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Aparicio

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[54] **PAVING MACHINE SLIP FORM**

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[52] **U.S. Cl.** **404/98**
[51] **Int. Cl.²** **E01C 11/28**
[58] **Field of Search** 404/98, 96, 83, 105

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[57] **ABSTRACT**

The disclosed embodiment of the present invention is a paving machine slip form which generally includes a primary plate for shaping a curb and a sidewalk, a primary blade mounted at the leading end of the primary plate, a finishing plate mounted at the trailing end of the primary plate, and a secondary blade mounted between the primary plate and the finishing plate. The primary plate and finishing plate are supported substantially horizontally to ride over and smooth the exposed surfaces of wet concrete which has been deposited on the ground. Each of the primary and secondary blades are mounted for pivotal movement and a respective hydraulic ram is provided for moving each of such blades to a position to restrict the amount and reduce the thickness of the concrete passing under the primary and finishing plates. In addition, the finishing plate is pivotally mounted and a hydraulic ram is provided for moving it into a position to smooth the upper surface of the concrete layer of reduced thickness. More particularly, the primary and secondary blades and the finishing plate are each selectively movable from a position in which a lower edge or surface thereof is at approximately sidewalk level to a position in which the lower edge or surface thereof extends from approximately sidewalk level to approximately street level.

12 Claims, 5 Drawing Figures

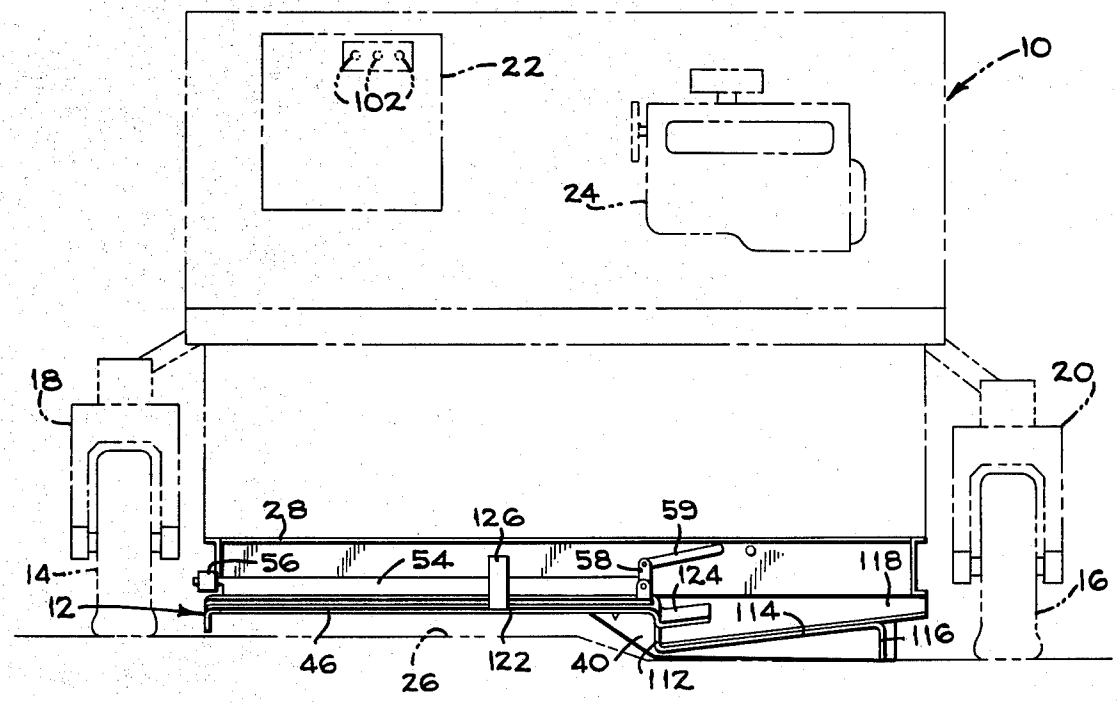
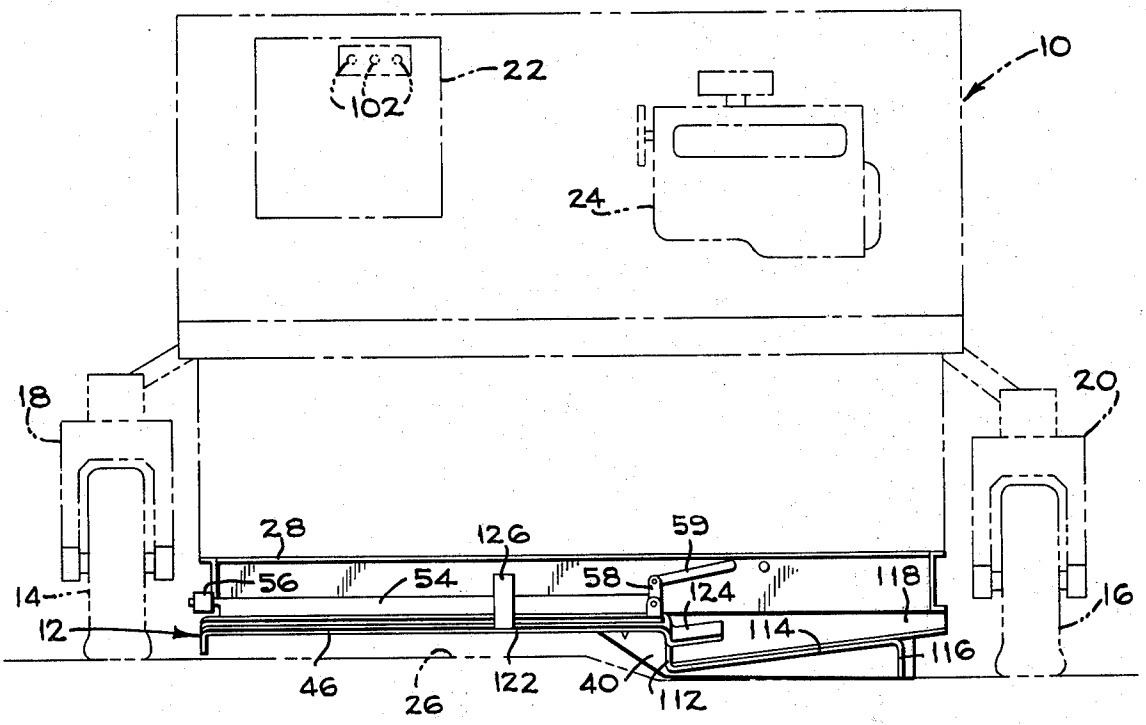


