United States Patent

Martenson et al.

[15] **3,678,817**

[45] **July 25, 1972**

[54] MATERIAL CONTROL SYSTEM FOR A FINISHING MACHINE

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[52] **U.S. Cl.** **94/46**

[51] **Int. Cl.** **E01c 19/48**

[58] **Field of Search** 94/46, 44, 39

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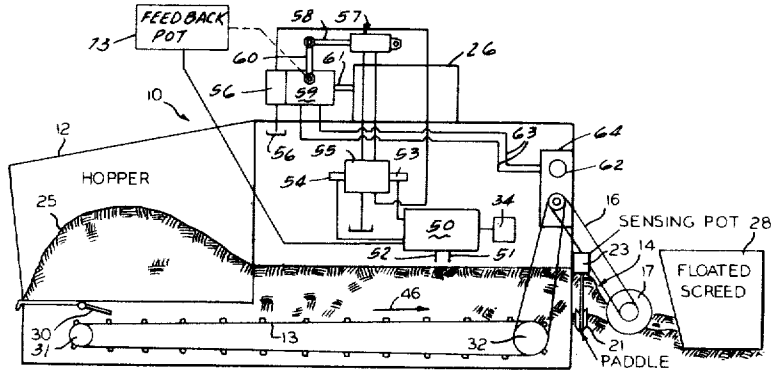
[57] **ABSTRACT**

A machine including a hopper for receiving a quantity of material which is to be delivered to the road surface, a conveyor for moving the material from the hopper along the axis of the machine to a pre-work station, a flow control gate associated with the hopper to control the amount of material delivered to the conveyor, a sensor connected to the machine and positioned at the pre-work station for sensing the material demanded at the pre-work station in relation to the actual amount of material being delivered to the pre-work station, a circuit connected between the sensing means and the delivery means for controlling either the speed of the conveyor or the gate associated with the hopper for controlling the amount of material delivered to the pre-work station in accordance with the amount present.

26 Claims, 4 Drawing Figures



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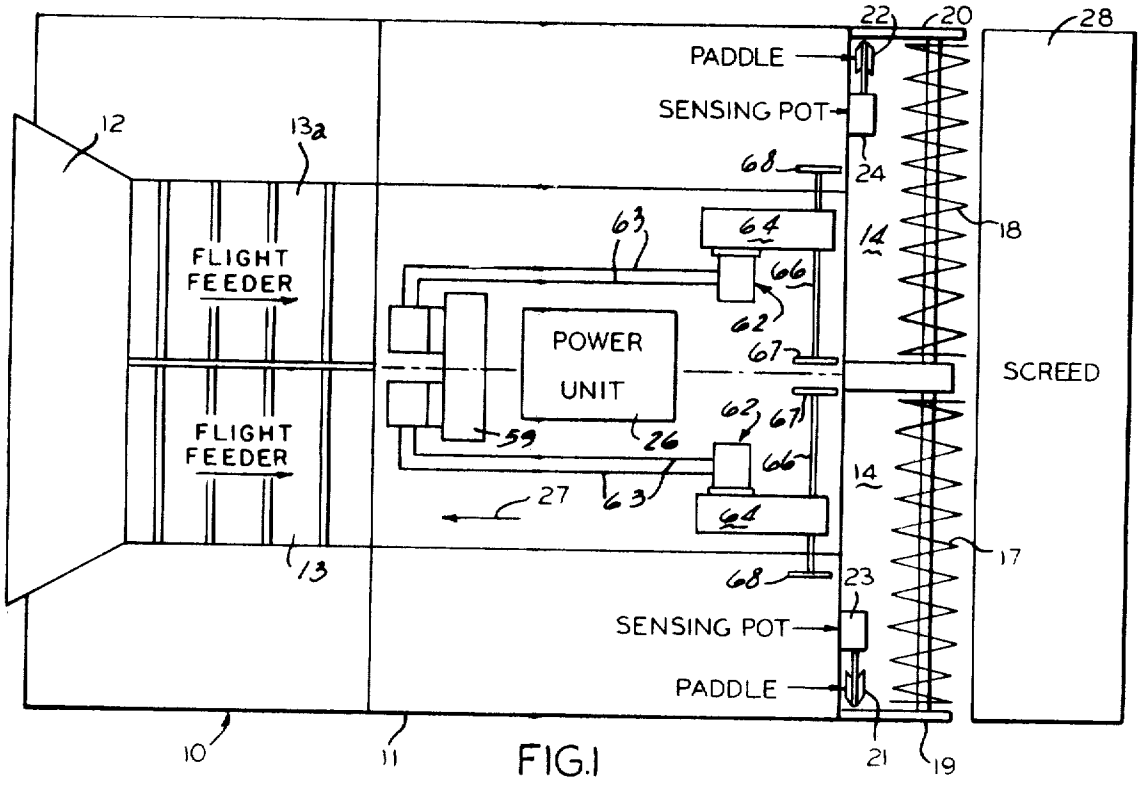

