Nov. 26, 1968 V. P. COLIZZA ETAL 3,412,657

SURFACING MACHINES

Filed June 3, 1966 2 Sheets-Sheet 1

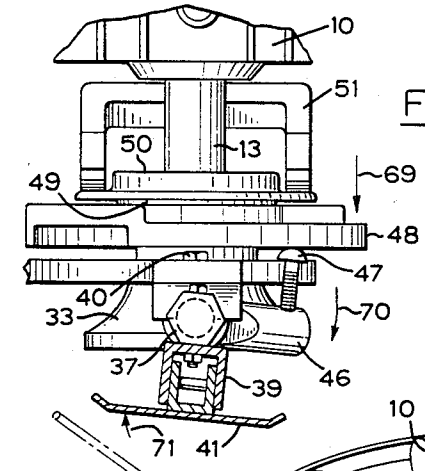

FIG. 4

FIG. 1

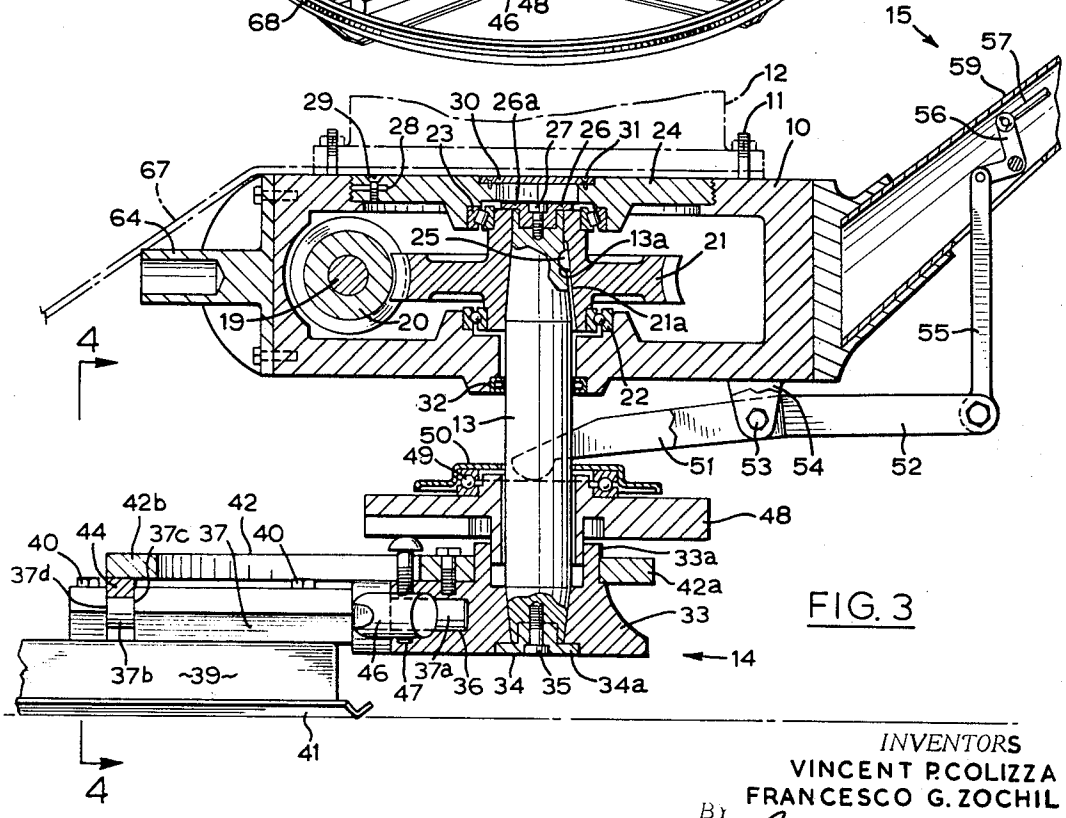

FIG. 3

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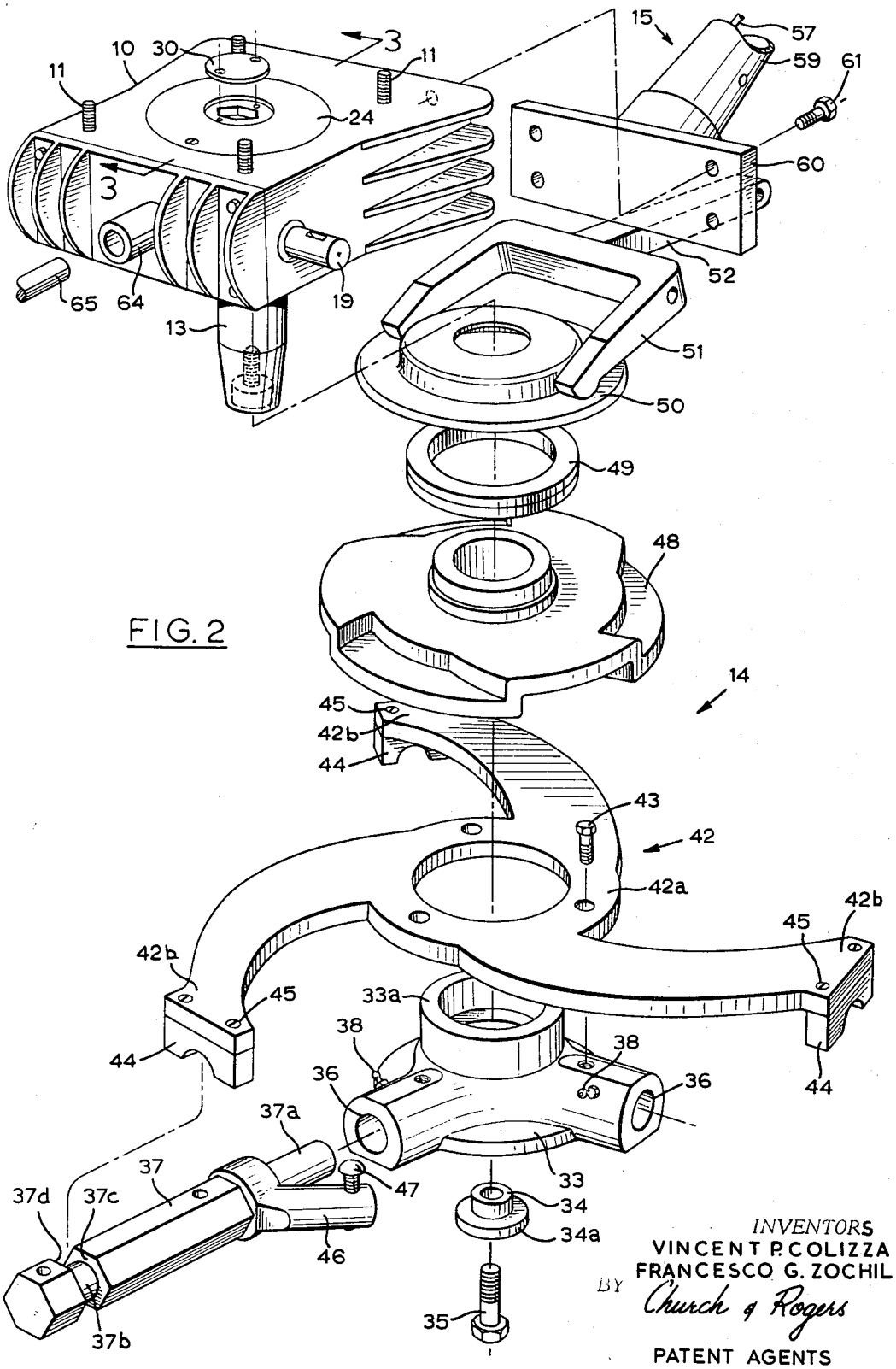

FIG. 2

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United States Patent Office 3,412,657
Patented Nov. 26, 1968

3,412,657

SURFACING MACHINES

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Filed June 3, 1966, Ser. No. 555,133
12 Claims. (Cl. 94—45)

ABSTRACT OF THE DISCLOSURE

In a motor-driven rotary surfacing machine, such as a trowelling machine, a rotatable hub has hub bearings carrying a plurality of radially-extending tiltably rotatable shafts supporting the surfacing elements; a spider member attached to the hub provides radially-extending arms, each of which extends over a respective shaft and carries a respective "outboard" bearing that engages its shaft above the operational area of the respective surfacing element; the spider member interconnects the outboard bearings to stabilise and improve the surfacing action. The hub, a tilting mechanism for the surfacing elements, the shaft on which the hub is mounted and a driving pinion for the shaft are so mounted and constructed that they can be completely disassembled upon removal of single axial bolts. The centre portion of the operator's handle is unobstructed and is concave to fit closely against the operator's body for better control of the machine.

