



(86) Date de dépôt PCT/PCT Filing Date: 2013/01/21

(87) Date publication PCT/PCT Publication Date: 2013/07/25

(45) Date de délivrance/Issue Date: 2021/02/16

(85) Entrée phase nationale/National Entry: 2015/07/09

(86) N° demande PCT/PCT Application No.: CA 2013/000049

(87) N° publication PCT/PCT Publication No.: 2013/106917

(30) Priorité/Priority: 2012/01/19 (US61/588,635)

(51) Cl.Int./Int.Cl. *B24B 7/18* (2006.01),
B24B 23/02 (2006.01), *B24B 55/10* (2006.01),
B24B 7/22 (2006.01)

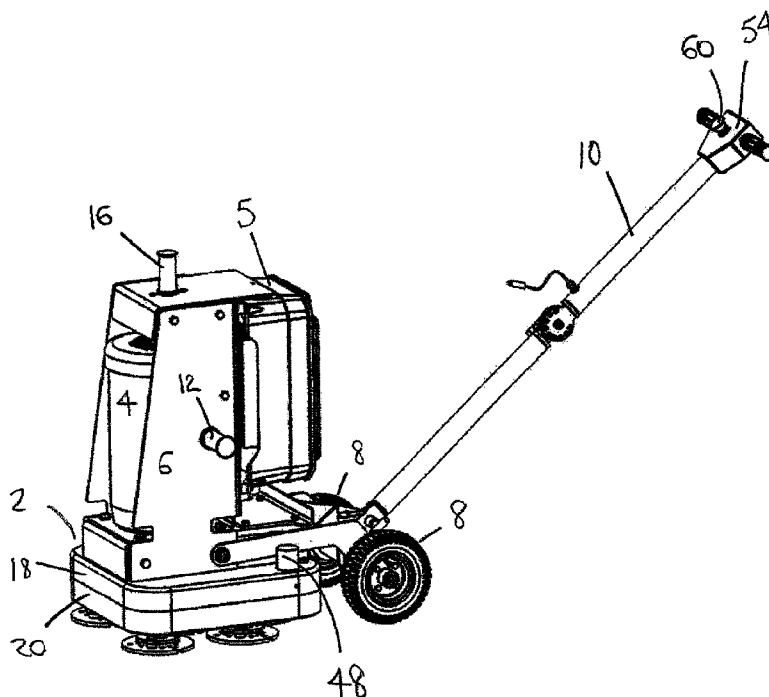
(72) Inventeurs/Inventors:
CHABROS, ALEX, CA;
ROGERS, OWEN, CA

(73) Propriétaires/Owners:
NEWGRIND INC., CA;
RCAD TECHNOLOGIES INC., CA

(74) Agent: OYEN WIGGS GREEN & MUTALA LLP

(54) Titre : APPAREIL POUR L'ABRASION SUPERFICIELLE

(54) Title: APPARATUS FOR SURFACE ABRASION



(57) Abrégé/Abstract:

There is provided a surface abrasion apparatus featuring overlapping abrasion paths to prevent tooling marks; a spaced housing, aluminum monocoque motor design and vacuum venturi to prevent overheating of the apparatus during operation; positioning of the tool plates to allow abrasion adjacent a vertical wall; O-ring seals to allow operation in wet conditions; magnetic and hook and fastener attachment of tool segments to allow ease of tooling; and articulation of the handle to permit greater operability.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(10) International Publication Number
WO 2013/106917 A1

(43) International Publication Date
25 July 2013 (25.07.2013)

- (51) International Patent Classification:
B24B 7/18 (2006.01) **B24B 55/10** (2006.01)
B24B 23/02 (2006.01) **B24B 7/22** (2006.01)
- (21) International Application Number: PCT/CA2013/000049
- (22) International Filing Date: 21 January 2013 (21.01.2013)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
61/588,635 19 January 2012 (19.01.2012) US
- (71) Applicants: **RCAD TECHNOLOGIES INC.** [CA/CA];
1165 Dansey Avenue, Coquitlam, British Columbia V3K 3H5 (CA). **NEW GRIND INC.** [CA/CA]; 3140 Chaucer Avenue, North Vancouver, British Columbia V7K 2C2 (CA).
- (72) Inventors: **CHABROS, Alex**; 1165 Dansey Avenue, Coquitlam, British Columbia V3K 3H5 (CA). **ROGERS, Owen**; 3140 Chaucer Avenue, North Vancouver, British Columbia V7K 2C3 (CA).
- (74) Agent: **BURRI, Stephen R.**; c/o Island IP Law, 43 Machleary Street, Nanaimo, British Columbia V9R 2G3 (CA).
- (81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

[Continued on next page]

(54) Title: APPARATUS FOR SURFACE ABRASION

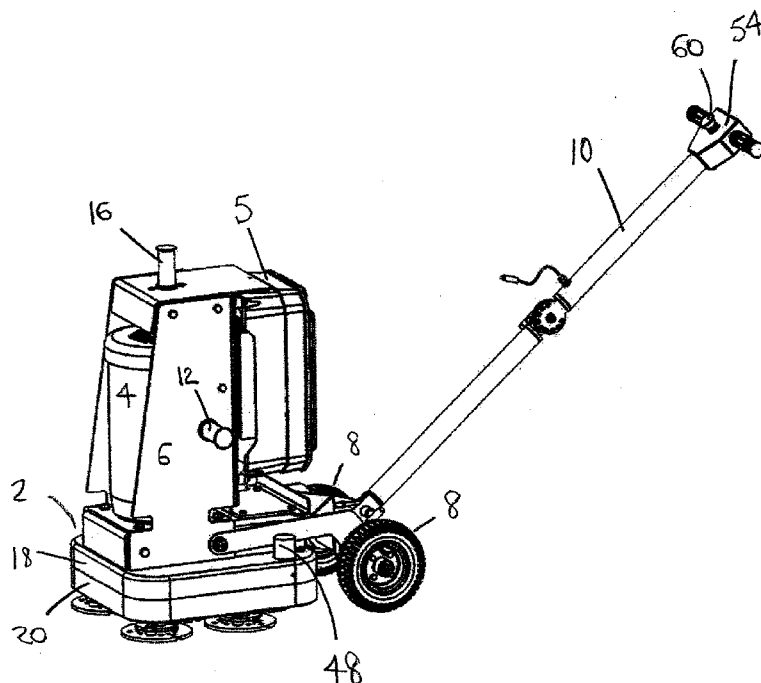


FIG. 1

(57) Abstract: There is provided a surface abrasion apparatus featuring overlapping abrasion paths to prevent tooling marks; a spaced housing, aluminum monocoque motor design and vacuum venturi to prevent overheating of the apparatus during operation; positioning of the tool plates to allow abrasion adjacent a vertical wall; O-ring seals to allow operation in wet conditions; magnetic and hook and fastener attachment of tool segments to allow ease of tooling; and articulation of the handle to permit greater operability.

WO 2013/106917 A1

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,

SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

APPARATUS FOR SURFACE ABRASION

FIELD OF THE INVENTION

The present invention relates to construction tools. In particular, the present invention
5 relates to devices for resurfacing through abrasion.

