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(54) Apparatus for treating a vertical surface

(57) Apparatus for cleaning, shot blasting, painting or otherwise treating a large vertical surface, for instance the side of a ship, comprises a unit (2) having a workhead (5) horizontally reciprocatable of the unit (2) by means of an archimedian screw (5A) rotated by a motor (4) mounted on the unit (2). Means for raising and lowering the unit on the vertical surface comprises a wire

rope and pulley system or two pairs of rams (6A, 6B, 7A, 7B) each ram mounting a pair of electromagnets (10). The rams and electromagnets are selectively operable so that the unit (2) can be moved up or down a path on a surface in a sequence of steps. Means are also disclosed for moving the unit (2) horizontally, so that firstly it can be moved upwardly in sequence of steps, then laterally, and then downwardly in another sequence of steps.

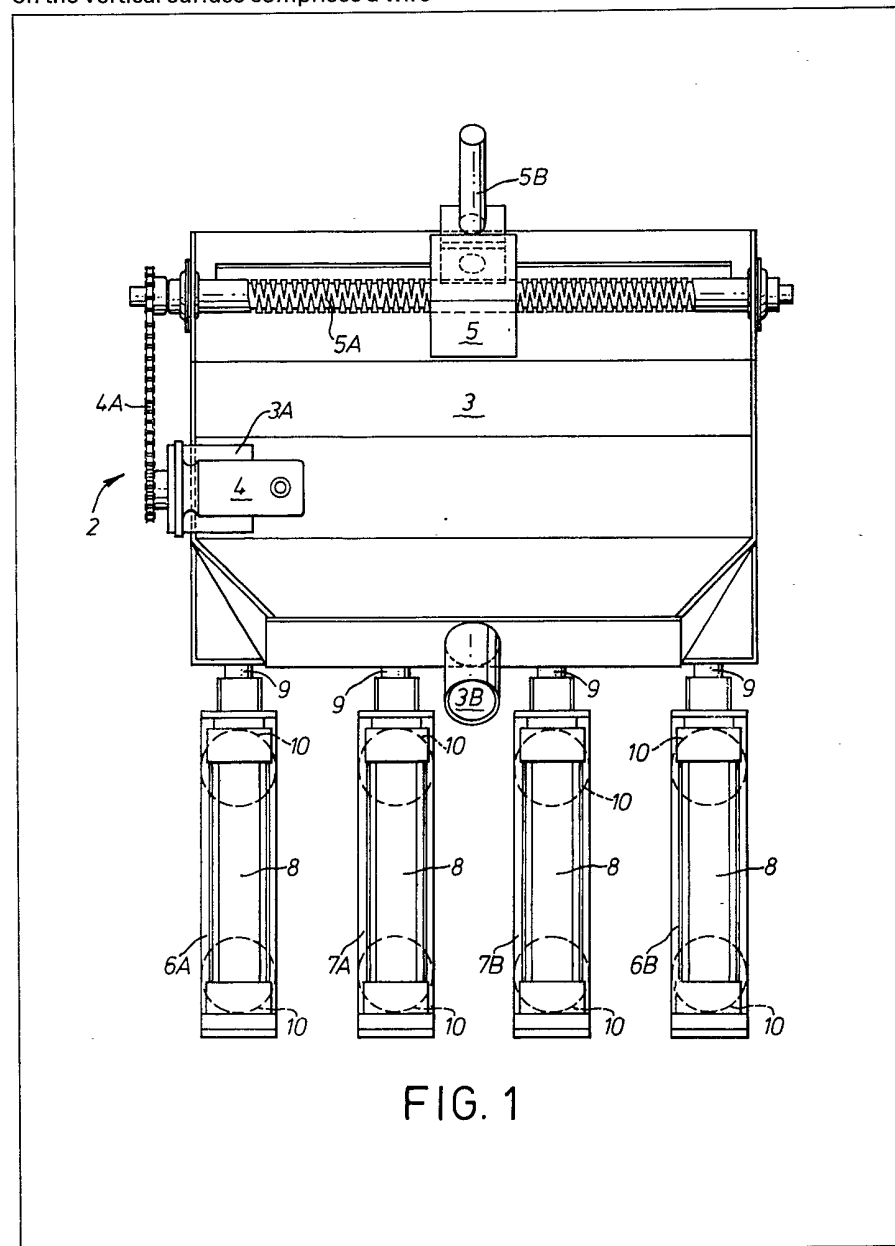


FIG. 1

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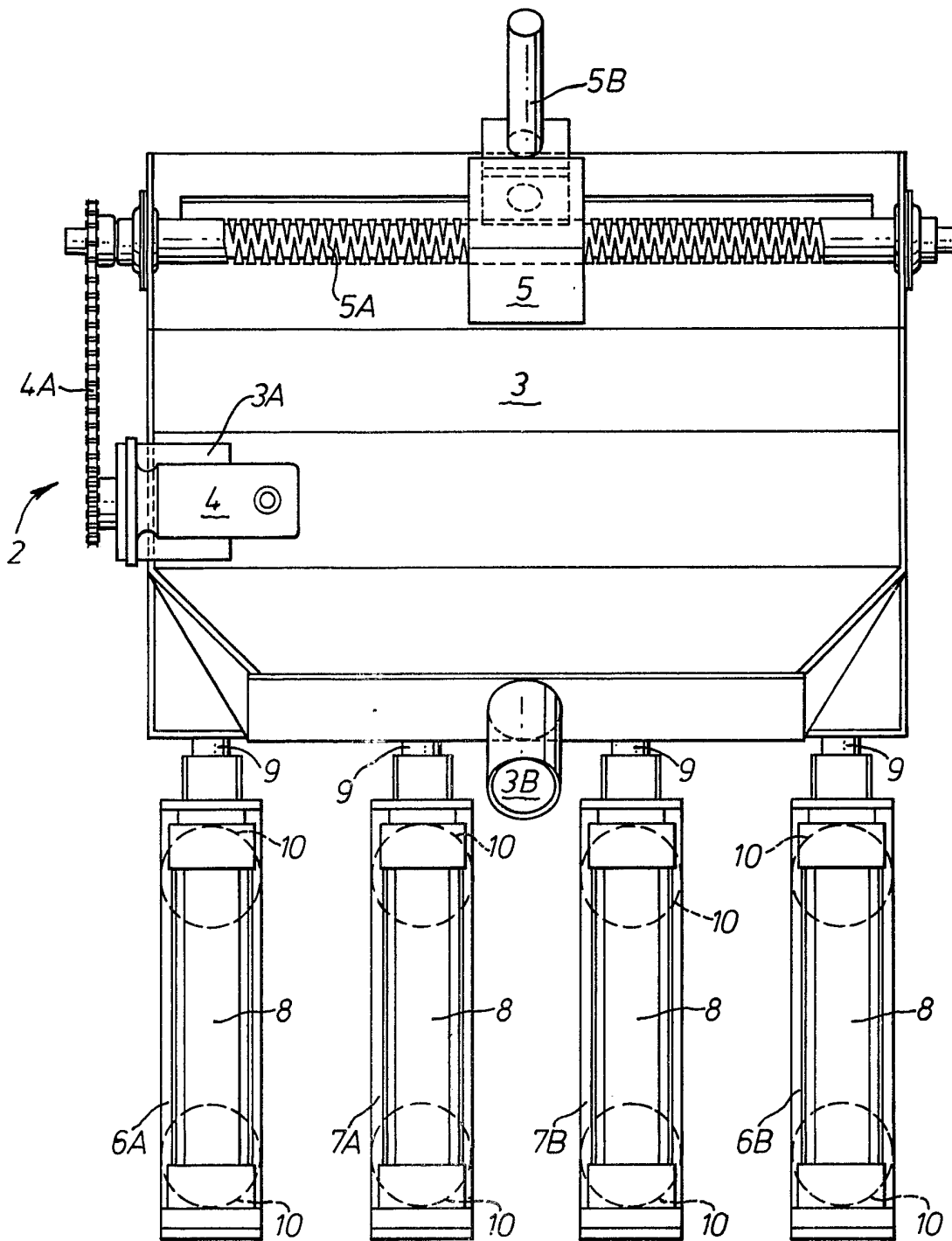