This invention is concerned with improvements in or relating to surfacing machines of the rotary type, such as are used for trowelling cement surfaces.

Trowelling surfacing machines of the rotary type are now commonly used for finishing cement surfaces, such machines usually comprising a motor-driven rotary hub having three or four arms radially extending therefrom, a trowelling blade being mounted on each arm. The arms are mounted in bearings in the hub for rotation about respective horizontal axes, and means are provided for simultaneously rotating the arms to vary the angle of inclination of the trowelling blades with respect to the surface being finished, this angle being adjusted by the operator, as dictated by his experience and the surface finish desired. In a normal trowelling operation the machine is first fitted with relatively wide "float" trowels, which are used in a preliminary operation of levelling the semi-hard cement and which are rotated with a relatively flat attitude, and is then fitted with relatively narrow "finish" trowels that are used to smooth and glaze the concrete and are usually rotated with a different inclination, as dictated by the nature of the concrete and the operator's experience, until the operation is concluded.

The trowelling machines commonly used hitherto have been found to have a number of serious practical disadvantages. We have found that owing to substantial differences in the smoothing effects of the different trowels of the machine, several passes over the surface are necessary to ensure that all irregularities are smoothed away. These irregularities become more and more noticeable as the machine ages, the principal reason being that the arm bearings in the hub wear rapidly under the forces applied thereto, permitting the arms to have substantial undesirable free movement as they rotate, until eventually it is impossible to produce a smooth surface without a complete overhaul, including replacement of the bearings. It has also been found that maintenance and repair of the known machines is difficult and tedious, in that access to the working parts of the machine often require its almost complete disassembly, involving the removal of a relatively large number of bolts, studs, nuts, etc., which frequently are seized and badly corroded because the highly corrosive conditions under which the machines are operated.

It is an object of the present invention to provide a new form of surfacing machine, in particular a new form of cement trowelling machine.

It is a more particular object of the present invention to provide a new form of cement trowelling machine provided with a trowelling blade stabilizer.

It is a further object of the present invention to provide a new surfacing machine, in particular a new cement trowelling machine which is particularly adapted for easy and rapid disassembly of the parts thereof, for servicing and repair, etc.

In accordance with the present invention there is provided a surfacing machine comprising a motor, a hub, means mounting the hub for rotation about a generally vertical axis, means drivably connecting the motor and the hub, first bearings in said hub, a shaft mounted in each first bearing for tilting rotation about a horizontal axis that extends radially with respect to said vertical axis, means associated with each shaft for attachment of a respective surfacing element thereto, a second bearing for each shaft spaced radially outward from the first bearing, and means interconnecting said second bearings for transmission between them of forces received by each bearing.

Preferably the said interconnecting means comprise a stabilizing spider member mounted on said hub and rotatable therewith, the spider member having a respective radially extending arm for each shaft extending generally coextensively therewith and carrying the respective second bearing, forces which are applied by each surfacing element to its shaft being transmitted via the respective spider arm to the spider member and from thence to the other spider arms and the respective surfacing elements.

Also in accordance with the invention there is provided a surfacing machine comprising a gearbox, an output shaft mounted with respect to said gearbox to have its axis of rotation generally verticle in normal operation of the machine, a motor mounted with respect to the said gearbox and connected for driving the said output shaft through said gearbox, a hub mounted on said vertical shaft, first bearings in said hub, a respective surfacing element supporting shaft mounted in each bearing for tilting rotation about a generally horizontal axis that extends radially with respect to said vertical axis, tilting means mounted around the vertical shaft for tilting rotation of the said supporting shafts, and a single axial retaining bolt retaining said hub and the tilting means on said shaft.

A cement trowelling surfacing machine which is a particular preferred embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings wherein;

FIGURE 1 is a general perspective view of the machine, as seen from above and to one side,

FIGURE 2 is an exploded view of the machine to show in detail the essential working parts thereof and the manner in which they are assembled together,

FIGURE 3 is a section through the machine, taken generally on the line 3—3 of FIGURE 2, and

FIGURE 4 is a section through the machine, taken on the line 4—4 of FIGURE 3 to show particularly the operation of the blade tilting mechanism.

The machine comprises a gearbox **10** on which is mounted, as by four screw-threaded studs **11** and cooperating nuts, a motor **12**, which is illustrated herein as being an internal combustion engine, but which may also be an electric motor. A shaft **13** extends downwards from the gearbox with its axis generally vertical, and

carries at its lower end a surfacing element assembly indicated generally by **14**, and to be described in more detail below. The machine is guided and controlled by means of a handle assembly indicated generally by **15**.