BACKGROUND OF THE INVENTION

It is common for home and business owners, developers, and renovators to wish to renew
a horizontal surface such as a floor, deck, patio or other indoor or outdoor surface. One
10 means of performing such renewal is to abrade the upper surface of the existing material
to provide a newly revealed, cleaner surface, or to prepare the surface for installation
thereon of another surface material.

Various grinding machines for performing surface abrasion are well known in the prior
art. Such prior art machines, however, have several drawbacks. Some are limited in the
15 type of power supply they may employ. Others leave undesirable tooling marks in the
surface, or fail to abrade the surface sufficiently close to adjoining walls. Still others may
overheat and require frequent cooling periods, or may be difficult to service.

SUMMARY OF THE INVENTION

20 There is provided an apparatus for abrading a surface, the apparatus comprising a chassis;
an upper chassis plate attached to the chassis and a corresponding lower chassis plate
attached to the upper chassis plate, the upper and lower chassis plates having a common
outer perimeter; a plurality of aligned openings through the upper and lower chassis
plates, the openings forming an array; a motor attached to the chassis above the chassis
25 plates; a variable frequency drive attached to the motor; sealing means for preventing
entry of fluid into the motor; a plurality of tool plate assemblies, each assembly
comprising a drive shaft extending from the variable frequency drive through a pulley
and an opening in the chassis plates to a tool holder connected to the drive shaft below

the lower chassis plate, a tool plate connectable to the tool holder, and a plurality of tool segments connectable by tool segment attachment means to the lower side of the tool plate, each tool segment having abrasion means on its lower surface and attachment means on its upper surface; a pair of idler pulleys, each pulley positioned between the
5 upper and lower chassis plates in alignment with a corresponding idler opening passing through the upper and lower chassis plates; a drive belt wound adjacent each of the pulleys and idler pulleys; a framework attached to the chassis and surrounding the motor; at least one pair of wheels attached to the chassis; at least one weight post extending from the framework; an elongated handle extending from the chassis; control means for
10 controlling the motor; and a pair of vacuum venturi disposed on opposing first and second sides of the chassis.

The apparatus may further comprise a vacuum pipe attachable to each of the vacuum venturi for connection to a vacuum for removal of heated air and debris. A cooling space may be provided between the inside of the framework and the outer sides of the motor.

15 The motor may be constructed as an aluminum monocoque. There may be a pair of opposing first and second weight posts extending horizontally from opposing sides of the framework, and a third weight post extending vertically from the top of the framework. Each weight post may be adapted to receive a one or more weights of any desired mass.

The array may position the plurality of tool plates in a pattern in which the area abraded
20 by each tool plate as the apparatus is moved during abrasion of a surface is partially overlapped by the area abraded by at least one other tool plate. There may be six tool plate assemblies. The array may position the outside edge of five of the six tool plates adjacent the outer perimeter of the chassis plates.

The sealing means may comprise a plurality of O-ring seals, or other non-liquid sealing
25 means. The tool segment attachment means may comprise one or more magnets, or a hook and fastener attachment system. The handle may have one or more articulations.

BRIEF DESCRIPTION OF THE DRAWINGS

In drawings which illustrate by way of example only specific embodiments of the invention:

Fig. 1 is a perspective view of an apparatus for surface abrasion according to one
5 embodiment of the invention;

Fig. 2 is a bottom plan view of the apparatus, showing the positioning of the tool plate array;

Fig. 3 is a view of the machine chassis with one side of the chassis lifted away;

Fig. 4 shows a bottom plan view of a symmetrical tool plate, a side plan view of a tool
10 holder attached to a tool plate, and a perspective view of a tool plate with two tool segments;

Fig. 5 shows a bottom perspective view of a tool holder, a tool plate having a hook and loop fastener backing, and a tool plate with associated fastening magnets;

Fig. 6 depicts a vacuum venturi in the machine chassis, and the vacuum pipe insertable
15 therein;

Fig. 7 shows a front perspective view of the apparatus of the invention with attached weight plates;

Fig. 8 shows the hand grips and control panel of the apparatus;

Fig. 9 indicates the articulation points of the handle of the apparatus;

20 Fig. 10 shows the apparatus in storage position with the handle folded over the top of the housing; and

Fig. 11 depicts a perspective view of the body of the apparatus showing the variable frequency drive attached to the motor.

25 DESCRIPTION OF THE INVENTION

According to a preferred embodiment of the present invention, there is provided an apparatus for abrading a surface.

As may be seen in the figures, the apparatus of the present invention comprises a machine chassis 2 having a motor 4 attached thereon. A variable frequency drive 5 is connected to the motor, and a framework 6 surrounds the motor. A pair of wheels 8 is connected to the framework to permit rolling transport of the apparatus. An elongated handle 10
5 extends upwardly from the chassis. A pair of opposing weight posts 12, 14 extends horizontally from opposing sides of the framework. A third weight post 16 extends vertically from the top of the framework.

The machine chassis comprises upper and lower chassis plates 18, 20 having paired openings 22 for insertion of tool plates 24, input shafts 26 and pulleys 28. Preferably, an
10 even number of tool assemblies are disposed within an array of an equal number of openings in the chassis. Idler pulleys 32 occupy two additional openings 34 in the machine chassis. Finally, a pair of vacuum venturi 36 is disposed on opposing sides of the machine chassis.

In the preferred embodiment, an even number of openings are spaced within the chassis
15 plates in an alignment which permits a desired overlap 38 between the abrasion area of adjacent tool plates, as shown in Fig. 2. This layout is arranged such that there are rows of tooling heads that overlap each other from side to side in a calculated ratio to provide a cutting path that has an even and level tool path profile. Referring to Fig. 3, rotation of the circular symmetrical tool plates is effected by driving in a forward or reverse
20 direction an input shaft to effect rotation of a belt 40 interwoven among the pulleys of the tool assemblies, thereby rotating the tool assemblies clockwise or counter-clockwise.

With reference to Fig. 4, each tool assembly 42 comprises a tool holder 44 disposed on the lower side of the machine chassis, adapted to receive a tool plate 24, and a plurality of tool segments 46 adapted to engage with the tool plate. The tool plate includes a central
25 input shaft which extends upwardly through a pulley within the machine chassis. The positioning of the openings of the drive train system of the apparatus is designed to ensure that the tool plates extend fully to the outer edge of the apparatus to permit abrasion immediately adjacent a vertical surface such as a wall. Tool holder 44 may be
30 made from aluminum, for example, to pull heat away from tool segment 46. Various means of attachment of each tool segment 46 to tool plate 24 are possible. These may include the use of magnets 47.

Referring to Fig. 5, various means of attachment of each tool plate 24 to a corresponding tool holder 44 are possible. These means may include the use of magnets 53 or hook and loop fasteners (not shown). Three equidistant pins 49 of tool holder 44 engage corresponding holes 51 of tool plate 24.