FIG. 1

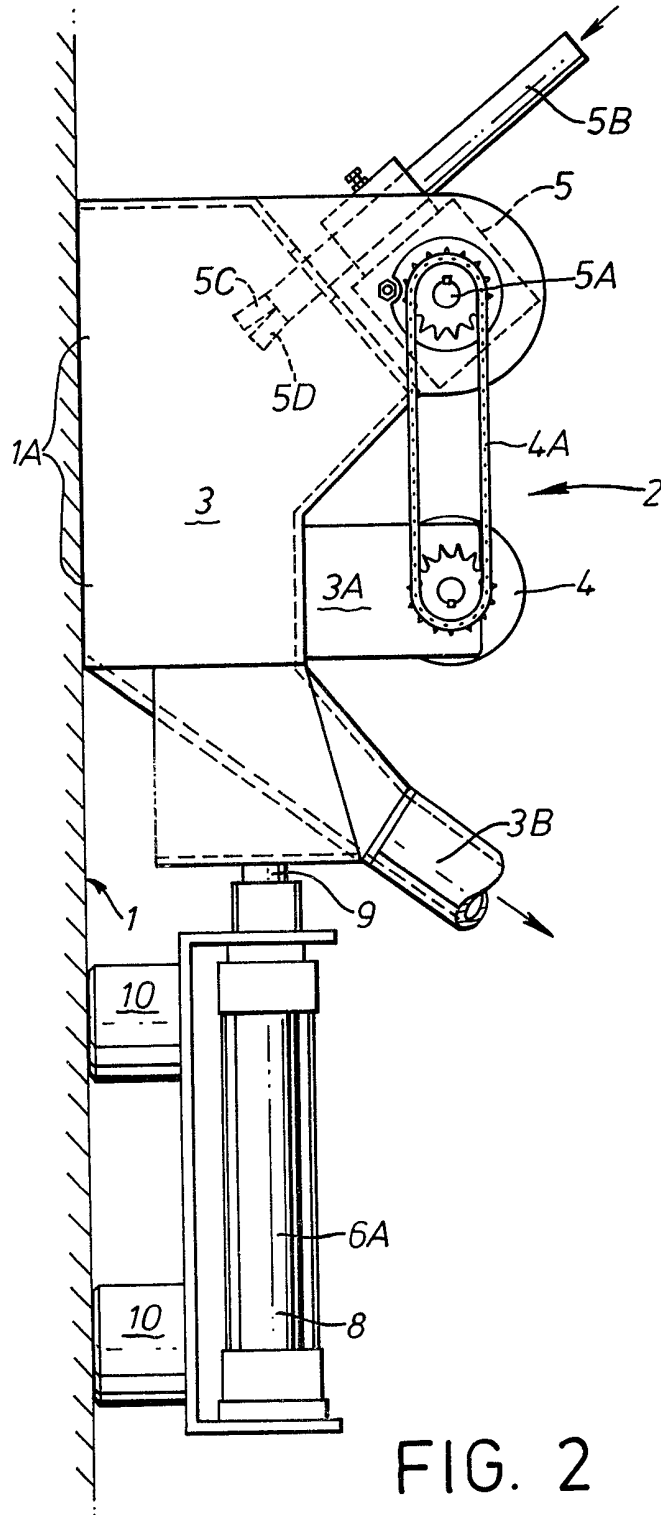


FIG. 2

FIG. 3 3/4

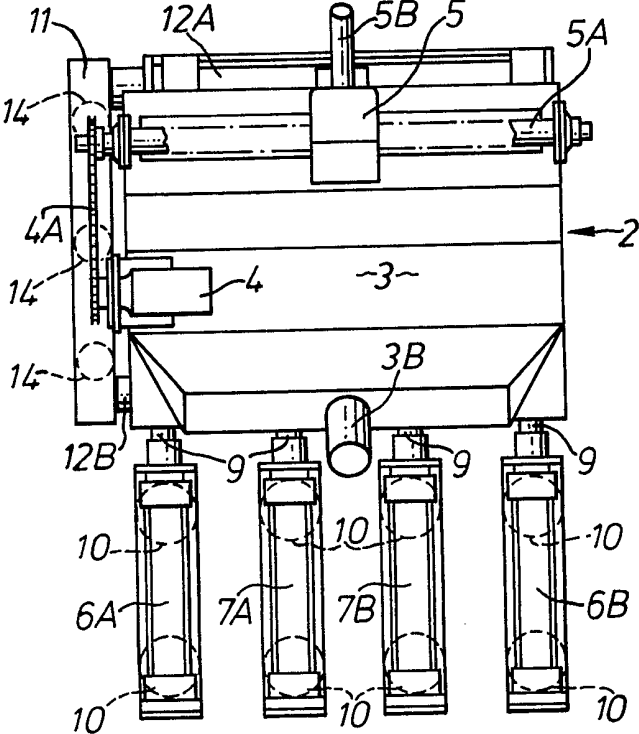