The motor **12** is illustrated as having a drive pulley **16** which is connected by a drive belt **17** to a gearbox pulley **18**, mounted on a horizontal shaft **19** of the gearbox. The shaft **19** carries a worm gear member **20**, which meshes with a pinion gear **21** mounted around the shaft **13** and having its axis of rotation coincident with the axis of rotation of the shaft.

Referring especially to FIGURE 3, it will be seen that the pinion **21** is mounted within the gearbox between two vertically spaced bearings **22** and **23**, the lower bearing **22** having its outer race seated within a corresponding recess in the gearbox, and its inner race a press fit on the boss of the pinion. Similarly, the upper bearing **23** has its inner race a press fit on the boss on the pinion, while its outer race is mounted in a corresponding recess in a removable cover plate **24** of the gearbox. The bore in the pinion boss that receives the shaft **13** is tapered to increase in diameter downwards, and the portion of the shaft engaged therein is provided with a corresponding taper, so that the two parts can be mated snugly together. The pinion and the shaft are provided with corresponding key ways **13***a* and **21***a*, in which a key **25** is engaged to constitute additional means ensuring that the two parts will rotate together. The two parts are held tightly in the said snug engagemen by an end cap member **26**, which extends into an axial bore in the shaft and has a radially extending head **26***a* engaging the pinion boss, the end cap in turn being held tightly in engagement with the shaft by a single screw-threaded bolt **27**.

The cover plate **24** is of circular form and in this embodiment is screw-threaded into a corresponding recess in the gearbox. This plate is slit, as at **28**, at at least one part of its periphery, and a clamp bolt **29** extends freely through the part of the plate above the slit and is screw-threaded into the part of the plate below the slit. It will be seen that the spacing between the two bearings **22** and **23** can readily be adjusted when required by rotating the cover plate **24**; the bolt **29** is then tightened to hold the plate tightly in its set position. In an alternative arrangement which is not illustrated the cover plate is fastened to the gearbox by a plurality of circumferentially spaced Allen bolts, the bearing spacing being determined by circular shims disposed between the plate and the gearbox. A small supplementary cover plate **30** is provided, held by bolts **31**, so as to permit ready access to the bolt **27** without disturbing the adjustment of the plate **24**. Since the gearbox normally is filled with a lubricant fluid a sealing ring **32** is provided where the shaft **13** emerges from the gearbox, and the box is provided with the conventional filling and draining means.

The lower end of the shaft **13** is also tapered, decreasing in diameter downwards, and is a snug fit inside the corresponding tapered bore of a hub **33**. The hub is also held fast with the shaft **13** by a cap member **34**, of the same general form as the cap member **26**, and secured by a single axial bolt **35**. The hub is provided with three radially-extending bores **36**, each constituting a plain bearing that receives the inner end **37***a* of a respective radially extending shaft **37**. In other embodiments which are not illustrated, four such bores **36** and four shafts **37** are provided. Lubricating nipples **38** are provided for the bearings. Each shaft has an inverted trough-like member **39** fastened thereto by bolts **40**, each member **39** comprising part of means for fastening thereto a corresponding surfacing member comprising a trowel blade **41**. The means by which the trowels are fastened to the member **39** and thus to the shafts **37** are not illustrated herein, since they form no part of the present invention, and especially suitable means are more particularly described and claimed in Patent No. 3,296,946, and in our copending application Ser. No. 502,683, filed Oct. 22, 1965.

A spider member **42** comprises a central boss portion **42***a* which is mounted around an upstanding corresponding part **33***a* of the boss **33** and is rigidly fastened thereto, as by bolts **43**. The spider member also comprises three radially outward extending arms **42***b*, which in this embodiment are integral with the boss portion **42***a*, and which are generally coextensive with their respective shafts **37**, the arms extending above their corresponding shafts with their radially outermost portions above the operational areas of the associated surfacing elements constituted by the blades **41** thereof. Each arm **42***b* has a downwardly-opening saddle bearing member **44** fastened thereto at its radially-outer end, as by screws **45**, so that each bearing member **44** also is located above the said operational area of the associated surfacing element. Each saddle bearing engages a corresponding part **37***b* of the arm **37** that is of circular cross section, so that the arm can rotate freely therein. It will be seen that in this embodiment, the major part of the shaft **37** is of non-circular cross section, so that the provision of the part **37***b* also causes the formation of two radially-extending shoulders **37***c* and **37***d*, which butt against the adjacent surfaces of the bearing member **44** and restrain lengthwise movement of the shaft **37** in its bearings. The function of the spider member **42** and its bearings **44** will be described below.