- 5 To minimize overheating, the drive system of the present invention is of an aluminum monocoque design. This drive train is assembled within two aluminum billet halves that allow for improved heat dissipation, thus improving the longevity of the enclosed drive components by pulling away undesirable heat from the ball bearings and belt system. Two vacuum ports pass through the drive train to further improve heat dissipation.
- 10 As shown in Fig. 6, in addition, a pair of replaceable vacuum pipes 48 may be disposed within vacuum venturi on opposing sides of the machine chassis to permit vacuum removal of heat generated by the drive train, along with debris abraded from the surface being worked upon. A further cooling aspect comprises the placement of the framework a spaced distance 50 from the motor to permit free flow of air around the motor.
- 15 In order to increase the degree of abrasion of a surface, weights 52 may be added to the apparatus. As shown in Fig. 7, one or more individual weights may be added to each of the top and side weight posts to achieve a desired total added weight. The apparatus eight system permits variable weight positions to customize the weight balance and grinding characteristics to allow a user to define selected point pressure bias depending on the shape or
- 20 profile of the surface needing grinding. The apparatus is designed to accept non-proprietary weights thereby allowing the user to add common Olympic-sized weights of varying sizes and weights. Most prior art devices require use of proprietary weights.

- As depicted in Fig. 8, at the upper end of the handle of the apparatus, there is provided a perpendicular crossbar having opposing hand grips, separated by a control panel 54. The
- 25 control panel may include a forward motion switch 56, a reverse motion switch 58, and an emergency stop switch 60.

- Referring now to Figs. 9 and 10, to permit operation in a variety of circumstances, the handle of the present invention is provided with a plurality of articulation points 62 along its length. Adjustment of handle articulation at these points permits easier
- 30 manoeuvrability of the apparatus. In addition, the handle may thereby be folded over the

framework of the apparatus for compact storage and transport. Handle articulations in multiple locations allowing the machine to be operated in tight quarters, backwards, and under height restricted areas.

Referring to Fig. 11, the apparatus of the present invention is outfitted with a customized
5 variable frequency drive ("VFD") 5 that allows users to use either single or three-phase power sources and to employ variable speed control. VFD also permits current-limiting to suppress current surges and to limit current to a desired maximum as defined within the VFD's programmable parameters.

The tool plate system is adapted to accept standard tooling which has been modified to
10 allow for quick tool changes. The current method for mounting tooling is by fastening tooling directly to the tool plate and requires unfastening to change tools. The new design of the present invention permits use of a magnetic interface to make tool changes faster and easier. Each tool plate has a symmetrical mounting pattern which provides a consistent tool motion to result in a desired abrasion pattern.

15 In operation, the motor, typically electric, variably drives an input shaft in a forward direction, clockwise or counter-clockwise. The input shaft causes a drive pulley to rotate, thereby rotating the drive belt, which in turn rotates each of the tool assembly pulleys and their associated tool plates, to which tool segments are attached. A user moves the apparatus around the surface being abraded to achieve a renewed surface. The motor
20 may also be operated in a reverse direction to effect rotation of the pulleys, belt and tool plates in the opposite direction. A pair of idler pulleys redirects the drive belt around adjacent pulleys.

The apparatus includes a plurality of tool plates, each adapted to receive modified tool segments, which have an abrasive media bonded to their lower surface. The modified
25 tool segments are held in place by the magnet of the tool plate in the preferred embodiment. In an alternate embodiment, the tool plate may have a hook and loop fastener for attachment of abrasive media having a hook and loop fastener interface. The apparatus further includes a plurality of pulleys, each pulley being adapted to rotate a corresponding tool plate; and a plurality of drive shafts in continuous contact with the
30 pulleys via the drive belt such that the tool plates rotate in one direction when the forward

drive shaft is engaged, and in the opposite direction when the reverse drive shaft is engaged.

A control interface for the machine allows for both forward and backward tool rotation which allows the user to re-dress tooling without having to remove the tooling from the machine. The symmetrical design of the drive train system permits operation in forward
5 or reverse direction without incident or impact on machine service factor.

The drive train system of the apparatus is designed to be easily assembled and serviced in the field by an individual with basic mechanical skills. Unlike prior art machines that need to be sent to a repair facility, this drive train can be fully disassembled and re-
10 assembled in approximately 20 minutes with a simple tools and without the use of liquid silicone-type sealers, as the drive train has o-ring seals. The drive train system of the present apparatus is fully sealed and water tight to prevent ingress of foreign debris and other contaminants, including water. This allows for the machine to be used in both wet and dry conditions.

15 The vacuum system of the invention has removable vacuum interface pipes on the upper side of the machine chassis to allow use of inserts of different sizes for vacuum hoses of varying sizes. The vacuum system also incorporates twin flare type openings at the bottom of the drive train which provides a venturi effect to maximize particulate extraction.

20 The tool plate driver allows for multiple tool plate options that can be easily installed and removed by a simple pull. The tool plate driver system also has the ability to accept various densities of rubber to further expand the machines grinding capability by offering varying degrees of articulation.

While specific embodiments of the invention have been described and illustrated, such
25 embodiments should be considered illustrative of the invention only. The invention may include variants not described or illustrated herein in detail. Thus, the embodiments described and illustrated herein should not be considered to limit the invention as construed in accordance with the accompanying claims.

CLAIMS

1. An apparatus for abrading a surface comprising:
 - a framework with a motor housed therein;
 - a chassis housing a drivetrain, the drivetrain comprising:
 - a drive pulley operatively connected to the motor;
 - a plurality of tool assembly pulleys;
 - a belt operatively connecting the drive pulley and the plurality of tool assembly pulleys;
 - a plurality of tool assemblies operatively connected to the drive pulley and the plurality of tool assembly pulleys, each tool assembly comprising:
 - a tool holder;
 - a tool plate comprising a tool segment with an abrading surface;
 - wherein the tool holder and tool plate are detachably connected by a plurality of equidistantly spaced pins, wherein the number of pins is three, wherein the belt operatively connects the drive pulley and the plurality of tool assembly pulleys, whereby lateral or longitudinal displacement of the chassis across the surface to be abraded results in a path of any one tool assembly to be at least partially overlapped by a path of at least one other tool assembly.
2. An apparatus according to claim 1 comprising a handle connected to the framework, the handle comprising at least two elongate pivotally connected members, whereby the handle is configurable in an extended position and a stowed position.
3. An apparatus according to claim 1 or 2, wherein the number of tool plates is six, and wherein the tool plates are arranged to form three aligned rows of two tool plates each in a first direction, and two staggered rows of three tool plates each in a second direction perpendicular to the first direction.
4. An apparatus according to any one of claims 1 to 3 wherein the framework comprises a laterally extending post on each side, each post configured to receive a weight thereon.