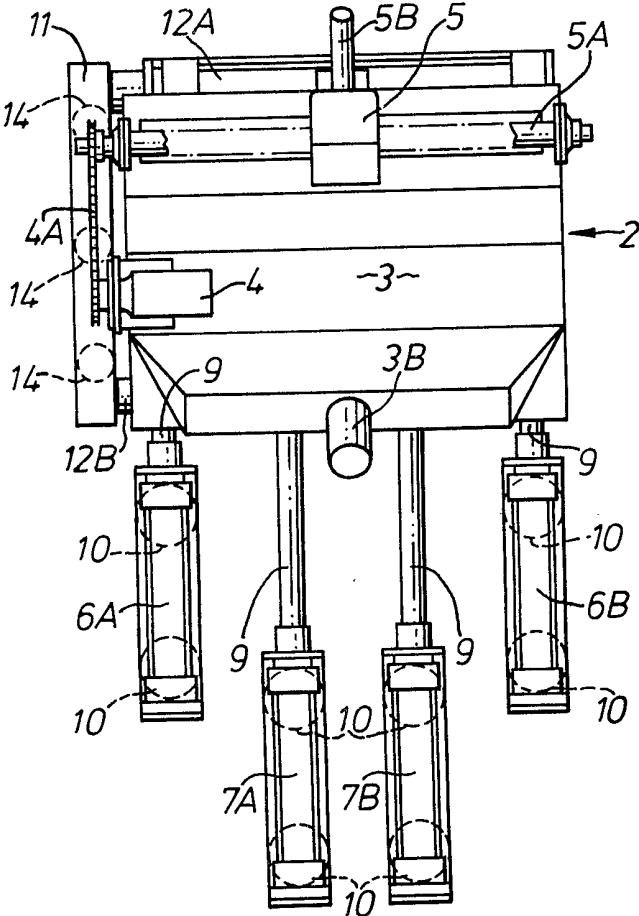
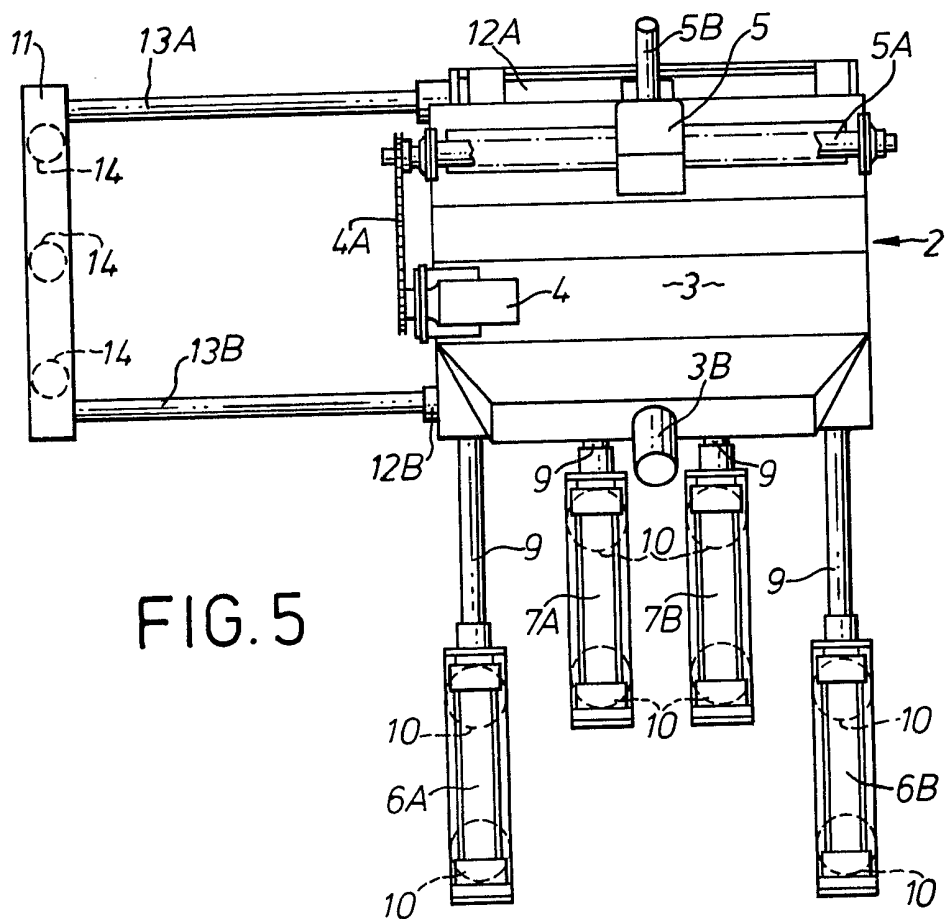