Each shaft **37** has an arm **46** fast therewith, the arm extending angularly outward with respect to the axis of rotation of the shaft, and having an adjusting screw **47** at the end thereof. The head of the screw **47** engages a corresponding under-surface of a cam plate **48** mounted around the shaft **13**. A thrust bearing **49** engages the upper face of the cam plate, and is engaged by a pressure plate **50**, which is in turn engaged by the arms **51** of a fork member **52**, the member **52** being pivoted by a pin **53** to two spaced downwardly extending lugs **54** on the lower part of the gearbox **10**. The other end of the fork is connected as by a link rod **55**, to a bell crank lever **56**, which is pivoted in the arm **15** and is connected by another link rod **57** to a ratchet control mechanism **58** disposed at the upper end of the arm for easy manipulation by the operator. The operation of this mechanism **58** also will be described below.

The handle assembly **15** comprises a tubular shaft **59** of tapered cross section, having its greatest diameter at the point where it is joined to a bracket **60**, which is fastened to the gearbox by bolts **61**. It has been found with prior machines that the greatest stress is applied to the handle member at the point where it joins the gearbox assembly, and it most often breaks at this place, and the handle member described and illustrated combines the maximum of strength at the place where this is required, but with the minimum of weight so as to reduce the overall weight of the machine. A transverse handle member **62** is fastened to the upper end of the shaft **59** and carries a control **63** for the motor, the handle member being so shaped that the operator is able to press it without physical inconvenience against his stomach muscles to assist in supporting the machine and controlling its operation.

The exterior of the gearbox is provided with suitable cooling fins, and the side thereof opposite to the handle assembly is provided with a socket **64** for reception of a rod **65**, so that the machine can be readily carried by two persons grasping the handle **62** and the rod **65** respectively.

The machine is provided with a guard ring **66**, which is generally coextensive with the radially outermost extent of the circle being swept by the trowelling blades, so as to guard against the blades engaging some obstacle in their path. In this embodiment the guard ring is stationary, and is connected, as by radially extending straps **67**, to the gearbox, although in some other embodiments the ring may be connected to the trowel blades and rotatable therewith. The guard ring is provided with an outer rubber bumper **68**.

With the motor **12** in operation the worm **20** is driven and rotates the pinion **21** at a corresponding slower speed. The shaft **13** and the hub **33** rotate with the pinion, causing the shafts **37** and the trowel blades **41** to rotate. The normal tendency for the trowel blades is to lie flat in a plane generally parallel to the surface they engage, so that the screws **47** press against the cam plate **48**, which in turn presses against the pressure plate **50** and the fork arm **51**. The operator adjusts the angle of inclination of the blades by moving the handle of the mechanism **58** to move the fork arms **51**, the pressure plate **50** and the cam plate **48** downwards in the direction of the arrow **69** in FIGURE 4; thereupon the adjusting screws **47** and the crank arms **46** are rotated in the direction of the arrow **70** and the blades are rotated in the direction of the arrow **71**. Since there is a positive linkage between the mechanism **58** and the blades, the control handle can be used with a scale which is calibrated to show the actual inclination of the blades to the surface, as contrasted with prior machines in which there is no positive indication of angle, so that the operator must judge the adjustment with the machine in operation.

The forces acting on the blades **41** are applied to the bearings **44** on the spider arms, and also to the bearings **36** in the hub **33**, but since the bearings **44** are disposed above the operational areas of their respective blades, nearer to the centres of action of the blades, they will receive the greater proportion of the said forces. Moreover, the blades are supported at two relatively widely radially spaced bearings, and the practical effect of this arrangement is that there is comparatively little tendency to wear the hub bearings, **36**, so that their life is many times that of corresponding bearings in known machines which are the sole support for the blades.