1/11

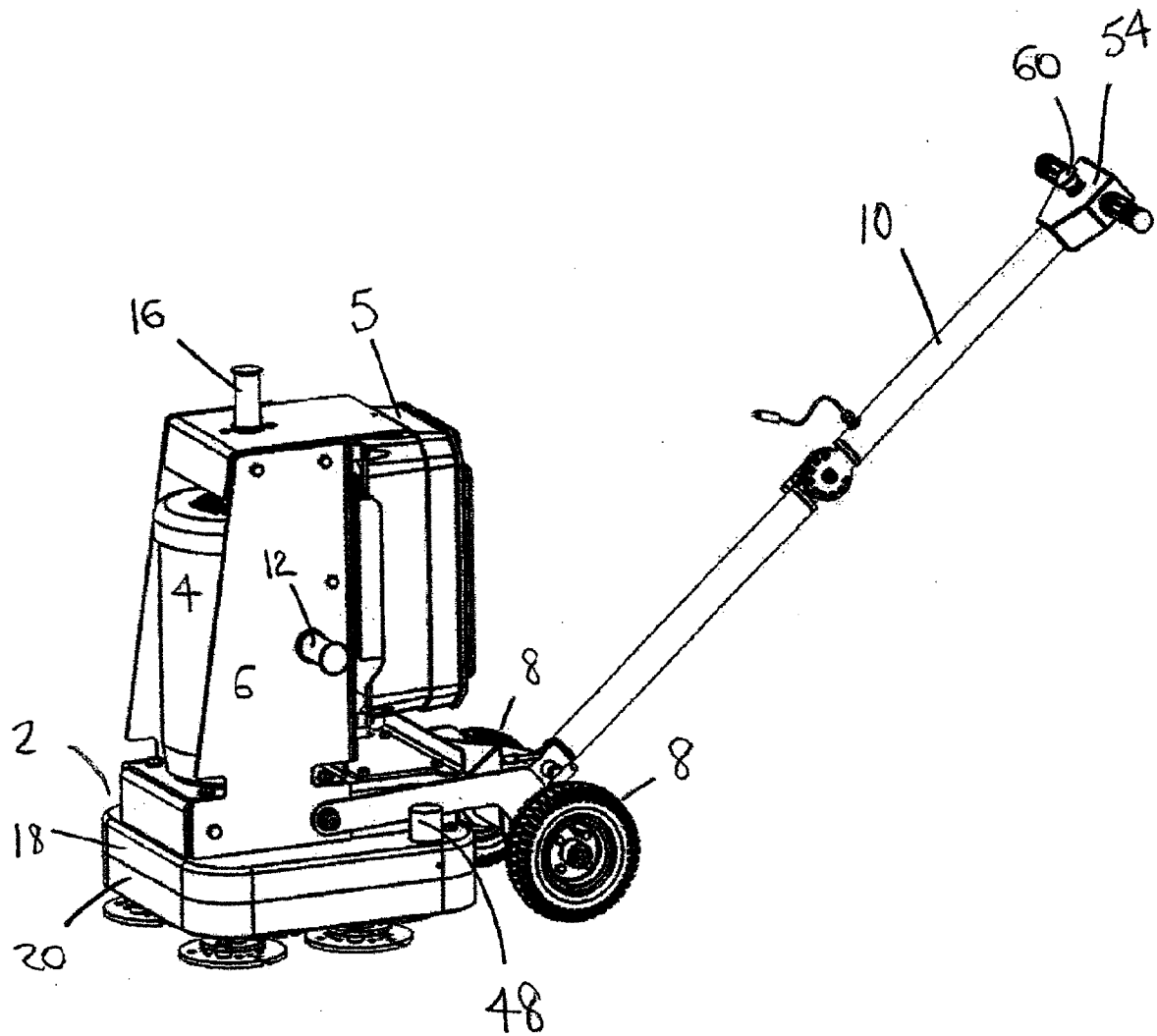
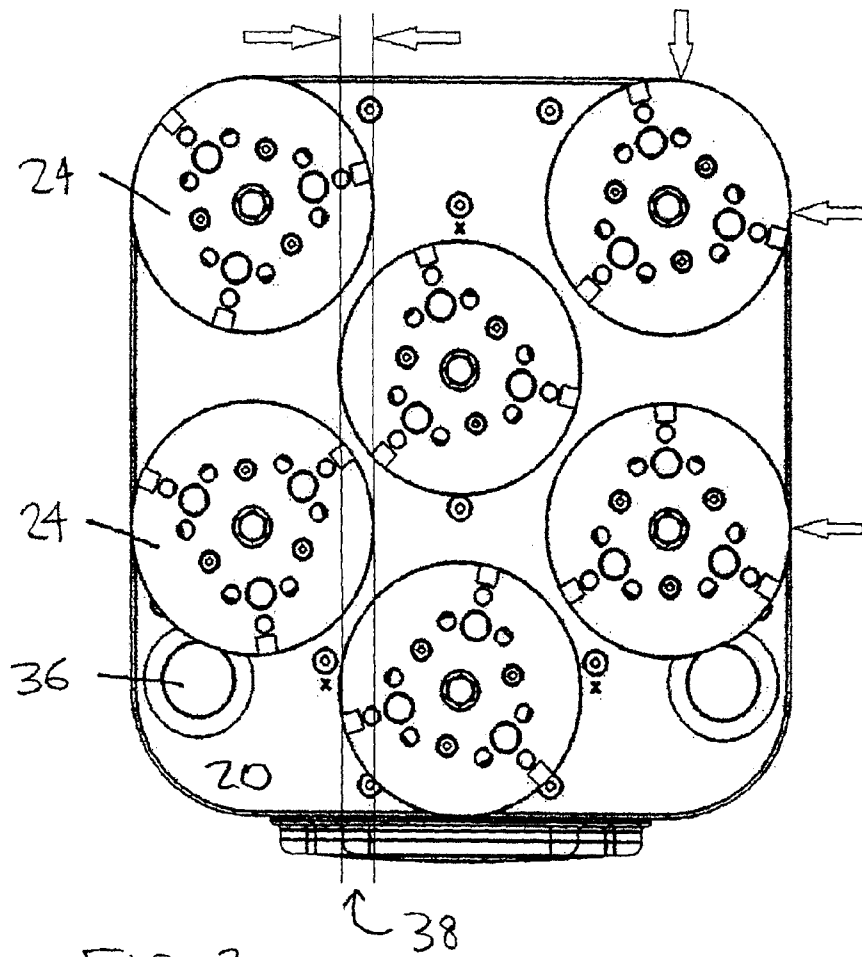
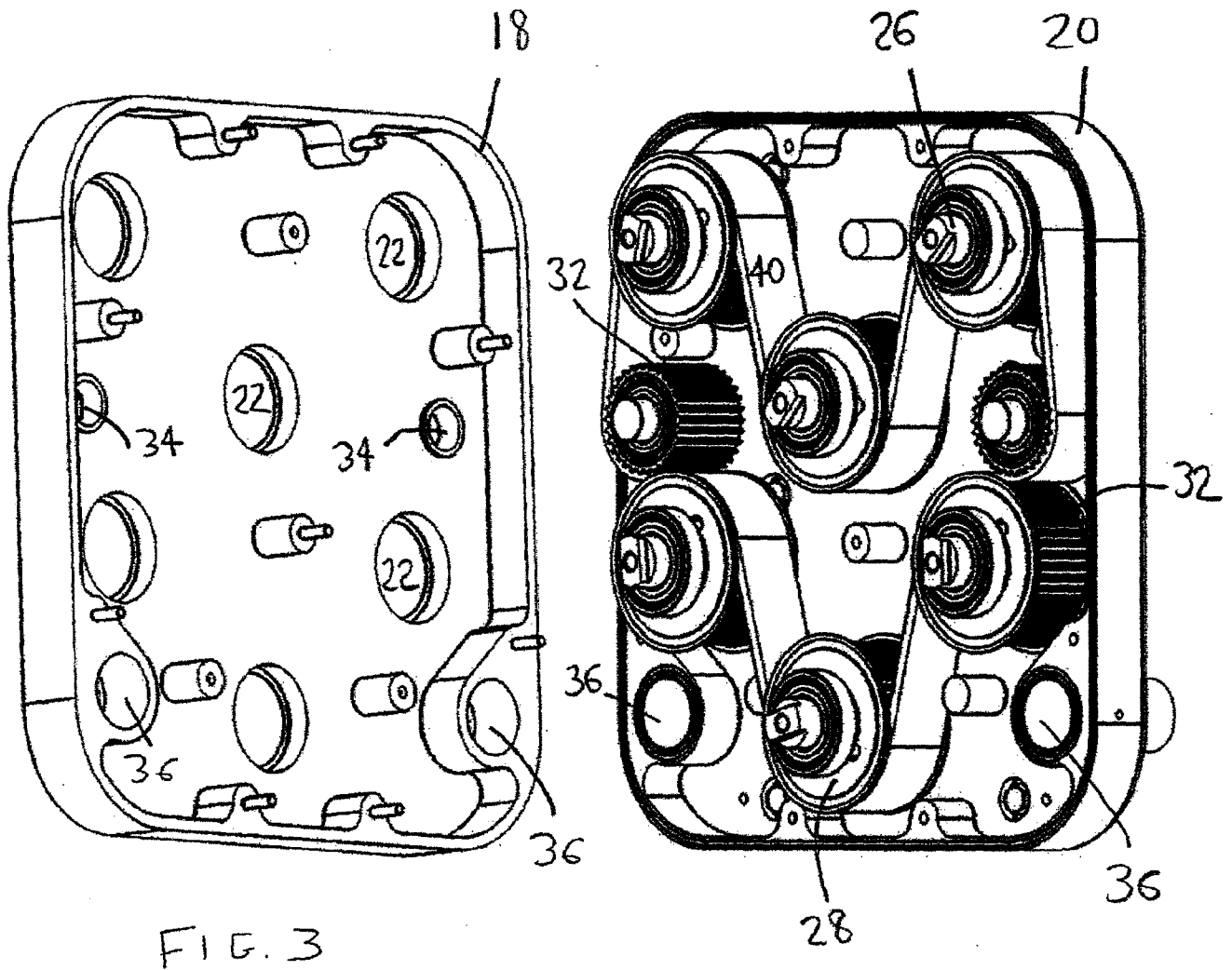