FIG. 4



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SPECIFICATION

Apparatus for treating a vertical surface

5 This invention relates to apparatus for cleaning, shot or grit blasting, painting or otherwise treating a relatively large, vertical or substantially vertical surface, for example the side of a building, ship or oil rig platform surface. An object of the invention is to provide a simple but reliable apparatus for carrying out such operations.

10 According to the invention such apparatus comprises:- a unit having a frame or body; a drive motor mounted on the frame or body; a workhead movably carried by the frame or body; and means for moving the workhead relative to the frame or body, which means is driven by the drive motor; and means for raising and lowering the unit relative to the surface to be treated.

20 Where the surface to be treated is of metal or concrete, the workhead may comprise a grit blast machine or a water jetting lance, or it may comprise a paint spray gun or other means for applying a coating to the surface under treatment.

25 The means for raising and lowering the unit may be a wire rope and pulley system operable to a double drum winch, whilst the unit may, if desired, be controlled in its rising and falling movements by parallel vertical guides.

30 Alternatively the means for raising and lowering the unit may be two pairs of vertically disposed rams, each ram cylinder carrying a pair of spaced electromagnets for gripping a metallic surface under treatment, and the upper ends of the piston rods of the rams being connected to the unit which carries the workhead. By selective operation of the pairs of rams and electromagnets the unit may be moved upwardly or downwardly in a sequence of steps.

40 The invention will now be described by way of example, with reference to the drawings, in which:-

Figure 1 is a front view of one embodiment;

Figure 2 is a side view;

45 *Figures 3 to 5* are front views of another embodiment, showing various steps in a sequence of operation of the apparatus.

Referring to Figures 1 and 2, one embodiment of apparatus for abrasively grit or shot blasting a metallic, vertical surface 1 includes a unit 2 having a body 3 with a bracket 3A on which is mounted a drive motor 4, which may be electrically, hydraulically or pneumatically powered. A workhead 5 is movably carried on the body 3, being mounted on a horizontal, rotatable, Archimedean-type screw 5A, for traversing movement to and fro across the unit, the screw 5A is rotated from the motor 4 by means of a chain and sprocket drive 4A.

60 Means for raising and lowering the unit 2 relative to the surface 1 comprises two pairs of hydraulic or pneumatic rams 6A, 6B; 7A, 7B, each having a cylinder 8 and a rod 9. The upper end of each rod 9 is fixed to the bottom of the body 3. Mounted on each cylinder 8 is a pair of spaced electromagnets 10 which can be selectively energised for gripping the surface 1. Also the rams can be selectively operated in pairs for moving the unit upwardly or downwardly

70 in a sequence of steps. Thus while the electromagnets of one pair of rams 6A, 6B grips the surface 1, those rams are operated to extend their rods and move the unit 2, together with the other pair of rams 7A, 7B (whose electromagnets are not energised), upwards one step. Then the electromagnets of the rams 7A, 7B are energised to grip the surface 1, the electromagnets of the rams 6A, 6B are released, and the rams 7A, 7B are operated to extend their rods and move the unit 2, together with the rams 6A, 6B, upwards another step. It will be understood that the sequence of steps can be upwards or downwards as required. At each step a zone 1A of the surface 1 will be cleaned as the workhead 5 is traversed. The workhead can be traversed to and fro across the zone 1A one or more times as required.

80 The body 3 is in the form of a grit or shot blast enclosure which has an opening at the left hand side (Figure 2) adjacent the zone 1A, the opening being surrounded by surface-engaging seals, not shown, of known type.

85 The workhead 5 carries a blast discharge tube 5B connected to a known blast pot (not shown) which supplies grit or shot by compressed air to the tube 5B, which has two diverging nozzles 5c, 5D for directing the abrasive grit or shot with great force against the zone 1A for removing dirt, paint and so on therefrom. The grit or shot and removed dirt rebound from the zone 1A within the enclosure and leave it by way of an outlet tube 3B.