FIG.1

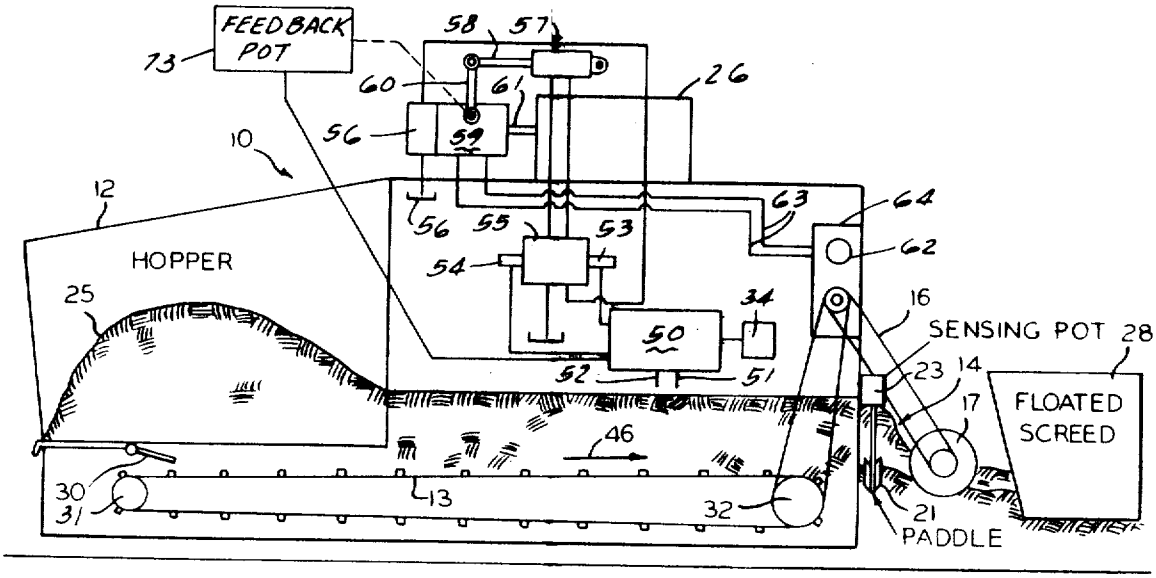

FIG.2

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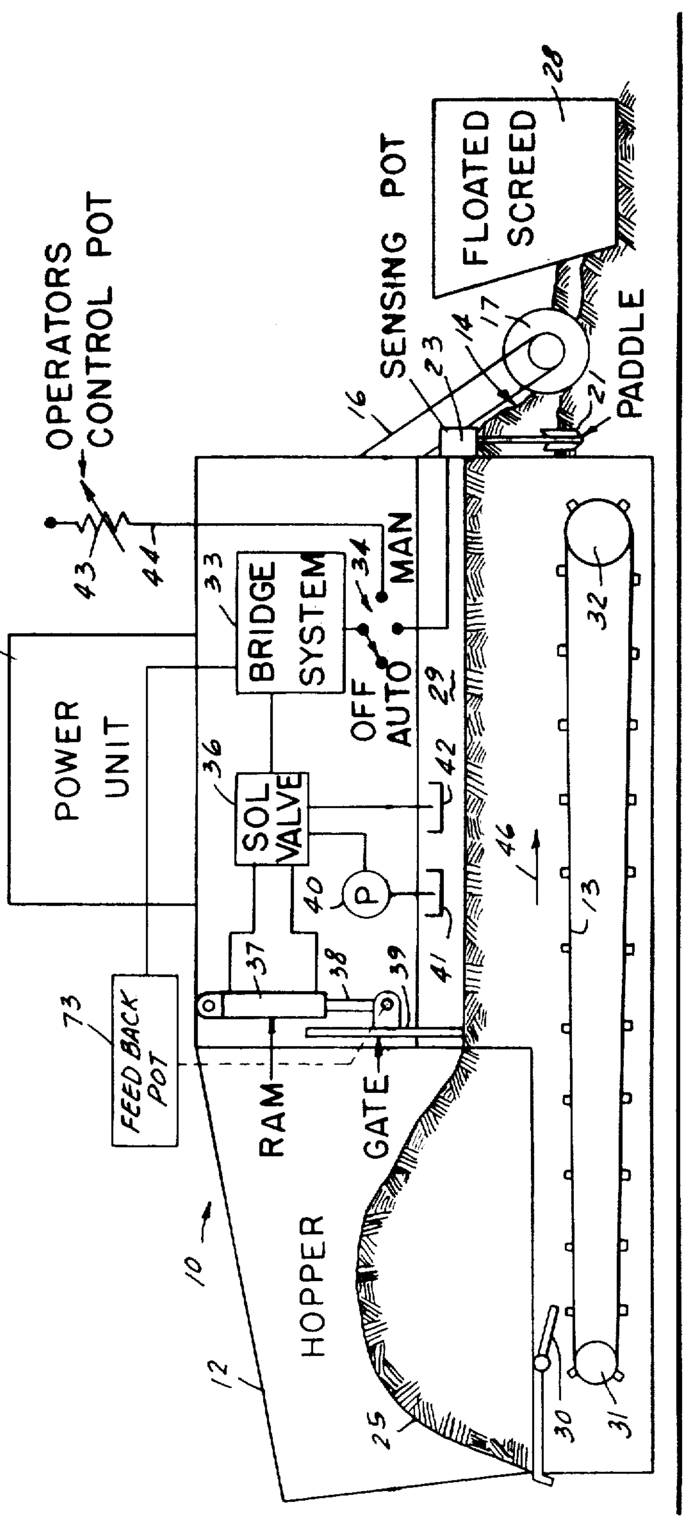