FIG. 1



3/11



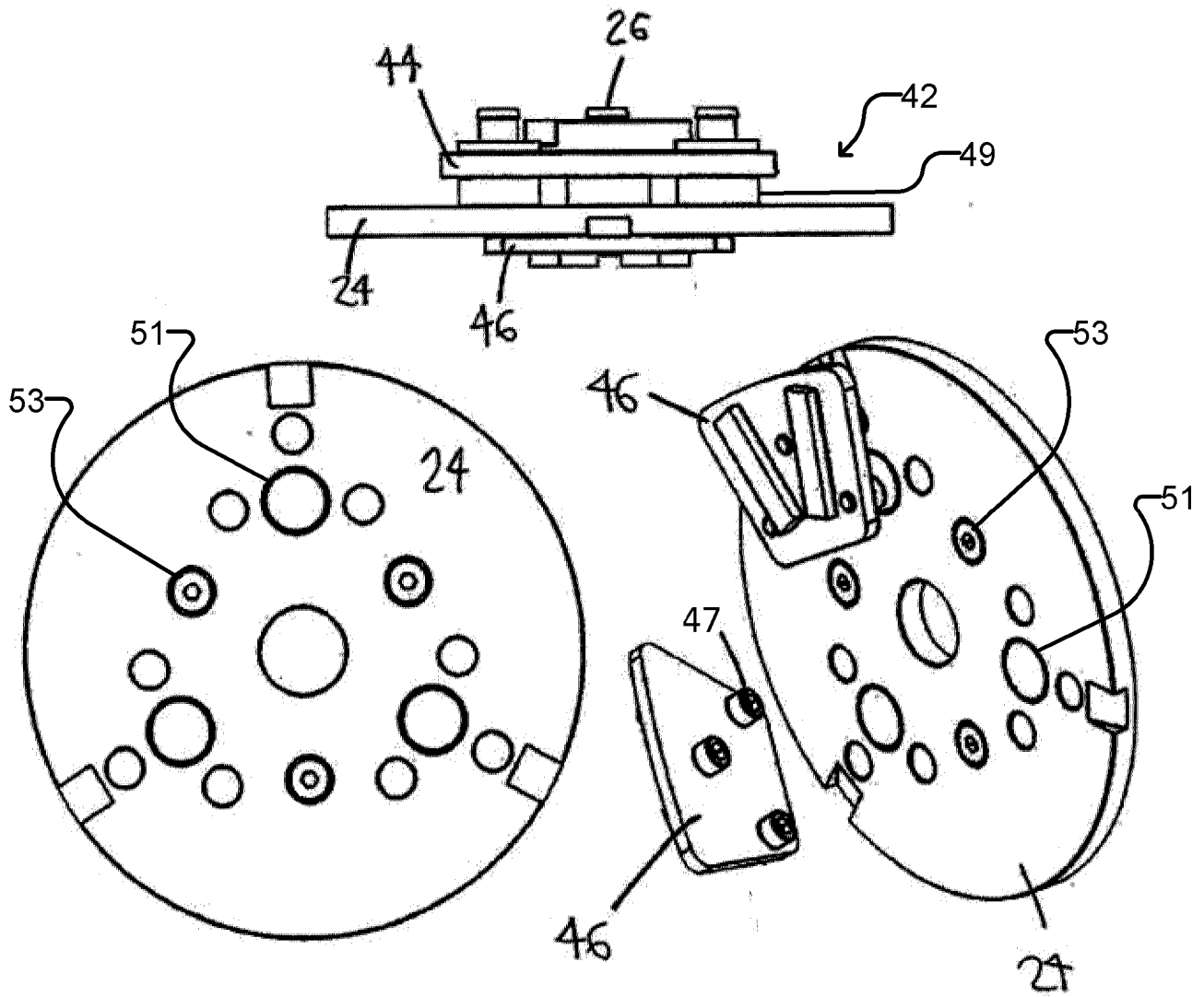


FIG. 4

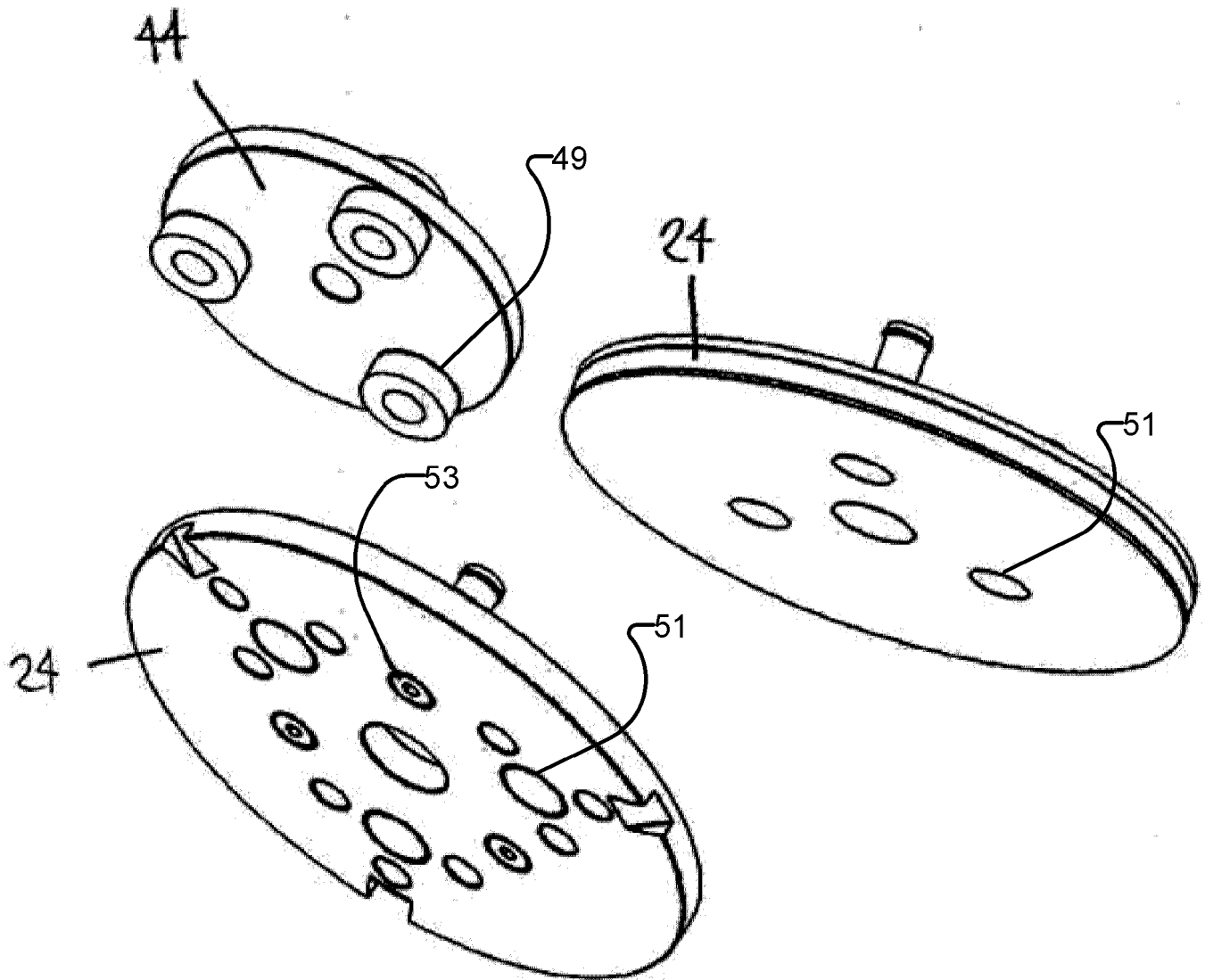