Fig_1



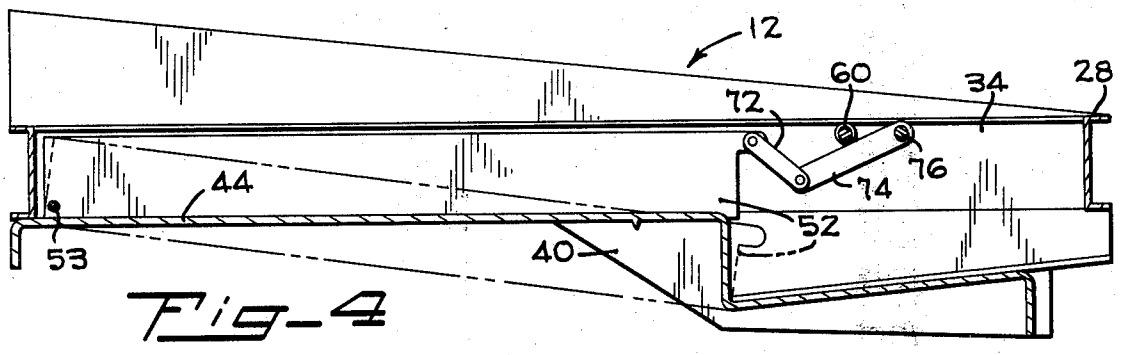


Fig_4

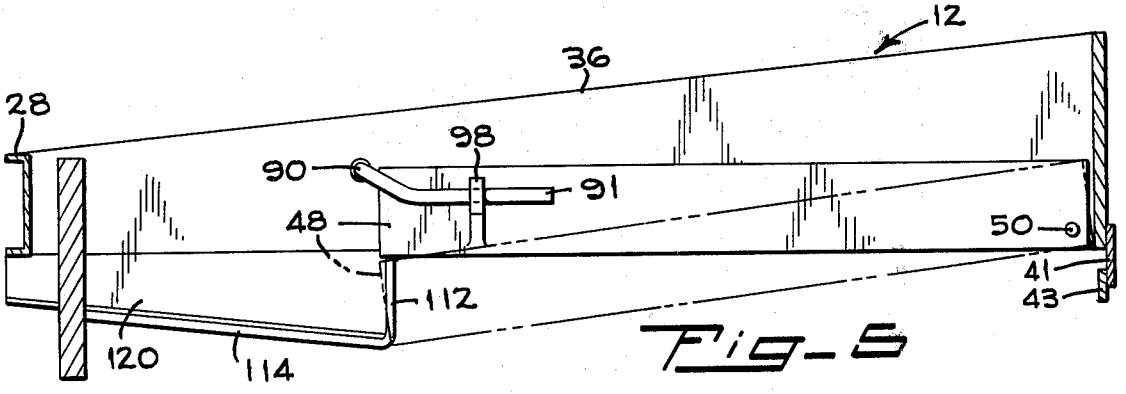