FIG. 3

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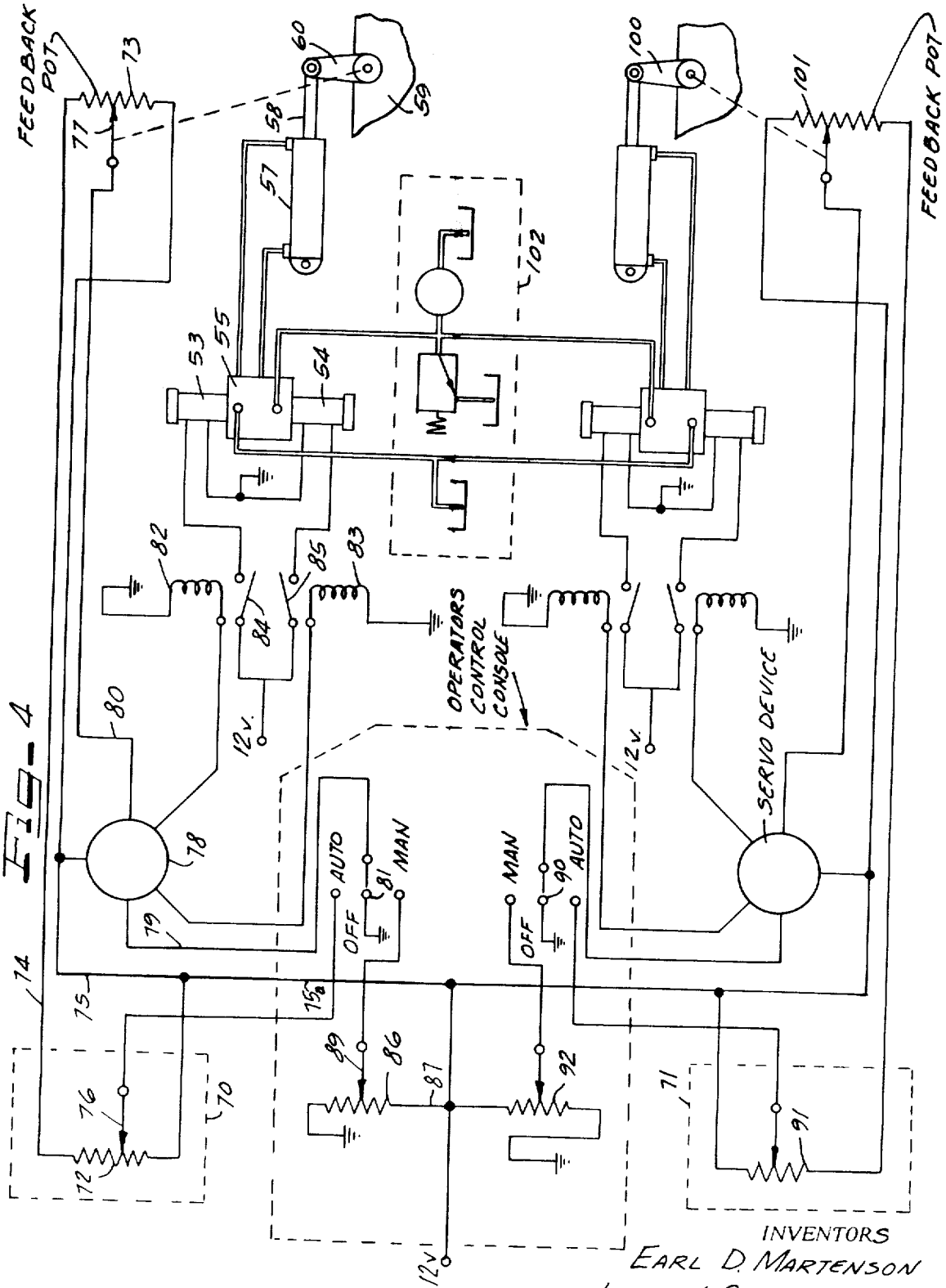

Fig. 4

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MATERIAL CONTROL SYSTEM FOR A FINISHING MACHINE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to a finisher which has particular utility when used for delivering material to a road surface to refinish the road surface. Specifically, the present invention is directed to a new and improved finishing machine control system which includes sensing means and a control circuit connected between the sensing and power means to provide a continuous flow of material to a pre-work station and distribution screw and wherein the rate of flow of the material to the pre-work station and distribution screw is varied in accordance with supply and demand requirements of the machine.