FIG. 5

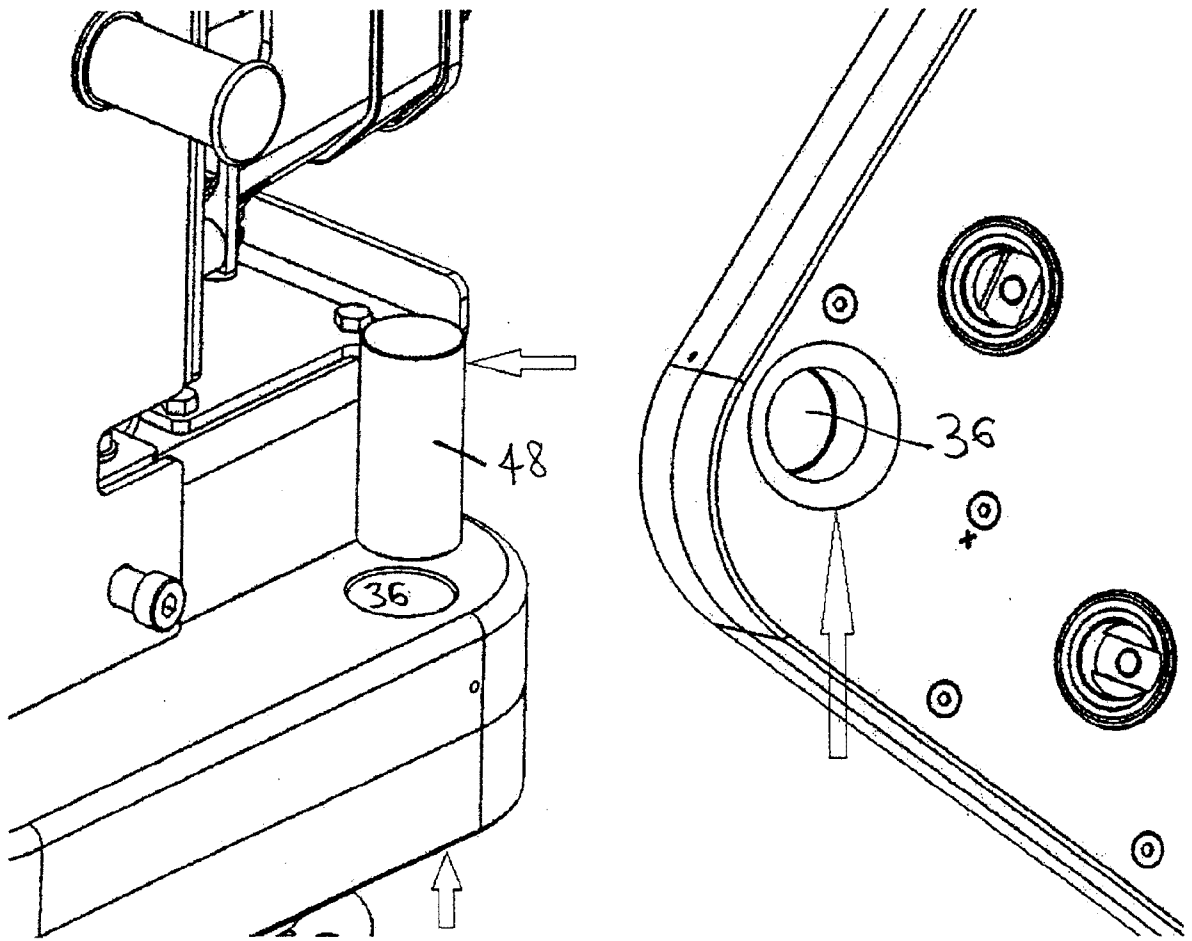


FIG. 6

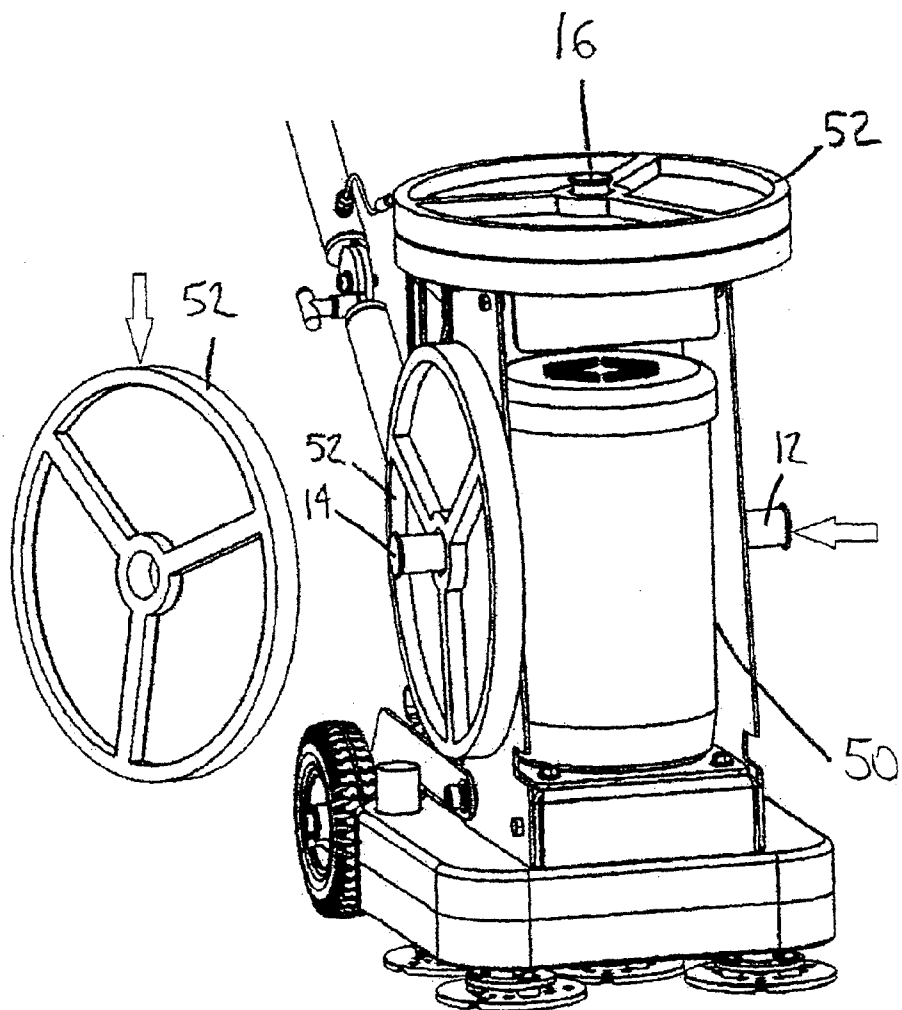