Fig_5

Fig-2

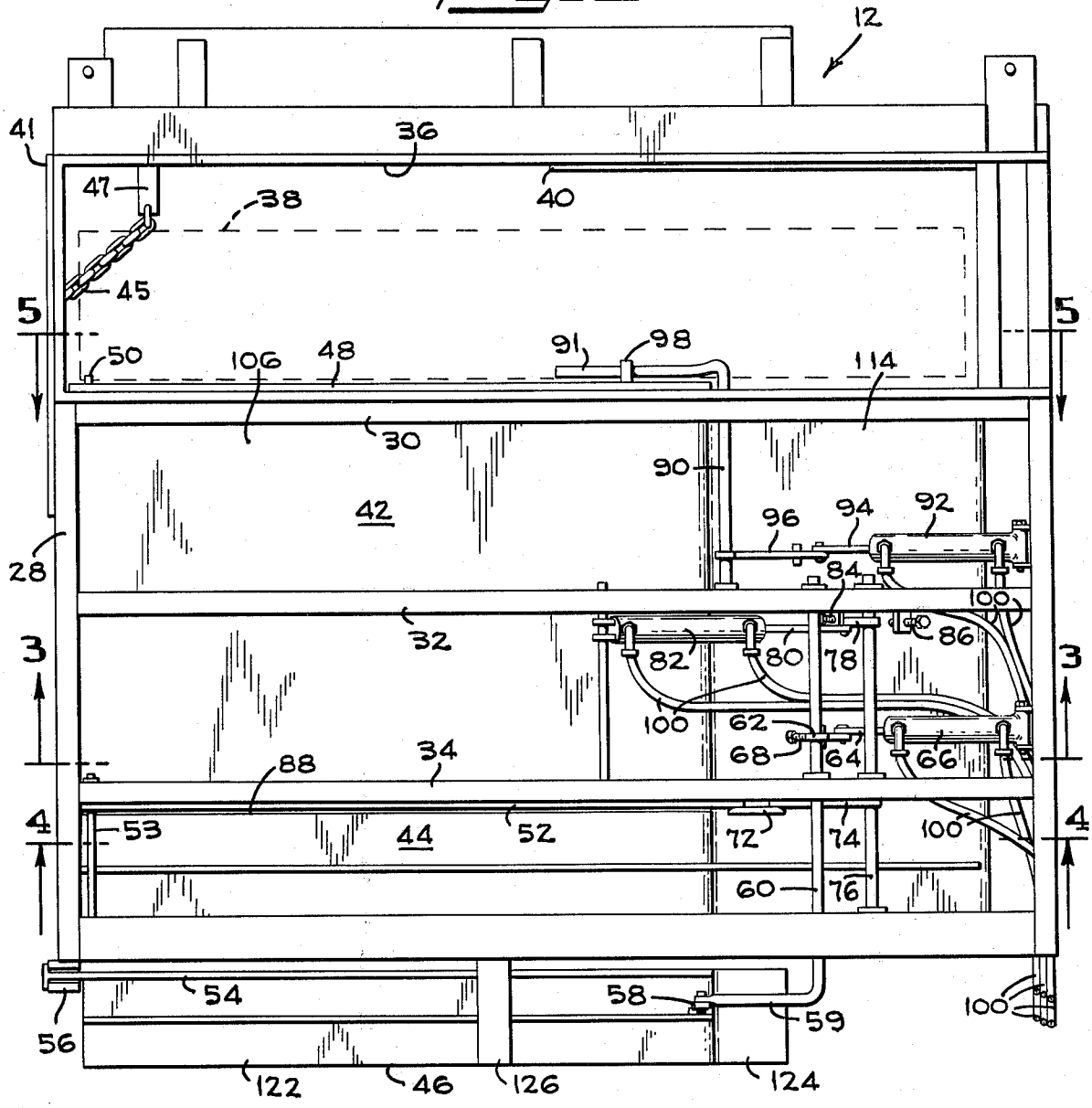
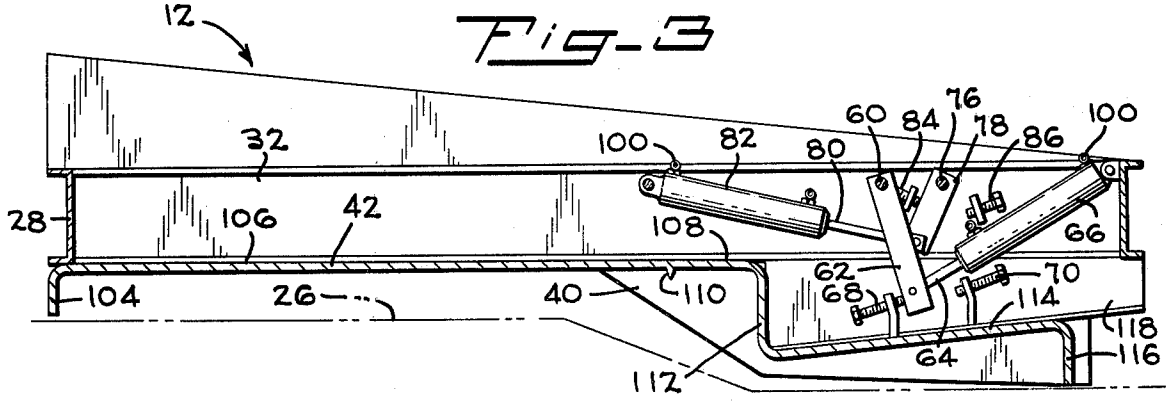