2. Description of the Prior Art

Heretofore, finishers for delivering material to a road surface would operate on an intermittent ON-OFF basis to deliver material to a pre-work station. That is, a quantity of material would be delivered to the road surface where the material would be spread in readiness for an additional operation such as compressing by a heavy roller. The machine conveyor and distribution screw would be turned off when sufficient material was delivered to the pre-work station and then would again be turned on to supply additional material when the quantity of material at the pre-work station has been spread.

This type of machine, of the prior art, for delivering material to a road surface has several disadvantages. One of the disadvantages is that the OFF-ON operating cycle of the conveyor-spreading screw apparatus causes variation of material volume in the pre-work area; such variation produces variable forces on the floated screed element spreading the material and thus disturbing the screed equilibrium and producing surface roughness variations in the material being spread. Another disadvantage is that the OFF-ON operation of the conveyor-spreading screw apparatus produces variations in power load requirements to the finisher which generates power unit surges affecting the entire drive train and the paving speed of the finisher. Such speed variations affect the compaction of the material being spread giving additional roughness to the final compacted surface of the material being spread.

SUMMARY OF THE INVENTION

Accordingly, one of the objects of the present invention is to provide a material control system for a finisher for delivering material to a road surface which will provide a continuous flow of material to the road surface.

Another object of the present invention is to provide control system for a machine delivering material to a road surface wherein the rate of flow of the material to the road surface is controlled in accordance with the supply and demand requirements of the particular road surface being refinished.

Another object of the invention is to provide a control system for a machine delivering material to a road surface wherein the volume of material delivered is controlled through a hopper delivery gate and the speed of the delivery apparatus is maintained at a fixed value or within a stepped speed range.

Another object of the present invention is to provide a material control system for a finisher for delivering material to a surface and wherein the material control includes a sensing device for sensing the actual amount of material demanded at the surface and includes controlling means to provide a sufficient amount of material at the surface and circuit means connected between the sensing means and the controlling means to adequately regulate the actual amount of material which is required to be delivered at the surface to sustain continuous operation.

Briefly, the control system of the present invention is a control system for the conveyor-distribution screw apparatus of a power driven machine which is capable of moving over a road surface under its own power. A hopper is provided for as a reservoir receiving a quantity of material which is to be delivered to the road surface via a conveyor which moves the material from the hopper along the axis of the machine to a pre-work station which is located at one end of the machine and above the road surface. A pair of feed screws extend transversely of the axis of the machine to deliver the material across the pre-work station to the sides of the machine.

In the preferred embodiment sensing means are provided at each side of the machine at the outboard extremities of the pre-work station to sense the material demand of the pre-work station with respect to the actual amount of material delivered to the sides of the machine by the feed screws. The amount of material delivered to the sides of the machine is proportional to the amount of material required to supply the demand under the screed, the pre-work station being immediately forward of and feeding the screed. A signal generated by the sensing devices at the sides of the machine can be used to control the rate of flow of the material delivered to the pre-work station.

An electromechanical control circuit is connected to the sensing devices at the pre-work station and includes means for regulating the desired amount of material which is to be delivered to the pre-work station. The control circuit includes at least one centering servodevice which will acquire a position indicative of the sensing device at the pre-work station and of the controlling means to regulate a power source which drives the feeding conveyor and distribution screws, which, in turn, control the amount of material delivered to the pre-work station.

BRIEF DESCRIPTION OF THE DRAWINGS

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 wherein like reference numerals throughout the various views of the drawings are intended to designate similar elements or components, and wherein:

FIG. 1 is a somewhat diagrammatic plan view of a finisher constructed in accordance with the principles of this invention;

FIG. 2 is a somewhat diagrammatic representation of a side elevational view of the finisher of FIG. 1;

FIG. 3 is a somewhat diagrammatic representation of a side elevational view of another control system according to the invention showing the electrical and hydraulic connections of the various components thereof; and

FIG. 4 illustrates an electrical schematic diagram of a circuit which may be employed in practicing the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Illustrated in FIG. 1 is a finisher constructed in accordance with the principles of this invention and is designated generally by reference numeral 10. The finisher 10 includes a frame superstructure 11 which includes a hopper 12 for receiving a quantity of material. The lower section or floor of the hopper is open and allows the material within the hopper to be delivered to a pair of flight feeders or conveyors 13 and 13a. The material from hopper 12 is picked up by the conveyors 13 and 13a and delivered to a pre-work station 14 at one end of the machine.

In the area of the pre-work station 14, and positioned at the center of the machine is an extended support housing 16. A pair of distribution screws 17 and 18 each have one end thereof rotatably supported by the support housing 16. Distribution screw 17 has the other end thereof rotatably supported by an outboard support plate 19, and distribution screw 18 has the other end thereof supported by an outboard support plate 20. The support plates 19 and 20 are secured to the sides of the machine 10 and extend axially therefrom.

