This invention relates to an apparatus attachable to relatively heavy, movable, motor-driven pieces of equipment for enabling same to be moved up flights of stairs under their own power. More particularly, this invention relates to a stair-climbing attachment for use on floor washing, waxing and polishing machines.

This invention was developed because of a need for equipment for moving commercial floor cleaning, waxing and polishing machines up flights of stairs and the following description will proceed primarily with reference to this particular use. However, it will be understood that the invention can also be used on other kinds of heavy, movable, motor-driven pieces of equipment which must be moved up flights of stairs, inclines, or the like.

Commercial janitorial service organizations use heavy-duty floor washing, waxing and polishing machines. These machines are motor driven and ordinarily they are supported on wheels so that they can be moved about on one level rather easily. However, because of their weight and size, such machines are difficult to move up flights of stairs. Many buildings requiring professional janitorial service have elevators or, the elevators may not be conveniently situated for moving the machines up higher floors in the building. This problem has existed for many years but none of the prior devices proposed for use in moving such heavy machines up flights of stairs has provided a satisfactory solution to this problem.

Accordingly, it is an object of this invention to provide an apparatus which can be conveniently attached to relatively heavy, movable, motor-driven machines and which can be drivenly coupled to the motor thereof and which includes drivable means for ascending stairs, abutments, inclines and the like.

It is a further object of this invention to provide apparatus, as aforesaid, which is capable of supporting the machine to which it is attached in a stable, reliable fashion as the machine is moved up the stairs.

It is a further object of this invention to provide apparatus, as aforesaid, which can be drivenly coupled to the motor of the machine with which it is to be used in an easy and convenient fashion.

It is a further object of this invention to provide apparatus, as aforesaid, which is of simple and durable construction so that it can be manufactured and maintained in effective operating condition at a minimum cost.

Other objects and advantages of this invention will become apparent to persons acquainted with equipment of this type upon reading the following description and inspecting the accompanying drawings:

In the drawings:

FIGURE 1 is a perspective view of the apparatus of the invention and showing in broken lines the floor cleaning machine with which it can be used and also showing in broken lines a portion of a flight of stairs.

FIGURE 2 is a front view of the stair-climbing apparatus of the invention.

FIGURE 3 is a sectional view taken along the line III—III of FIGURE 2.

FIGURE 4 is an exploded view of the coupling structure used in the stair-climbing apparatus according to the invention.

The stair-climbing apparatus 10 to which the invention relates is comprised of a base 11 which is here shown as being made of sheet metal, although it will be apparent that the base can be made of other suitably strong materials. The base 11 has a planar top wall 12 and a depending peripheral flange 13. The top wall 12 is here shown as being circular in plan view, but it will be apparent that the top wall can be of a different shape so long as it is large enough to support effectively the machine with which it is used.

The top wall 12 has a central opening 14 through which projects a coupling unit 16. The coupling unit 16 is comprised of an upper, generally annular member 17 which has a central opening 18 and a plurality of equidistantly spaced recesses, here three recesses 19, in the peripheral edge of said opening. The opening 18 and the recesses 19 are shaped so that they can slideably but non-rotatably receive a drive element 21 which is fixed on the machine M to which the climbing apparatus 10 is attached.

In the illustrated embodiment, the machine M is a floor washing, waxing and polishing machine having a driving motor 23, handle means 24 for maneuvering the machine, and a weight-supported housing 26 within which the washing, waxing or polishing pad or brush is received.

The drive element 21 is coupled to the shaft of the motor 23 for being rotated thereby. Ordinarily, the drive element 21 is installed on the machine M when said machine is originally manufactured and said drive element is adapted to be connected to the pad or brush so as to effect rotation thereof when the machine is being used for washing, waxing or polishing purposes.

When the machine M is to be moved up a flight of stairs, then the pad or brush is removed and the coupling member 17 is drivenly connected to the drive element 21 by inserting said drive element into the opening 18. It will be understood that the shape of the opening 18 can be designed to cooperate with driving elements 21 of different shapes used on different types of machines. Also, the coupling member 17 can be removed from the coupling unit 16 and another coupling member having a differently shaped opening therein can be installed in place thereof so that the climbing apparatus can be used with machines having differently shaped drive elements.