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Fig-3


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PAVING MACHINE SLIP FORM

FIELD OF THE INVENTION

This invention relates generally to a concrete paving machine and more particularly to a slip form for spreading wet concrete and smoothing the upper surface thereof to form a curb, sidewalk and driveway ramp.

BACKGROUND OF THE INVENTION

Stationary forms have generally been employed in the past for forming certain concrete structures. If it is desired, for example, to pour a concrete slab on the ground, the area to be covered is enclosed by forms and wet concrete is poured into the enclosed area. Once the concrete is poured into the forms, it is necessary to spread the concrete and smooth its upper surface with a trowel or the like device. This method is extremely time consuming, requiring a large number of man-hours to set up the forms, pour the concrete into the area enclosed by the forms, and smooth the upper surface thereof by troweling.

In recent years, the manual labor required to pour certain concrete structures has been considerably reduced by the development of concrete pouring or paving machines. Such machines can spread or lay down a certain thickness of concrete within certain boundaries and simultaneously smooth the upper surface thereof. At first, these machines were employed for paving streets and only a flat, relatively narrow strip of concrete could be formed which was generally of uniform thickness. Subsequent developments permitted larger widths and other than complete flat finished surfaces, such as crowned surfaces, to be formed by such machines. In more recent years, machines and associated slip forms have been developed which will pour and spread concrete in the shape of curbs and sidewalks, while simultaneously smoothing the exposed surfaces of such concrete structures. Generally, these machines include a hopper structure which distributes and deposits the wet concrete across the desired width of the resulting structure onto the ground. A slip form is carried by the machine, generally on its underside, and rides over the wet concrete, shaping its upper and side surfaces into the desired configuration. Such machines are generally self propelled, with the drive wheels being positioned outside the area to be covered.

The slip form of such a paving machine coacts with the surface of the ground to effectively extrude the wet concrete into a structure having the desired cross sectional shape in a manner similar to an extrusion mold. Because of this extrusion, it has only been possible in the past to form such a strip having the same cross sectional shape along its entire length. A driveway ramp, however, in the area where it crosses a sidewalk and curb, is depressed from the level of the sidewalk and curb. Accordingly, when a driveway ramp crosses an area in line with the sidewalk and curb on either side thereof, such paving machines must pass over that area without depositing any concrete. Subsequently, such a driveway must be poured by using stationary forms and a concrete finisher or by using a different slip form than that employed for shaping the curb and sidewalk. As previously mentioned, the use of stationary forms is relatively time consuming. It is also time consuming if it is necessary to change from one slip form to another on a concrete paving machine in order to pour a sidewalk, curb, and driveway ramp.

SUMMARY OF THE INVENTION

A primary object of the present invention is to provide a paving machine and a slip form which are capable, while pouring a layer of wet concrete on the ground, of changing the cross-sectional shape of that layer at desired locations along its length.