A more important effect of the spider **42** and its radially outboard bearings is that it provides virtually a rigid connection between the blades that tends to equalize the forces applied to them, and correspondingly equalizes their smoothing actions. In particular, if one of the blades is subjected to an unusual force, such as is caused by engagement with an obstruction, this force is immediately transmitted via the bearings **44** and the rigid spider member **42** to the other blades. The practical effect of this equalization is that in normal operation the blades are all able to work substantially equally efficiently on the surface, and there is little or no marring of the trowelled surface when one of the blades engages an obstruction. It is consequently found that in the normal trowelling of a surface a considerably smaller number of passes is required to obtain a satisfactory finish, giving a corresponding increase in the efficiency of the operation, and the speed with which it can be completed.

Disassembly of our new machine for servicing is unexpectedly simple, as compared with known machines, since removal of the single bolt **35** will permit the cap member **34** to be removed, which immediately permits the boss **33** with the attached trowel blades and spider **42** to be removed from the shaft, followed by the cam plate **48**, the bearing **49** and the pressure plate **50**. Any of these parts can be then individually inspected and replaced just as simply by merely placing them back on the shaft **13**, replacing the cap **34** and screwing the bolt **35** tightly home. The shafts **38** and their attached members **39** can be removed from the hub at any time simply by removing the bearing members **44**, whereupon the shafts can be slid endwise out of the bearings **36**. The saddle bearings can readily be closely inspected, and in view of their very simple form and arrangement can readily and inexpensively be replaced when they begin to show signs of wear.

If at any time access is required to the interior of the gearbox then the motor **12** must first be removed, but this is a simple operation. With the motor removed the shaft **13** can be removed simply by removing the supplementary cover plate **30** and unscrewing the bolt **27**, whereupon the shaft can be drawn vertically downwards out of the gearbox, leaving the pinion **21** accurately located in place. Upon removal of the main cover plate **24** and the pinion and its bearings can be withdrawn for inspection.

It will now be seen that we have provided a new form of trowelling machine which is particularly effective in maintaining a constant trowelling action, despite irregularities or obstructions in the surface being trowelled, with the result that its rate of operation and the results obtained are considerably improved as compared with known machines. The parts of the machine in which maximum strength and rigidity are required have this amply provided, and yet the machine is sufficiently light to be easily handled, consistent with the very rugged conditions under which it is required to operate. The mode of attachment of the blades is particularly simple and effective, and is unaffected by the dirty and difficult conditions of operation. The life of the usually fast wearing components of the machine is very considerably extended beyond that of known machines, and when service is required the machine can very rapidly be disassembled by relatively unskilled labour for examination and replacement of the worn component parts.

What we claim is:

1. A surfacing machine comprising a machine frame, a hub, means mounting the hub on the machine frame for rotation about a generally vertical axis, a motor mounted by the machine frame, means drivably connecting the motor and the hub, a plurality of first bearings carried by said hub, a plurality of surfacing elements supporting shafts each mounted in a respective first bearing for tilting rotation about a generally horizontal axis that extends radially with respect to said vertical axis, means associated with each shaft for attachment beneath the shaft of a respective surfacing element having a respective operational area, a spider member mechanically connected with said hub, rotatable therewith, and having a respective arm means for each shaft extending generally coextensively with its respective shaft above the said operational area of the respective surfacing element, and a second bearing for each shaft carried by each arm means and in which the respective shaft is mounted for said tilting rotation, each said second bearing being positioned above respective arm means that it is disposed above the respective shaft and the operational area of the respective surfacing element, the said spider member interconnecting said second bearings for transmission between them of forces received by each bearing from the respective surfacing element.

2. A machine as claimed in claim **1**, wherein the said second bearings are of arcuate downwardly-opening saddle type and straddle a cylindrical neck of the respective supporting shaft to permit the said tilting rotation therein.

3. A machine as claimed in claim **2**, wherein the portions of each supporting shaft immediately adjacent the respective second bearing are of non-circular cross-section and abut the bearing to constitute means for retaining the shaft against endwise movement in the associated bearings.

4. A machine as claimed in claim **1**, wherein the said second bearings are of arcuate downwardly-opening saddle type and straddle a cylindrical neck of the respective shaft near to the radially outer end thereof to permit the said tilting rotation therein and wherein the portions of each supporting shaft immediately adjacent the respective second bearing are of non-circular cross-section and abut the bearing to constitute means for retaining the shaft against endwise movement in the associated bearings.