According to the present invention, a pair of sensing paddles 21 and 22 are positioned adjacent the support plates 19 and 20 respectively. The sensing paddles are arranged to float or move upwardly when the volume of material within the area of the pre-work chamber is sufficiently high to engage the paddles. Connected to the paddle 21 is a potentiometer device 23, and connected to the paddle 22 is a potentiometer device 24. The potentiometer devices 23 and 24 produce variable resistances in accordance with the position of the paddles connected thereto for respectively controlling the separate flight feeders and distribution screws for each side of the machine.

The finisher 10 may include a power unit 26, such as gasoline or diesel engine, which is connected to wheels or the like, not shown, to propel the machine in the direction of arrowed line 27 when the machine is used for delivering material to the pre-work station 14. Also, a floated screed 28 may be positioned immediately behind the pre-work station 14 of finisher 10 to even out and pre-compact the material before the material is finally worked to form the road surface. That is, if the material delivered to the pre-work station 14 is asphalt, the screed will smooth the asphalt a uniform thickness before the asphalt is finally compressed onto the road surface.

During the operation of the finisher 10, the material is delivered along the axis of the machine by the conveyors 13 and 13*a* to the pre-work station 14. At the pre-work station 14, the material is then moved in opposite directions transversely from the axis of the machine by the feed screws 17 and 18. When the material reaches the end of the feed screws 17 and 18, in the region of the support plates 19 and 20, the volume of material is sensed by paddles 21 and 22. The movement of paddles 21 and 22 produce resistance changes within their respective potentiometer devices 23 and 24. These resistance changes are used to control the rate of feed of the material to the screed via the pre-work station 14, and which rate of feed corresponds to the supply and demand requirements at the screed of the surface being covered.

FIG. 2 illustrates a side elevational diagrammatic view of the finisher 10 of FIG. 1 and includes one form of control system constructed in accordance with the principles of this invention. The hopper 12 receives material 25 which is to be delivered to the screed via the flight feeders 13, 13*a* and the pre-work station 14. The material is delivered through a tunnel 29 which is formed within the machine and extends along the axial length of the machine. A deflector plate 30 may be provided at the lower portion of hopper 12 to prevent material from inadvertently flowing back from the hopper over the front of the flight feeders and onto the surface in front of the machine. The flight feeders 13, 13*a* may be supported by a pair of end rollers 31 and 32, and the rollers 32 may be connected to drive chain or other means for rotating the wheel to move the conveyors 13 and 13*a* and the distributing screws 17 and 18.

Also shown in FIG. 2 is a control arrangement for controlling the programmed feed operation of the finisher. The sensing paddle 21 senses the height of material, such as asphalt, delivered by the feed screw 17. The sensing paddle 21 changes the value of a pickup sensor 23, which may be either a potentiometer or a differential transformer or any other suitable device to develop a control signal indicative of the position of sensing paddle 21. The control signal is then delivered to a proportional control and amplifier circuit 50. Also connected to the control and amplifier 50 is a manual override switch. Electric power is applied to the control and amplifier 50 through a pair of lines 51 and 52. The electric power may be derived from the battery generator source of power plant 26.

The output of control and amplifier 50 is connected to a pair of solenoid actuating devices 53 and 54 which control the operation of a control valve 55. The control valve 55 receives hydraulic fluid from a reservoir 56 and controls the direction of hydraulic fluid delivered to a hydraulic ram 57. The hydraulic ram 57 includes an extensible piston 58. Movement of the extensible piston 58 controls the operation of a main hydraulic pump 59 by movement of a swash-plate adjusting lever 60. The main hydraulic pump 59 includes a shaft 61 for receiving mechanical power from, for example, the power unit 26. Hydraulic fluid under pressure is delivered from the main pump 59 to a hydrostatic motor 62 via conduit means 63. The output of hydrostatic motor 62 is connected to a gear reducer drive 64 which, in turn, is connected to a shaft 66.

Shaft 66 has secured to one end thereof a gear sprocket 67 for receiving a chain drive to control the rotation of one of the feed screws 17 or 18. The other end of shaft 66 has a gear sprocket 68 connected thereto for receiving a chain drive which controls movement of the flight feeders 13 or 13*a*. Therefore, the speed of rotation of feed screws 17 and 18 is proportional to the linear rate of feed of the flight feeder conveyors 13 and 13*a*.

The control system of FIG. 2 senses the amount of material delivered to the pre-work station 14 and then conveyed transversely to the axial movement of the machine toward the paddle 21 and 22. The control and amplifier circuit 50 includes means for selecting a MANUAL mode of operation to give operator control of material when AUTOMATIC operation is not desirable.

