather than to attempt to drive the wheels 21. The float 10 has considerable friction upon the surface of the concrete, and also will be held by air pressure differential. This phenomena is well understood by those familiar with concrete work. Accordingly, considerable force, and variable force, is required to drag the float 10. For this reason cables 39 wound upon the drums 33 are employed for pulling the carriage 20. The cables are extended a considerable distance ahead of the carriage and secured in suitable pins. Thereafter, the operator winds the cable upon the drums 33 to move the carriage and drag the float 10.

A beam 35 is mounted upon the carriage 20 for aid in cleaning the finishing surface on the bottom of the float 10. In the end of its use, when the float is not to be used for a period of time, the carriage 20 is moved beyond the end of the poured concrete and the float 10 uncoupled from the sling 24. The carriage is then backed up and the cables 39 attached to the float. Thereafter, the drums 33 are rotated to pull the cables and lift the float into a position substantially as illustrated in dotted outline in the Figure 1. With the float 10 standing on edge as thus illustrated in Figure 1, the bottom thereof is quite easily cleaned to preserve the smooth finishing surface.

No dimensions have been specified, because it has been found that the principles of this invention are applicable to substantially all paving widths. In small roadway paving projects, for example, large concrete mixing machines are not practical. Therefore, a small job will best be constructed of single width strips of about ten feet. The wheels of my machine are then set to ride the forms, and a single float 10 employed.

However, on large jobs, a double lane can be poured at one time. In that event the sheet metal 11 is divided by a knife edge 41. A cutter or colter 42, carried upon a bracket 43, precedes the float 10 and cleaves the concrete, thereby settling large fill material and generally preparing the concrete for the later finishing by the float and knife edge.

The cut thus made does not go through the entire bed of concrete, but forms a plane of weakness which will protect the divided portions against lateral cracking. The cut is filled with yieldable filler material in the conventional manner.

Although the invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that

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numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter clamped.

What is claimed is:

1. A road machine comprising a carriage supported upon wheels to ride on spaced road forms for a concrete roadway, an elongated float beneath said carriage extending from the forward portion to the rear portion of said carriage and connected to said forward and rear portions by means of tow means, said float including spaced beams and a flexible substantially rectangular plate with adjustable means connecting said plate to said beams whereby said plate can be flexed relative thereto, said plate being of less width than the distance between said wheels to rest and be supported directly on the concrete poured between said forms, supporting means connecting the front and rear ends of said float with said carriage, and controlled power means on said carriage for raising and lowering said supporting means simultaneously to a predetermined height to accurately control the height of said plate relative to said road forms.

2. A road machine comprising a carriage supported upon wheels to ride on spaced road forms for a concrete roadway, an elongated float beneath said carriage extending from the forward portion to the rear portion of said carriage and connected to said forward and rear portions by means of tow means, said float including spaced beams and a flexible substantially rectangular plate with adjustable means connecting said plate to said beams whereby said plate can be flexed relative thereto, said plate being of less width than the distance between said wheels to rest and be supported directly on the concrete poured between said forms, supporting means connecting the front and rear ends of said float with said carriage, controlled power means on said carriage for raising and lowering said supporting means simultaneously to a predetermined height to accurately control the height of said plate relative to said road forms, said power and supporting means including a piston operated sling linkage the piston of which may be deactivatable to relieve said float of support by said linkage and thereby impose the weight of said frame and plate upon said concrete.

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