5. A machine as claimed in claim **1**, wherein the said machine frame comprises a gear box, the said means for mounting the hub comprises an output shaft mounted by said gearbox to have its axis of rotation generally vertical in operation of the machine, and the said motor is mounted by the said gear box and is drivably connected to the

said output shaft through said gear box, and wherein there are provided tilting means mounted around the vertical shaft for vertical movement along the length of the shaft, the tilting means engaging with respective crank arms extending from the supporting shafts for simultaneous tilting rotation of the said supporting shafts, and a single axial retaining bolt means engaged in the lower end of said shaft and retaining said hub and the tilting means on said shaft.

6. A machine as claimed in claim **1**, wherein the said machine frame comprises a gear box, the said means for mounting the hub comprises an output shaft mounted by the said gear box to have its axis of rotation generally vertical in normal operation of the machine, means for mounting the said output shaft in the gear box comprise two vertically-spaced bearings mounted within the gear box with a common vertically-extending axis of rotation coextensive with the axis of the said output shaft, and wherein there are provided a pinion gear rotatably mounted by the last-mentioned bearings with its rotational axis coincident with the output shaft axis, the top end of the shaft being a taper fit within the pinion with its diameter decreasing upwards, and a single axial fastening means retaining the pinion on the top end of the shaft.

7. A machine as claimed in claim **6**, wherein the said gear box comprises a cover plate screw-threaded therein for rotation about an axis coincident with the axes of rotation of the pinion and the shaft, and for corresponding vertical movement along said coincident axis, the upper one of said spaced pinion gear bearings is mounted by the cover plate for rotational and vertical movement therewith, and there are provided means for locking the cover plate against rotation to maintain a predetermined vertical spacing between the two bearings.

8. A machine as claimed in claim **1**, and comprising an operator's handle extending from the said machine frame, the handle having a crossbar to be grasped by both hands of the operator on either side of a middle portion and the said middle portion being unobstructed and of concave form to fit closely against the front of an operator's body.

9. A surfacing machine comprising a gear box, an output shaft mounted by said gear box to extend through the lower part thereof beyond the gear box and to have its axis of rotation generally vertical in normal operation of the machine, a motor mounted by the machine and drivably connected to the said output shaft through the gear box, a hub mounted on the part of the vertical shaft extending from the gear box, bearings in said hub, surfacing element supporting shafts each mounted in a respective hub bearing for tilting rotation about a generally horizontal axis that extends radially with respect to the said vertical axis, tilting means mounted on the vertical shaft and engaging said supporting shafts for tilting rotation thereof, and means retaining said hub and the tilting means on said shaft, characterized in that means for mounting the said output shaft in the gear box comprise, a pinion gear having a boss with upper and lower boss portions and having in said boss an upwardly tapered bore receiving the correspondingly tapered upper end of the output shaft, the output shaft being keyed for sliding movement in said bore and against relative rotation therein to rotate with the pinion gear, two vertically-spaced pinion gear bearings mounted within the gear box and respectively engaging the said upper and lower pinion boss portions to mount the pinion gear for its rotation, an upper single fastening means at the upper end of the shaft retaining the pinion on the shaft, and a cover plate closing an aperture in the upper part of the gear box wall to permit access through the said aperture upon removal of the cover plate to the said upper fastening means, whereby release of the said upper fastening means permits the removal of the output shaft downwards from the pinion gear and its replacement therein without displacement of the pinion gear in its bearings.

10. A surfacing machine as claimed in claim **9**, wherein the said tilting means is mounted on the vertical shaft for vertical movement along the length of the shaft to engage with respective crank arms extending from the said supporting shafts for simultaneous tilting rotation of the said supporting shafts, and there is provided a single axial retaining bolt means engaged in the lower end of the said shaft and retaining said hub and the tilting means on the said shaft.

11. A machine as claimed in claim **9**, wherein said gear box comprises a cover plate screw-threaded therein for rotation about an axis coincident with the axes of rotation of the pinion and the shaft, and for corresponding vertical movement along said coincident axis, the upper one of said spaced pinion gear bearings is mounted by the cover plate for rotational and vertical movement therewith, and there are provided means for locking the cover plate against rotation to maintain a predetermined vertical spacing between the said two bearings.

12. A machine as claimed in claim **9** and comprising an operator's handle extending from the said machine frame, the handle having a crossbar to be grasped by both hands of the operator on either side of a middle portion, and the said middle portion being unobstructed and of concave form to fit closely against the front of an operator's body.

References Cited

UNITED STATES PATENTS

2,351,278	6/1944	Mathews	94—45
2,594,331	4/1952	McCrery	94—45
2,979,996	4/1961	Spitler	94—45

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