In the AUTOMATIC mode of operation, when the amount of material delivered to pre-work station 14 and sensed by paddle 21 is less than the required amount, a difference signal will be generated by control and amplifier circuit 50 to control the operation of solenoids 53 and 54. This action in turn controls the movement of the extensible piston 58 of ram 57 which, in turn, controls movement of lever 60 to increase the amount of hydraulic fluid delivered to the hydrostatic motor 62 via the main pump 59. The increased hydraulic fluid will increase the speed of rotation of the hydrostatic motor to increase the rate of advancement of the flight feeders and the speed of rotation of feed screw 17. This action will deliver more material to the pre-work station 14 until the sensing paddles sense that the actual amount delivered is the same as the desired amount required for the road surface. Similarly, if the sensing paddle 21 senses more material than is required, the control and amplifier circuit 50 produces a different signal which decreases the speed of rotation of the hydrostatic motor 62 to decrease the amount of material delivered to pre-work station 14. A feedback potentiometer 73 is coupled to lever 60 and connected to the control and amplifier 50 to signal that the requested change in material flow has been accomplished and to maintain the requested flow until signalled again by the sensors. A similar operational relationship also exists between sensing paddle 22 and screw 18.

Illustrated in FIG. 3 is an alternate control arrangement for controlling the feed operation. In this arrangement, the potentiometer device 23 is connected to a control bridge system 33 via a selector switch 34. A selector switch includes an OFF position, an AUTOMATIC position and a MANUAL position. The control system 33 is controllably connected to a solenoid valve 36 which, in turn, controls the amount of hydraulic fluid delivered to a hydraulic ram 37. A hydraulic ram 37 includes an extensible piston 38 which is connected to a movable gate 39. The position of gate 39 controls the quantity of material 25 delivered from the hopper 12 to the flight feeders.

Solenoid valve 36 is an electrically-operated hydraulic control valve and is connected to a hydraulic pump 40. The pump 40 is connected to a reservoir 41 for taking fluid therefrom and delivering the hydraulic fluid to the valve 36. The fluid from valve 36 is then delivered to a second reservoir 42. It will be understood that reservoirs 41 and 42 are indicated only schematically and may be formed by a single container.

In FIG. 3 the feedback potentiometer is coupled to the gate 39 and is electrically connected as a feedback element to the bridge system 33.

According to the present invention, the control system includes a manual selection which can be adjusted by a potentiometer 43. A potentiometer 43 is connected to the MANUAL position of selector switch 34 via a line 44. When switch 34 is in the AUTOMATIC position, the hydrostatic finisher 10 will operate automatically in response to the

material demanded at the work station by the paddles **21** and **22** which generate error signals for controlling the feeder-screw apparatus in accordance with the demand of the screed. It will be noted that the hydrostatic pump is mechanically connected to control the resistance value of the feedback potentiometer **73** as a means for balancing the bridge and maintaining the operating level of the finisher at the new desired delivery rate of material to the pre-work station **14**; that is, an electrical balance where material supply is equal to the demand of the screed.

Illustrated in FIG. **4** is one form of electrical mechanical control circuit which may be used to control a finisher in accordance with the principles of this invention. The control circuit of FIG. **4** includes left and right hand sensors **70** and **71** which may be used in controlling the operation of the separate longitudinal conveyors **13** and **13***a*. In this case, the speed of linear advancement of each conveyor corresponds to that of the corresponding feed screw **17** or **18**.

Sensor **70** includes a potentiometer **72** having its two end terminals connected to a second potentiometer **73** over conductors **74** and **75**. Potentiometer **72** and **73** have movable pointer arms **76** and **77**, respectively, connected to a servodevice **78** over conductor **79** through the AUTO contact of switch **81** and conductor **80** to form a bridge circuit. The pointer arm **76** is coupled to a sensor paddle at one of the ends of the pre-work station and the pointer arm **77** is coupled to the movable adjusting lever **60** of the hydraulic pump **59** as in FIG. **2**. This connection would be to gate **39** in FIG. **3**.

The lower terminal of potentiometer **72** is connectable to a power supply via conductor **75***a*. Movement of potentiometer arm **76** in response to a change of material at the corresponding outboard side of the work station causes an unbalance of the bridge circuit and servodevice **78** causes operation of a corresponding one of the relays **82** and **83**, say relay **83** and closure of its contact **85**, to in turn operate solenoid valve **54**. Operation of valve **54** operates ram **57**, piston **58** and lever arm **60** of hydrostatic pump **59** to vary the rate of material delivery accordingly.

Operation of lever **60** also moves pointer **77** causing a rebalancing of the bridge circuit with respect to pointer **76** and servodevice **78**. The new setting of potentiometer **73** is therefore a feedback control to set the sensing means at a new rate of material flow, i.e. a new reference balance point.

Similar operation is available for manual override operation of the finishing machine wherein a manually variable potentiometer **86** is connected in circuit with the servodevice and potentiometer **77**. The lower terminal of potentiometer **86** is connected to a power supply via conductor **87** and is connected via conductors **87** and **75** to the lower terminal of potentiometer **73**. Pointer arm **89** is connected to servodevice **78** through the MAN contact of switch **81**. In this mode of operation, the bridge balances to the desired material feed rate selected by the operator.