90 The workhead 5 may be traversed at a required speed by regulating the speed of the motor 4.

95 The tube 5b is longitudinally adjustable in the workhead to permit accurate setting or spacing of the nozzles 5C, 5D in relation to the surface zone 1A being treated.

100 In this embodiment the blast enclosure of the body 3 is 90 cm. wide (as seen in Figure 1).

105 Although a chain and sprocket drive connection 4A is shown, other forms of drive connection could be used. Also other forms of traversing mechanism than the rotatable screw 5A could be used.

110 The workhead 5 could carry, instead of the blast tube 5B, a paint spray gun or a water lance.

115 If the drive motor 4 is electrical, then its operation could be controlled by limit switches operated by the movements of the workhead 5.

120 Although in the above-described embodiment the means for raising and lowering the unit 2 comprises the rams and electromagnets, other means could be used, for example a winch and cable system, with the cable running over pulleywheels.

125 The rods 9 of the rams can be articulately connected to the body 3, so that the rams can be moved relatively angularly with respect to the body. Thus by selective operation of rams and electromagnets, the unit 2 can be turned out of a vertical path of movement.

130 A second embodiment will now be described with reference to Figures 3 to 5 and this embodiment is the same as that of Figures 1 and 2 except that it has a sub-frame 11 mounted on the unit 2 by means of rams 12A, 12B fixed respectively to the top and bottom of the body 3. The sub-frame 11 is a vertical bar which mounts three electromagnets 14. The

sub-frame and rams 12A, 12B, with the electromagnets 14, permit the unit 2 to be moved sideways, from one vertical stepped path to another.

The stepped sequence of operation, which apart from the lateral movement is the same as that of the embodiment of Figures 1 and 2, will now be described.

Referring to Figure 3, all the six rams are in the closed, retracted state. The electromagnets 10 of the pair of rams 7A, 7B are energised, holding the unit 2 in position on the surface being treated. When a zone has been treated, it is necessary to move the unit 2 up to the next adjacent zone above, so that this next zone can be treated. Then the next adjacent zone above is treated, and so on as necessary. Thus the apparatus operates in a vertical path in a sequence of steps. To move the unit 2 from the first zone to the next, the pair of rams 7A, 7B (whose electromagnets are energised) is operated to extend their rods 9 so that the unit 2 and with it the pair of rams 6A, 6B (whose electromagnets are not energised) will be raised up one step to the second zone to be treated, Figure 4. For security the electromagnets of the rams 6A, 6B can now be operated. When treatment of the second zone is finished, it is necessary to move the unit 2 to the third zone. For this purpose the electromagnets of the rams 7A, 7B are released, these rams are retracted, and the pair of rams 6A, 6B is operated to move the unit 2 up to the Figure 5 position, which is assumed for present purposes to be the topmost zone to be treated.

It will be appreciated that the above-described sequence of steps can be carried out a number of times, according to the vertical extent of the path on the surface to be treated.

When the top of the path has been reached, then the apparatus can be operated to move the unit 2 sideways (to the left as seen in Figure 5) to a zone alongside the topmost zone just treated, and then by steps downward again, alongside the upward path already treated.

The upward, lateral, downward, lateral, upward and so on movements can be repeated as necessary according to the extent of the surface to be cleaned. In the two embodiments here described, an average treating time for each zone 90 cms wide would be approximately one minute.

To move the unit laterally, the electromagnets of the rams 7A, 7B are energised to hold the unit 2 against the surface; then the rams 6A, 6B are drawn up, so that all four rams are in the position shown in Figure 3; then the rams 12A, 12B are operated so that their rods 13A, 13B move the sub-frame 11 out to the position shown in Figure 5. Then the electromagnets 14 are energised and the electromagnets 10 are de-energised, so that the unit is held against the surface by the electromagnets 14. Next, the rams 12A, 12B are retracted, to move the unit 2 sideways to the left, ready to treat the zone alongside the previous topmost zone. Then the vertical stepping sequence takes place in reverse, so that the unit is moved downwardly and each zone is treated in turn.

It would be possible to provide the apparatus with limit switches, so that all the various movements are

started and stopped automatically, or in accordance with a programme.

Instead of reversing the direction of vertical movement by means of the embodiment shown in Figures 3 to 5, in another embodiment (not shown) the unit 2 and the rams 6A, 6B, 7A, 7B, could be turned by suitable means through 180°, so that the unit 2 would move downwardly with those rams above it instead of below.