FIG. 7

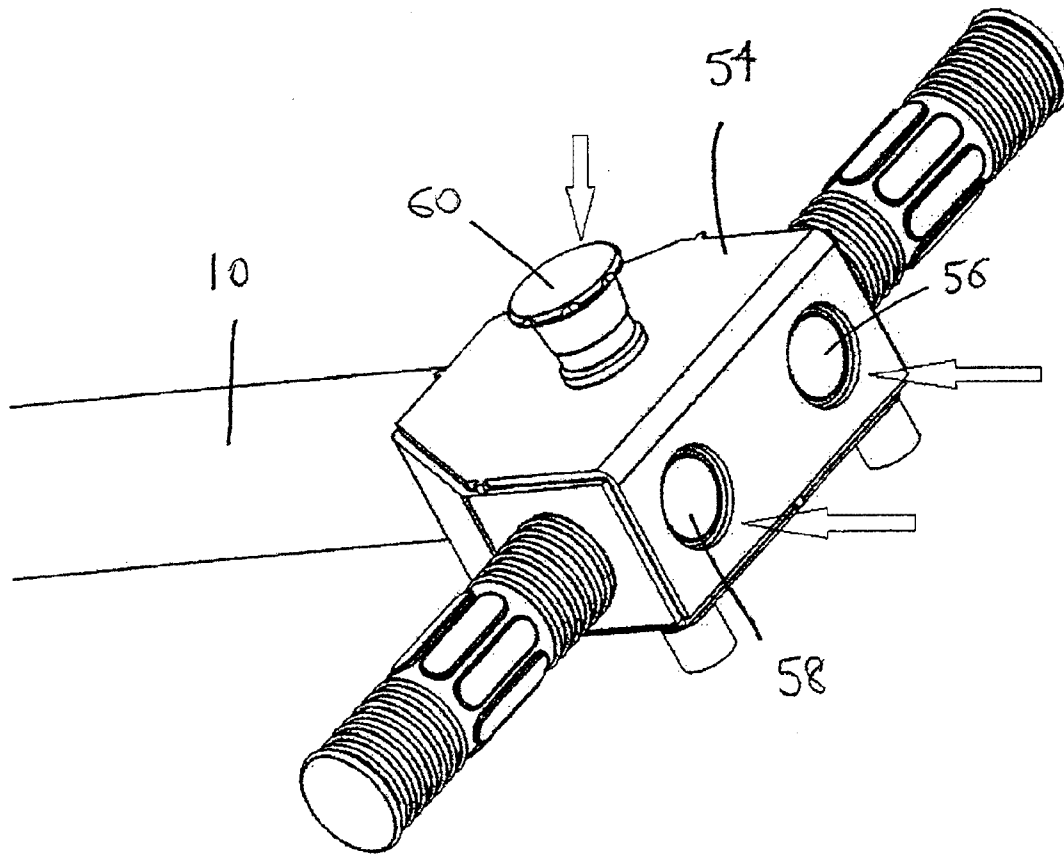


FIG. 8

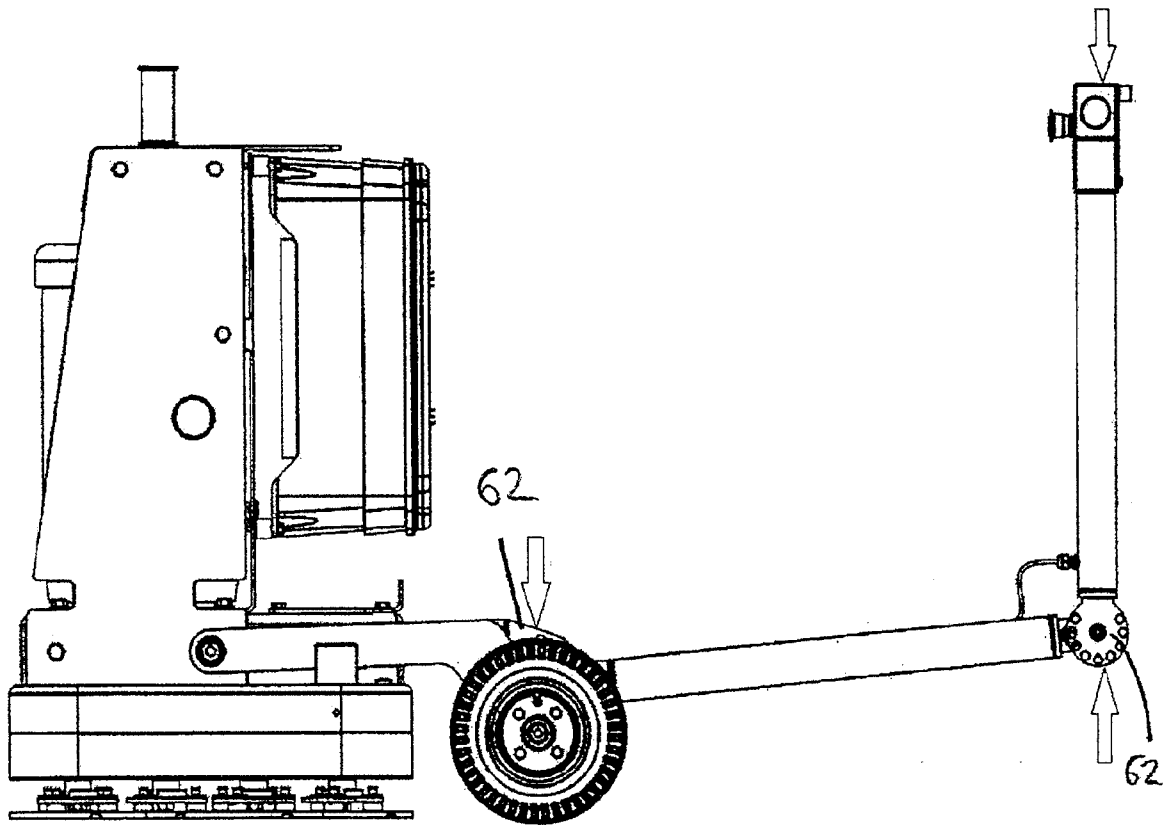