The coupling member 17 has depending arcuate teeth 32 extending downwardly from the lower surface thereof with the front walls of the teeth forming downward extensions of corresponding one sides of the recesses 19. The teeth 32 are adapted for driving engagement with the lugs 31 on the drive element 21 so that rotation of the drive element 21 will effect corresponding rotation of the coupling member 17 and the remainder of the coupling unit 16.

The coupling unit 16 also includes a lower plate-form element 33 which extends generally parallel with the member 17 and is spaced therefrom by tubular spacers 34. The spacers 34 engage the outer sides of the teeth 32 to prevent lateral movement of the member 17. Bolts 36 extend through the spacers 34 to secure the element 33 and the member 17 in fixed, vertically spaced-apart relation. A further plate 37 is secured to the underside of the element 33 by bolts 38. A tubular coupling part 39 extends downwardly from the plate 37 and it has substantially diametrically opposed, vertical slots 41 in its lower end for purposes to be described.

A guide element 42 is secured to and is spaced downwardly from the underside of the base 11 by a plurality of brackets 43 so that the upper surface of said guide element is substantially parallel with the element 33 and the top wall 12 of the base. The guide element 42 has a recess 44 in its upper surface into which the lower
end of the coupling part 39 is received. The guide plate also has an opening 46 therethrough which is coaxial with the axis of the coupling part 39.

A gear housing 47 is positioned below the guide plate 42. An upright shaft 48 is rotatably supported in the gear housing 47 at its upper end. Crosses through the central opening 46 in the guide element 42 and thence into the tubular coupling part 39. A pin 49 extends transversely through the upper end of the shaft and through the slots 41. Thus, the upright shaft 48 is removably coupled by the coupling unit 16 to the drive element 21 of the motor so that said upright shaft is rotated by said motor. The coupling unit 16 can be removed from the upright shaft 48 by a simple vertical sliding motion. A spring 50 is retained within the coupling part 39 and resiliently biases the shaft 48 out of the coupling unit.

The shaft 48 has a worm 51 integral therewith or fixedly secured thereto and said worm is located within the gear housing 47. The worm 51 is in continuous meshing engagement with a worm wheel 52 which is disposed within the gear housing 47 and which is fixedly secured to a horizontal shaft 53. The horizontal shaft 53 is rotatably supported in the gear housing 47. A pair of hangers 54 extend downwardly from the base 11 at the opposite side edges thereof and said hangers have bushings 56 at their lower ends in which the shaft 53 is rotatably supported. Stop collars 58 are secured on the shaft 53 and are adapted to abut against the hangers 54 to prevent lengthwise movement of the shaft 53.

Hubs 61 are secured to the opposite ends of the shaft 53. Four equally angularly spaced rods 62 extend radially from each hub in a vertical plane. Each rod is in alignment with a corresponding rod on the other hub whereby the outer ends of a pair of rods will substantially simultaneously contact the tread of a stair step as the climbing apparatus climbs the stairs and the next following pair of rods will be adapted to simultaneously contact the tread of the next higher step and so on. The rods 62 preferably have a length approximately equal to the height of a stair riser usually between about 7 and 9 inches.

The size of the base 11 and the shape thereof is of course chosen so that the base will not obstruct the stair-climbing motion of the apparatus. The hubs 61 and their associated rods 62 are positioned outside of the opposite side edges of the base 11 so that they contact each stair tread at widely spaced points to provide a stable, non-tipping support for the climbing apparatus and the machine during the stair-climbing movement.

Operations

While the operation of the climbing apparatus 10 has been indicated in general in the preceding description, the same will briefly be repeated to insure a complete understanding of the invention.

When it is desired to attach the stair climbing apparatus 10 to the machine 11, the coupling unit 16 is drillingly connected to the motor 23 of said machine. In the illustrated embodiment, this is done by removing the floor cleating, waxing or polishing pad or brush from the drive element 21 and then drivingly connecting the coupling unit 16 thereto by inserting the lugs 31 through the recesses 19 so that said lugs can drillingly engage the teeth 32 on the upper coupling member 17.