Although in the embodiments described above the rams 6A, 6B, 7A, 7B are moved in steps whose length corresponds to the height of a surface zone being treated, it would be possible to move the unit in shorter steps, so that for example the full stroke of a pair of rams would be carried out in two parts, that is, in two steps. The length of step could be chosen as required by the nature of the treatment being undertaken, the nature of the surface, the nature of any covering to be removed from or applied to the surface, and so on.

CLAIMS

1. Apparatus for cleaning, grit or shot blasting, painting or otherwise treating a vertical or substantially vertical surface, the apparatus comprising:-
 - a unit having a frame or body; a drive motor mounted on the frame or body; a workhead movably carried by the frame or body; and means for moving the workhead relative to the frame or body, which means is driven by the drive motor; and means for raising and lowering the unit relative to the surface to be treated.
2. Apparatus according to claim 1 wherein the drive motor is electrical or hydraulic or pneumatic.
3. Apparatus according to claim 1 or claim 2 wherein the means for moving the workhead is a horizontally-disposed traversing screw mounted in the frame or body and in operative engagement with the workhead.
4. Apparatus according to claim 3 wherein the screw is an Archimedean type screw.
5. Apparatus according to any preceding claim wherein the unit has a body in the form of a grit blast enclosure with an opening through which in use abrasive grit is projected on to a zone of the surface being treated, the opening being surrounded by surface engaging sealing means.
6. Apparatus according to claim 5 wherein the workhead carries a grit or shot blast nozzle and the body includes an outlet for grit or shot rebounded from the zone and for dust and particles removed from the zone.
7. Apparatus according to any preceding claim wherein the raising and lowering means includes hydraulic or pneumatic rams connected to the frame or body, the rams having means for releasably holding the unit against the surface being treated.
8. Apparatus according to claim 7 wherein rams are alternately operable respectively to release the unit from, and hold it against, the surface and to move the unit up or down from a zone which has been treated.
9. Apparatus according to claim 7 or claim 8 having two pairs of vertically disposed rams, with

the upper ends of the rods of the four rams being connected to a lower part of the frame or body.

10. Apparatus according to any of claims 7 to 9 for treating a metal surface, wherein the releasable holding means comprises two electromagnets mounted on the cylinder of each ram, one or more electromagnets being energised to grip the metal surface to hold the cylinder of a ram or rams stationary on the surface whilst one or more other electromagnets are not energised permitting the cylinder of a ram or rams to be moved relative to the surface.

11. Apparatus according to claim 10 when dependent on claim 9, wherein the electromagnets and rams are operable in a stepping sequence in which a) one pair of rams is held stationary on the surface; b) the rods of the said one pair of rams are extended to move the unit and the other pair of rams upwards one step; c) the said other pair of rams and the unit are held stationary on the surface; d) the said one pair of rams is released from the surface and their rods retracted to draw the rams up to the stationary unit; e) the rods of the said other pair of rams are extended to move the unit and the said one pair of rams upwards another step; and f) repeating the sequence.

12. Apparatus according to claim 11 wherein the electromagnets and rams are operable in a reverse stepping sequence to move the unit downwards.

13. Apparatus according to any of claims 7 to 12 wherein the rams are articulately connected to the unit to permit the unit to be turned out of a vertical path by selective operation of the rams and releasable holding means.

14. Apparatus according to any of claims 7 to 13 wherein a sub-frame is mounted on the unit for extension and retraction in a horizontal direction, the sub-frame carrying second means for releasably holding the unit on the surface and for moving the unit horizontally on the surface.

15. Apparatus according to claim 14 when dependent on claims 11 and 12 wherein the electromagnets, rams, and second release holding means are operable a) to move the unit upwards in a series of steps; b) then to move the unit horizontally; and c) then to move the unit downwards in a series of steps.

16. Apparatus according to claim 14 or claim 15 wherein the sub-frame comprises a vertical frame member carrying two or more electromagnets and a pair of horizontally disposed rams, the cylinder of one horizontal ram being mounted at the bottom of the unit and the cylinder of the other horizontal ram being mounted at the top of the unit, and the vertical frame member being mounted on the outer ends of the rods of the rams, the stroke length of which is such as to permit the unit to be moved horizontally from one surface treating zone to another alongside it.

17. Apparatus for cleaning, grit or shot blasting, painting or otherwise treating a surface, constructed and arranged substantially as herein described and shown in the drawings.