The apparatus of FIG. **4** also includes a separate control system which extends between sensor potentiometer **91** through switch **90** to potentiometer **101** and lever **100** for control of the other feeder-screw apparatus. Each control system may be connected to the same electrical power supply and may share the same fluid supply apparatus **102**.

The manually operable switches and potentiometers may, of course, be duplicated and one or more other operator consoles may be provided for controlling the operation of the finisher from any advantageous position. Also, other type of sensing devices and co-operating circuitry may be provided to control the finisher substantially in the manner described.

Many changes and modifications, other than those named above, may be made in the invention by those skilled in the art without departing from the spirit and scope of the invention as defined in the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A surface finishing machine comprising a reservoir for holding finishing material; a work station at the surface to be finished operatively associated with said finishing machine; delivery means for delivering material from said reservoir to said work station at a continuously variable volume of material; and delivery control means coupled between said work station and said delivery means including material volume sensing means which is constantly and uninterruptably variable for continuously controlling the delivery of said material as a continuous function of the volume of material delivered to said work station.

2. The finishing machine set forth in claim **1**, wherein said delivery means includes conveyor apparatus and said delivery control means includes means for varying the speed of said conveyor apparatus.

3. The finishing machine according to claim **1**, wherein said delivery means includes conveyor apparatus and said delivery control means includes means positioned between said reservoir and said conveyor apparatus for modulating the volume of material delivered to said conveyor apparatus.

4. A surface finishing machine comprising means for receiving material which is to be applied to a surface; delivery means operatively associated with said receiving means for delivering the material from said receiving means to a material work station at said surface; means for sensing the demand of material at the work station operatively associated therewith, said sensing means capable of being uninterruptedly and constantly variable through a range of rates of delivery; delivery control means connected between said sensing means and said delivery means to control the delivery rate of the material; and means connected between said delivery control means and said sensing means for setting said sensing means to a value which corresponds to the delivery rate whereby material demand is constantly sensed in relation to the material delivery rate setting of said sensing means.

5. A surface finishing machine according to claim **4** further including means connectable to said delivery control means for manually controlling said delivering means to vary the rate of the material being delivered to said material work station.

6. A surface finishing machine according to claim **4** wherein said means for delivering the material includes a conveyor, and wherein said delivery control means controls the speed of travel of said conveyor.

7. A surface finishing machine machine according to claim **4** wherein said means for delivering material includes a gate for controlling the amount of material passing therethrough, and wherein said delivery control means controls the opening of said gate.

8. A surface finishing machine according to claim **4** further including spreader means positioned at said material work station for spreading the material delivered thereto.

9. A surface finishing machine according to claim **8** wherein said spreader means includes first and second feed screws for moving the material at said material work station transversely to the direction of delivery to said work station.

10. A surface finishing machine according to claim **9** wherein said means for sensing the material demand at said material work station comprises first and second sensor means positioned at opposite ends of said work station.

11. A machine for delivering material to a road surface, comprising: a hopper for receiving a quantity of material; conveyor means operatively associated with said hopper for moving the material along the axis of the machine from said hopper to a pre-work station; a feed screw secured to said machine and positioned at said pre-work station for distributing the material transverse to the axis of the machine; means settable in response to the delivery rate of the material capable of being uninterrupted and constantly variable for sensing continuously changing demand of material at said work station; control means connected to said sensing means for continuously controlling the delivery rate of material carried by said conveyor means; and means connected between said control means and said sensing means for setting said sensing means in accordance with the material delivery rate.

12. A machine for delivering material to a road surface according to claim 11 wherein said feed screw comprises first and second feed screws each extending from the center of the machine in a direction transverse to the axis of the machine for moving the material from said pre-work station in opposite directions to the sides of the machine, and wherein said sensing means includes first and second sensors positioned on said machine for sensing the demand of material at the sides of said machine.

13. A machine for delivering material to a road surface according to claim 12 wherein said sensing means includes means for controlling the speed of rotation of said first and second feed screws in response to said first and second sensing means, respectively.

14. A machine for delivering material to a road surface according to claim 11 further including gate means connected to said hopper and controlled by said control means to control the amount of material delivered from said hopper to said conveyor.

15. A machine for delivering material to a road surface according to claim 11 further including switch means connected to said sensing means and a manually operable demand means connected to said switch means, said switch means being manually operable to connect said manually operable demand means to said sensing means for manually determining the material delivered to the pre-work station.

16. A machine for delivering material to a road surface according to claim 11 further including a power unit and drive means for moving the machine in advance of the material delivered to said pre-work station.

17. A machine for delivering material to a road surface, comprising: conveyor means within said machine for moving a quantity of material from a material loading area to a floating screed, said conveyor means moving the material along the axis of the machine; a feed screw secured to the machine and positioned at said floating screed for distributing the material in a direction transverse to the axis of the screed; sensing means operatively associated with said machine and positioned in adjoining relationship to said feed screw and said screed capable of being uninterrupted and constantly variable for sensing the changing amount of material being demanded beneath said floating screed; means for referencing the amount of material demanded to be delivered to said screed to the rate of delivery of material; and control means cooperable with said sensing means and said referencing means for continuously controlling the amount of material delivered to said screed by said conveyor, and permitting the amount of material delivered to said screed to be increased upon said sensing means sensing a quantity less than the demanded quantity, and permitting the quantity of material delivered to said pre-work station to be decreased when said sensing means senses a quantity greater than the demanded quantity, the said feed screw being in continuous operation maintaining a constant pressure against the floating screed.