Another object of the present invention is to provide a paving machine and a slip form which are capable, while pouring wet concrete and smoothing the exposed surfaces thereof to form a curb and sidewalk, to reduce the thickness of the resulting layer of concrete at desired areas to form a driveway ramp which extends from about street level to sidewalk level and crosses an area in line with such a curb and sidewalk.

These and other objects are attained by the provision, in combination with a slip form for shaping a curb and a sidewalk, of a form segment which is movable to a position to restrict the amount and reduce the thickness of wet concrete passing under at least a portion of the slip form. More particularly, a blade is mounted at either the leading or the trailing end of a smoothing plate which is movable from a position in which a lower edge thereof is at approximately sidewalk level to a position in which the lower edge thereof extends from approximately sidewalk level to approximately street level. In addition, a finishing plate, which is mounted at the trailing end of the paving machine, is movable from a position in which its lower surface is at approximately sidewalk level to a position in which its lower surface extends from approximately sidewalk level to approximately street level.

A feature of the present invention resides in the provision of a pair of blades, each mounted at opposite ends of the shaping plate and are mounted for rotation between two positions. In the first position of such blades, their lower edge is at approximately sidewalk level, such that a sidewalk and curb can be formed by the shaping plate. In the second position of such blades, their lower edge extends from approximately sidewalk level to approximately street level, such that a driveway ramp can be formed.

A further feature of the present invention resides in the provision of control means for controlling the position of each of the above mentioned blades and the position of the finishing plate independent of one another.

These and other objects, features and advantages of the present invention will be more fully realized and understood from the following detailed description, when taken in conjunction with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a trailing end view of a slip from constructed in accordance with the principles of the present invention and is shown therein as being secured to a paving machine;

FIG. 2 is a plan view of the slip form illustrated in FIG. 1;

FIG. 3 is a sectional view taken generally along line 3—3 of FIG. 2;

FIG. 4 is a sectional view taken generally along line 4—4 of FIG. 2; and

Flg. 5 is a sectional view taken generally along line 5—5 of FIG. 2.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Like reference numerals throughout the various views of the drawings are intended to designate the same elements.

With reference to FIG. **1**, there is shown a paving machine, generally designated with the reference numeral **10**, which includes a slip form **12**. The body and carriage of the paving machine **10** are illustrated in FIG. **1** in phantom lines and the slip form **12** is illustrated in full lines. The slip form **12** of the present invention can be employed with any paving machine and has been successfully employed with paving machines manufactured by Huron Manufacturing Company of Huron, S.D. and identified as models TP 572 and TP 880.

Generally, the paving machine **10** is supported on four wheels, two of which are shown and designated with the reference numerals **14** and **16**. The wheels **14** and **16** are carried by yokes **18** and **20**, respectively, which can be adjusted in height by hydraulic or other means (not shown) independently of one another. The paving machine **10** is provided with a plurality of controls which are represented generally by a phantom line outline designated with the reference numeral **22**. Such controls are employed for steering the paving machine, controlling a drive motor, such as that illustrated in phantom lines and designated with the reference numeral **24**, controlling the positions of the yokes **18** and **20**, and controlling hydraulic pumps and the like (not shown).

The paving machine **10** carries the slip form **12** on its underside. When wet concrete is deposited at the leading or forward end of the paving machine **10** onto the ground, the mean level of which is indicated by a phantom line generally designated with the reference numeral **26**, the slip form **12** effectively extrudes such concrete into a shape to form a sidewalk, curb, driveway ramp, and gutter. Details of the slip form **12**, however, will be better understood from the following description relating to FIGS. **2–5** of the drawings.

With particular reference to FIG. **2**, the slip form **12** includes a frame **28** which is formed of a plurality of structural channel members. A plurality of cross beams **30**, **32** and **34**, which are also structural channel members, extend between the side members of the frame **28**. The cross beam **30** is approximately aligned with the leading or forward end of the body of the paving machine **10**, such that a hopper inlet structure **36** extends forwardly thereof and is disposed for receiving the hopper and conveyor screw of a concrete dispensing unit, which is diagrammatically illustrated by the dotted line designated with the reference numeral **38**. A scraping blade **40** (see also FIG. **3**) is secured to a wall of the hopper **36** and extends downwardly to remove any excess earth in the path of the paving machine **10**. A rubber boot **41** is secured to a side member of the frame **28** (see FIG. **5**) and supports a metal strip **43** at its lower edge. A chain **45** extends from a bracket **47** to the boot **41** to restrain it from being pressed outwardly by the dispensed concrete. A similar boot is provided at the leading end of the frame **28**.