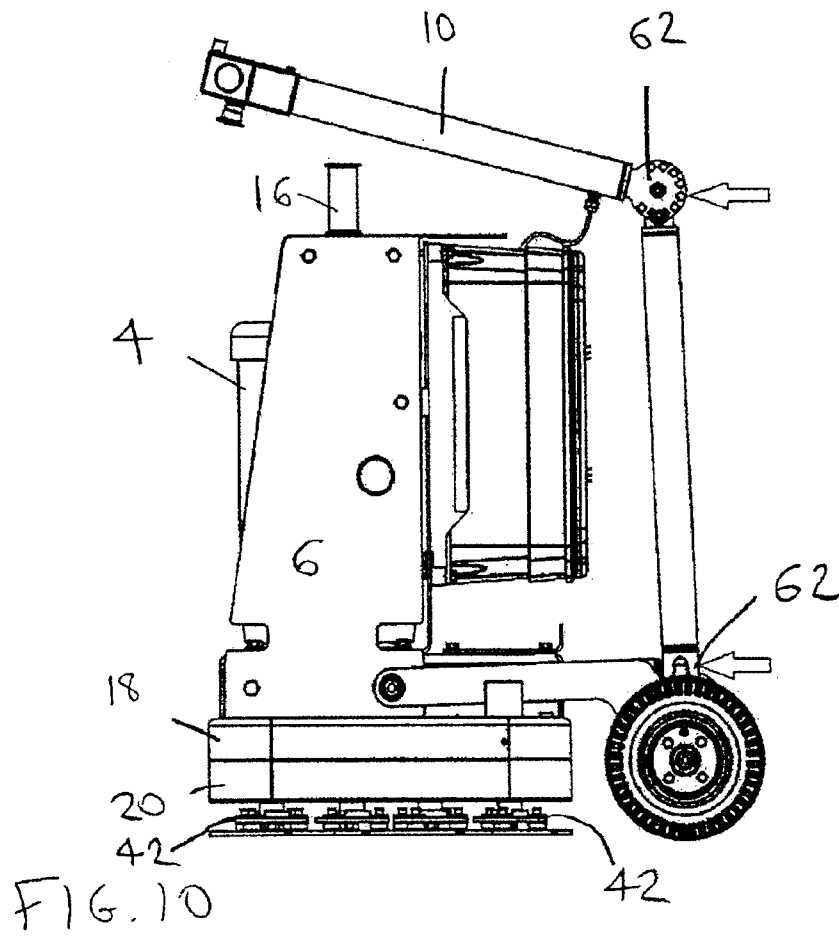


FIG. 9



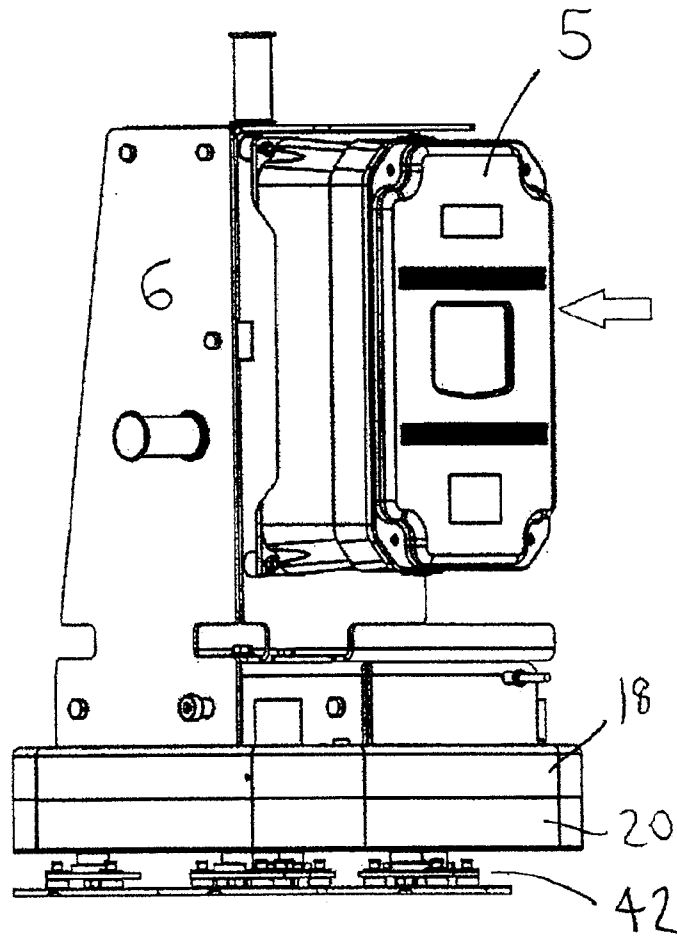


FIG. 11