18. A machine for delivering material to a road surface according to claim 17 wherein said feed screw comprises first and second feed screws each extending from the center of the machine in a direction transverse to the axis of the machine for moving the material delivered to said floating screed in opposite directions to the sides of the machine, and wherein said sensing means includes first and second sensors positioned on said machine for sensing the quantity of material delivered to the sides of said machine by said first and second feed screws, said referencing means includes first and second reference means for referencing the respective first and second sensors to the amount of material being delivered to the sides of the machine by said first and second feed screws respectively, and wherein said control means connected between said sensing means and said selecting means includes means for controlling the speed of rotation of said first and second feed screws in response to said first and second sensors, respectively.

19. A machine for delivering material to a road surface according to claim 18 further including switch means connected to said referencing means, and manual selecting means connected to said switch means thereby providing manual and automatic selection of the operation of said machine.

20. A method of controlling material to be applied to a road surface, comprising the steps of: supplying material to a hopper; delivering the material from said hopper to a work station; continuously and uninterruptedly sensing a varying amount of material demanded at said material work station with respect to the amount of material being delivered to said work station; producing a continuous and uninterrupted variable control signal which is indicative of material demand with respect to material delivery and controlling the amount of material delivered to said material work station in response to the control signal produced in accordance with the difference between the actual amount delivered and the material demanded at the work station.

21. The method of applying material to a road surface according to claim 20 further including the step of spreading the material at said material work station.

22. A method of delivering material to a road surface according to claim 21 further including the step of controlling the opening of said hopper in response to sensing the difference between the actual amount of material delivered to said work station and the demanded amount.

23. A method of controlling material applied to a road surface while contemporaneously controlling movement of a floating screed, the steps of supplying material to a hopper, delivering the material from said hopper to the screed; sensing the amount of material being delivered from said hopper to said screed; continuously and steadily sensing a varying amount of material being demanded by said screed; and controlling the amount of material delivered to the screed in response to sensing the difference between the actual amount delivered and the demanded amount while continually and steadily delivering material to the screed and thereby maintaining a relatively constant pressure against the floating screed.

24. In a system comprising a hydraulic circuit including a variable output hydraulic pump circuit and a hydraulic motor driven by said pump; the combination therewith of a servocontrol which comprises electromechanical transducer means coupled to said pump circuit to regulate the output flow rate therein so as to maintain a desired motor output; sensing transducer means continuously sensing a variable function and providing an electrical output signal responsive thereto; feedback transducer means continuously sensing a function variable responsive to the output of said electromechanical transducer means; and control means having a sensing input coupled to said sensing transducer means, a feedback input coupled to said feedback transducer means, said control means being adapted to control the output of said electromechanical transducer means to said pump circuit responsive to the inputs of said control means.

25. The system of claim 24, wherein said sensing transducer means includes a sensor adapted to continuously sense the elevation of a material transported by a conveyor; and wherein said hydraulic motor is adapted to be drivingly coupled to a conveyor such that the conveyor speed can be regulated by said servocontrol to maintain a predetermined material elevation on the conveyor.

26. A surface paving system which comprises a rearwardly traveling paving material conveyor; a transversely traveling paving material conveyor positioned rearwardly of said rearwardly traveling conveyor and adapted to receive paving material therefrom and distribute such paving material laterally across a surface to be paved; a prime mover for said system; a hydraulic conveyor-driving circuit comprising a variable output hydraulic pump having a power input coupled to said prime mover, a hydraulic motor hydraulically coupled to said hydraulic pump in a closed circuit and having a power output, and drive means drivingly coupling the hydraulic motor power output to the conveyor; and conveyor speed control means including a servocontrol which comprises elec-

tromechanical transducer means coupled to said pump to regulate the output flow rate therefrom so as to maintain a desired hydraulic motor output, sensing transducer means continuously sensing the elevation of paving material in the transversely traveling conveyor and providing an electrical output signal responsive thereto, feedback transducer means continuously sensing the output of said electromechanical transducer means, and control means having a sensing input coupled to said sending transducer means and a feedback input coupled to said feedback transducer means and an output coupled to said electromechanical transducer means, said control means being adapted to control the output of said electromechanical transducer means to said pump responsive to the inputs to said control means.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,678,817 Dated July 25, 1972

Inventor(s) Earl D. Martenson and James J. Gebhardt, Jr.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Title page, "[73] Assignee: Barber-Gaeine Company, Aurora, Illinois" should read --[73] Assignee: Barber-Greene Company, Aurora, Illinois--

Signed and sealed this 30th day of January 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

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