Rotation of the motor shaft will effect rotation of the coupling unit 16 and thereby rotation of the shaft 48. This rotation through the worm wheel gear 51, 52 will effect rotation of the shaft 53 at a reduced speed. The rods 62 will be moved so that each successive pair of aligned rods will engage the next higher step so that the climbing apparatus and the machine coupled thereto will ascend the steps. Power for effecting this ascending movement will thus be supplied by the motor of the machine.

The rods 62 will engage the steps substantially at the juncture of the tread and the riser. Thus, as the shaft 53 rotates the entire climbing apparatus 10 and the machine connected thereto pivots upwardly about the fulcrum provided at the points of engagement of the rods with the step. When the pair of rods 62 then supporting the stair climbing apparatus and the machine reach a substantially unloaded step, said hangers 54, to which the rods will be at least close to a position for engaging the next following stair step so that the ascending movement of the stair climber and the machine can continue by further rotation of shaft 53. It will be understood that the rods 62 may slide on the stair treads to some extent, if needed, so that transfer of the load from one pair of rods to the next pair of rods can be carried out easily and smoothly.

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

1. A stair-climbing apparatus attachable to a heavy, motor-driven, portable machine having a motor-driven rotatable drive element, comprising:
   a coupling unit adapted to be drivingly coupled to said drive element for being rotated thereby;
   gear means drivingly connected to said coupling unit; and
   shaft means drivingly connected to said gear means for being rotated in response to rotation of said coupling unit;
   spaced-apart spiders mounted on said shaft means and comprising a series of circumferentially spaced arms extending away from said shaft means and adapted for engaging stair steps.

2. A stair-climbing apparatus according to claim 1, including a generally horizontal base and support means on said base for supporting said shaft means for rotation about a substantially horizontal axis below said base.

3. A stair-climbing apparatus according to claim 2, in which said spiders are mounted on opposite ends of said shaft means and located on opposite sides of said base and beyond the marginal edge thereof, said arms lying in a vertical plane.

4. A stair-climbing apparatus according to claim 3, in which said gear means comprises a gear housing rotatably supporting said shaft means, a worm wheel in said housing and secured to said shaft means, an upright shaft rotatably and driveably fixed in said housing, a worm located in said housing and meshing with said worm wheel, said upright shaft extending upwardly from said housing and being drivingly connectible to said coupling unit.

5. A stair-climbing apparatus according to claim 4, in which said coupling unit and said upright shaft have cooperatable and extendible parts and lateral end extending pin means extendible therethrough so that said telescopic parts are drivingly connectible to each other by said pin means.

6. A stair-climbing apparatus according to claim 5, in which a substantially horizontal guide plate is supported on and located below said base and above said gear housing, said guide plate having an opening through which extends said upright shaft, said coupling unit being disposed above said guide plate.

7. A stair-climbing apparatus according to claim 6, in which said base has a central opening, said coupling unit extending through said central opening and including an upper member having an opening for receiving said drive element and having driving teeth engageable with lugs on the drive element whereby said coupling unit can be rotated by said drive element.

8. A stair-climbing apparatus according to claim 1, in which said arms are substantially straight members extending radially outwardly from said shaft means.

9. A stair-climbing apparatus according to claim 1, including a base on which the machine can rest, the coupling unit being freely axially movable relative to
said base, said coupling unit being separable from said gear unit and said drive element.

10. A stair-climbing apparatus according to claim 1, including a generally horizontal base on which the machine can rest, the base having an opening through which the coupling unit extends, the gear means being located directly below said opening and there being an upright shaft connecting said gear means to said coupling unit, said shaft means comprising a single horizontal shaft, hangers extending downwardly from said base and rotatably supporting said horizontal shaft adjacent the opposite ends thereof, said gear means being connected to said horizontal shaft substantially at the center thereof, said spiders consisting of hubs mounted on the opposite ends of said horizontal shaft and said arms being comprised of substantially straight members extending radially from said hubs in a vertical plane, with the members of each hub being aligned with corresponding members on the other hub.

References Cited

UNITED STATES PATENTS

255,693 2/1882 Tauber 280—5.26
843,034 2/1907 Ridgway 280—5.26
2,400,824 5/1946 Jackson 280—5.26 X

FOREIGN PATENTS

1,310,268 10/1962 France.
187,291 6/1907 Germany.

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