A primary shaping plate **42** is secured to one of the side members of the frame **28** and to the cross members **30**, **32** and **34** by appropriate welds or other suitable fastening means (not shown). A secondary shaping plate **44** is also secured to the frame **28** in tandem with the plate **42** by suitable welds or other fastening means which are not shown. A finishing plate **46** is mounted at the trailing or rearward end of the slip form **12**. It will be noted that the shaping plates **42** and **44** have a contour (see FIGS. **3** and **4**) which corresponds to the shape of a sidewalk, curb and gutter. It will also be noted that these plates and the finishing plate **46** are supported in a substantially horizontal position.

A blade **48**, which is a leading or primary blade, is mounted for pivotal movement on a shaft **50** at the leading end of the shaping plate **42**. In addition, a blade **52**, which is a trailing or secondary blade, is mounted for pivotal movement on a shaft **53** at the trailing end of the shaping plate **42**. The finishing plate **46** is provided with a reinforcing flange **54**, an extension of which is received in a U-shaped member **56** which permits pivotal movement of the finishing plate **46** in a vertical plane. The purpose for mounting the finishing plate **46** and the blades **48** and **52** for pivotal movement and the mechanism for effecting such movement will be explained in greater detail hereinbelow.

A link **58** is pivotally secured at its one end to the finishing plate **46** and its other end to an arm **59** which extends orthogonally from a shaft **60**. The shaft **60** is journalled in cross beams **32** and **34**. Accordingly, rotation of the shaft **60** will cause the finishing plate **46** to be moved in a vertical plane on a pivot point provided by the member **56**. One end of an arm **62** is secured to the shaft **60** and is connected at its other end to the extensible arm **64** of a hydraulic ram **66**. An end of the ram **66** is anchored on the frame **28**. A pair of stops **68** and **70**, which are adjustable, are disposed for limiting the travel of the arm **62**. When the arm **64** of the ram **66** is retracted from its position as shown in FIG. **3** to a position at which the arm **62** abuts against the stop **70**, the shaft **60** will be rotated in a counterclockwise direction as viewed in FIG. **3**, thereby lowering the finishing plate **46**.

As shown in FIG. **4**, the blade **52** is secured by means of a link **72** and an arm **74** to a shaft **76**. The link **72** is rotatably secured at its one end to a flange of the blade **52** and at its other end to one end of the arm **74**. The other end of the arm **74** is rigidly secured to the shaft **76**, such that the arm **74** and shaft **76** rotate as one unit. An arm **78** (see FIGS. **2** and **3**) is also ridigly secured at its one end to the shaft **76** and is pivotally secured at its other end to an extensible arm **80** of an hydraulic ram **82**. Stops **84** and **86**, which are adjustable, are disposed for limiting the travel of the arm **78**. When the shaft **76** is rotated in a counterclockwise direction by action of the ram **82**, the blade **52** is rotated from the position thereof illustrated in full lines in FIG. **4** to the position thereof illustrated in phantom lines. As shown in FIG. **2**, a slot **88** is provided in the shaping blade **44** to permit rotational displacement of the plate **52**. The shaft **76** is also journalled in the cross beams **32**, **34** and **36**.

In FIGS. **2** and **5** there is shown a shaft **90** that is journalles in cross beams **30** and **32** and that extends through a wall of the hopper inlet structure **36** with an end **91** thereof being bent at right angles to the main portion thereof to effectively form a crank. An hydraulic ram **92** has its extensible arm **94** pivotally connected to one end of an arm **96** having its other end rigidly secured to the shaft **90**. Appropriate adjustable stops, such as the stops **68** and **70** or the stops **84** and **86**, are provided for limiting the travel of the arm **96**. The end

91 of the shaft 90 passes through an aperture of a member 98 which is secured to the blade 48. When the shaft 90 is rotated in a clockwise direction as viewed in FIG. 5, the plate 48 will be lowered to the position which is illustrated by the phantom lines in FIG. 5. Each of the hydraulic rams 66, 82 and 92 are supplied with hydraulic fluid via a plurality of hydraulic lines 100 and are controlled in a conventional manner.

As shown in FIG. 1, part of the controls 22 include three levers 102, each of which are actuatable to control a respective one of the hydraulic rams 66, 82 and 92. Each of the levers 102 preferably have three positions and control appropriate valves for supplying hydraulic fluid to the hydraulic rams 66, 82 and 92. The first position of each of the levers 102 retracts the arm of a corresponding hydraulic ram; the second position extends the arm; and the third position stops the flow of hydraulic fluid to the ram and holds the arm at a particular position. Accordingly, each of the hydraulic rams 66, 82 and 92 can be controlled independently of one another. When it is necessary to form a driveway ramp, the primary blade 48 is lowered at a particular position of the paving machine. When the paving machine has advanced to a position at which the blade 52 is over an edge of the driveway ramp, it is lowered. As the paving machine advances and the finishing plate 46 arrives at the edge of the driveway ramp, it is lowered to finish the upper surface thereof. At the other edge of the driveway ramp, the blades 48 and 52 and the finishing plate 46 are raised in succession.

The contour of the primary shaping plate 42 is better illustrated in FIG. 3. As shown therein, the primary shaping plate 42 is provided with a down turned flange portion 104 having an edge thereof extending to approximately ground level 26 at the leading end thereof. The trailing end of the flange 104 is raised from its leading end to permit the paving machine to turn around a corner while forming a curved sidewalk or driveway ramp. The flange portion 104 defines an outer boundary of the sidewalk to be formed. The primary shaping plate 42 includes a horizontal portion 106 which is contiguous with the portion 104 and defines and smooths the upper surface of a sidewalk. A horizontal portion 108, which adjoins with the portion 106 defines an upper surface of a curb. A V-shaped projection 110 is provided between the portions 106 and 108 and forms an indentation between the sidewalk and the curb. A vertical portion 112 is contiguous with the portion 108 and smooths a side of the curb. The primary shaping plate 42 also includes a portion 114 which adjoins with the portion 112. The portions 112 and 114 shape the gutter of the resulting structure. A vertical flange portion 116 extends downwardly from the portion 114. Accordingly, the portions 106 and 108 are supported at approximately sidewalk level; the portion 112 extends from approximately sidewalk level to street level; and the portion 114 is supported at approximately street level. Since a street is usually crowned to permit run off of water therefrom, the use of the phrase "street level" is intended to indicate an approximate level corresponding to any point along the portion 114. The portion 114 is secured to and supported by a structural member 118 which is secured to the frame 28 and to the cross beam 32. A similar structural member 120 shown in FIG. 5 supports an end of the portion 114 which extends below the cross beam 30.

As shown in FIG. 4, the secondary shaping plate 44 has a contour which is identical to the contour of the primary shaping plate 42. If desired, a trailing edge of the secondary shaping plate 44 can be supported at a slightly lower level than the leading edge thereof to compress the concrete as the sidewalk, curb and gutter are being formed.

As shown by the phantom line outline of the blades 48 and 52 in FIGS. 4 and 6, such blades can be lowered to a position in which their lower edge extends from approximately sidewalk level to approximately street level. The finishing plate 46 can also be lowered, such that its underside surface is approximately aligned with the bottom edges of the blades 48 and 52 when they are in their lowered positions. The finishing plate 46 includes a portion 122 which is supported above sidewalk level in one position of the plate 46 and extends from approximately sidewalk level to street level at a lowered position of the plate 46. In addition, the finishing plate 46 includes a portion 124 which is offset vertically from the portion 122 and extends at an angle with respect to horizontal, corresponding approximately to the angle of the portion 114 of the shaping plate 42. In the raised position of the finishing plate 46, it is not in contact with the concrete. However, when the finishing plate 46 is lowered, the portion 122 and 124 thereof come into contact with the upper surface of the concrete to assist in the shaping of the driveway ramp and the edge defining the boundary between the street and the driveway ramp. A bar 126 is secured to and extends upwardly and toward the cross beam 32 from the position 122. As the finishing plate 46 is raised, the bar 126 engages the upper flange of the cross beam 32, causing the plate 46 to be lifted away from the upper surface of the concrete while a sidewalk and curb are being formed.

I claim:

1. A paving machine comprising:
   a. a carriage;
   b. means connected to said carriage for moving said carriage along the ground;
   c. a slip form secured to an underside of said carriage and including
      1. a frame;
      2. a primary shaping plate mounted on said frame and having a first portion supported substantially horizontally at a sidewalk level and a second portion contiguous with said first portion and substantially at right angles thereto with a lower edge thereof supported at a street level, such that at least part of said plate has a contour corresponding to the exposed surfaces of a curb;
      3. a primary blade extending across one end of said plate and mounted for rotational movement in a substantially vertical plane, with a lower edge thereof being supported at approximately sidewalk level in a first portion thereof and extending from approximately sidewalk level at one end thereof to approximately street level at the other end thereof in a second portion thereof, and
      4. blade moving means connected to said primary blade for rotatably moving said primary blade between its first position and its second position; and
   d. control means connected to said blade moving means for controlling the operation of said blade

moving means to rotatably move said primary blade between its first and second positions.

2. A paving machine as defined in claim **1**, further comprising hopper means carried by the machine frame at the leading end of said carriage for depositing wet concrete on the ground in advance of said slip form.

3. A paving machine as defined in claim **1** wherein said slip form further includes a finishing plate mounted for rotational movement in a substantially vertical plane in tandem with said shaping plate, and means for rotatably moving said finishing plate between a first position in which it is supported at approximately sidewalk level and a second position in which it extends from approximately sidewalk level at one end thereof to approximately street level at the other end thereof.

4. A paving machine as defined in claim **3** wherein said control means includes a first control element for controlling said blade moving means and a second control element for controlling said finishing plate moving means.

5. A paving machine as defined in claim **3** wherein said slip form further includes a secondary blade mounted for rotational movement in a substantially vertical plane between said shaping plate and said finishing plate, with a lower edge thereof being supported at approximately sidewalk level in a first position thereof and extending from approximately sidewalk level at one end thereof to approximately street level at the other end thereof in a second position thereof, and means for rotatably moving said secondary blade between its first position and its second position.

6. A paving machine as defined in claim **5** wherein said control means includes a first control element for controlling said primary blade moving means, a second control element for controlling said secondary blade moving means, and a third control element for controlling said finishing plate moving means.

7. A slip form for shaping a curb and a driveway ramp having a height which is depressed from the top surface of the curb, comprising:

a. a frame;

b. a primary shaping plate mounted on said frame and having a first portion supported substantially horizontally at a sidewalk level and a second portion contiguous with said first portion and substantially at right angles thereto with a lower edge thereof supported at a street level, such that at least part of said plate has a contour corresponding to the exposed surfaces of a curb;

c. a primary blade extending across one end of said plate and mounted for rotational movement in a substantially vertical plane, with a lower edge thereof being supported at approximately sidewalk level in a first position thereof and extending from approximately sidewalk level at one end thereof to approximately street level at the other end thereof in a second position thereof; and

d. means mounted on said frame and connected to said primary blade for rotatably moving said blade between its first position and its second position.

8. A slip as defined in claim **7** further comprising a finishing plate mounted on said frame for rotational movement in a substantially vertical plane in tandem with said primary shaping plate, and means mounted on said frame and connected to said finishing plate for rotatably moving said finishing plate between a first position in which it is supported at approximately sidewalk level and a second position in which it extends from approximately sidewalk level at one end thereof to approximately street level at the other end thereof.

9. A slip form as defined in claim **8** further comprising a secondary blade carried by said frame for rotational movement in a substantially vertical plane between said primary shaping plate and said finishing plate, with a lower edge thereof being supported at approximately sidewalk level in a first position thereof and extending from approximately sidewalk level at one end thereof to approximately street level at the other end thereof in a second position thereof, and means mounted on said frame and connected to said secondary blade for rotatably moving said secondary blade between its first position and its second position.

10. A slip form as defined in claim **7** further comprising a secondary shaping plate mounted on said frame in tandem with said primary shaping plate and having a first portion supported at approximately sidewalk level and a second portion contiguous with said first portion thereof and substantially at right angles thereto with a lower edge thereof supported at approximately street level, such that at least a part of said secondary shaping plate has a shape corresponding to the exposed surfaces of a curb.

11. A slip form as defined in claim **10** further comprising a finishing plate mounted on said frame for rotational movement in a substantially vertical plane in tandem with said shaping plates, and means mounted on said frame and connected to said finishing plate for rotatably moving said finishing plate between a first position in which it is supported at approximately sidewalk level and a second position in which it extends from approximately sidewalk level at one end thereof to approximately street level at the other end thereof.

12. A slip form as defined in claim **11** further comprising a secondary blade carried by said frame for rotational movement in a substantially vertical plane between said primary shaping plate and said secondary shaping plate, with a lower edge thereof being supported at approximately sidewalk level in a first position thereof and extending from approximately sidewalk level at one end thereof to approximately street level at the other end thereof in a second position.

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