Oct. 5, 1971 A. SCHNIZLER ET AL 3,609,922

ORBITAL SANDER

Filed Feb. 17, 1969

Fig. 1

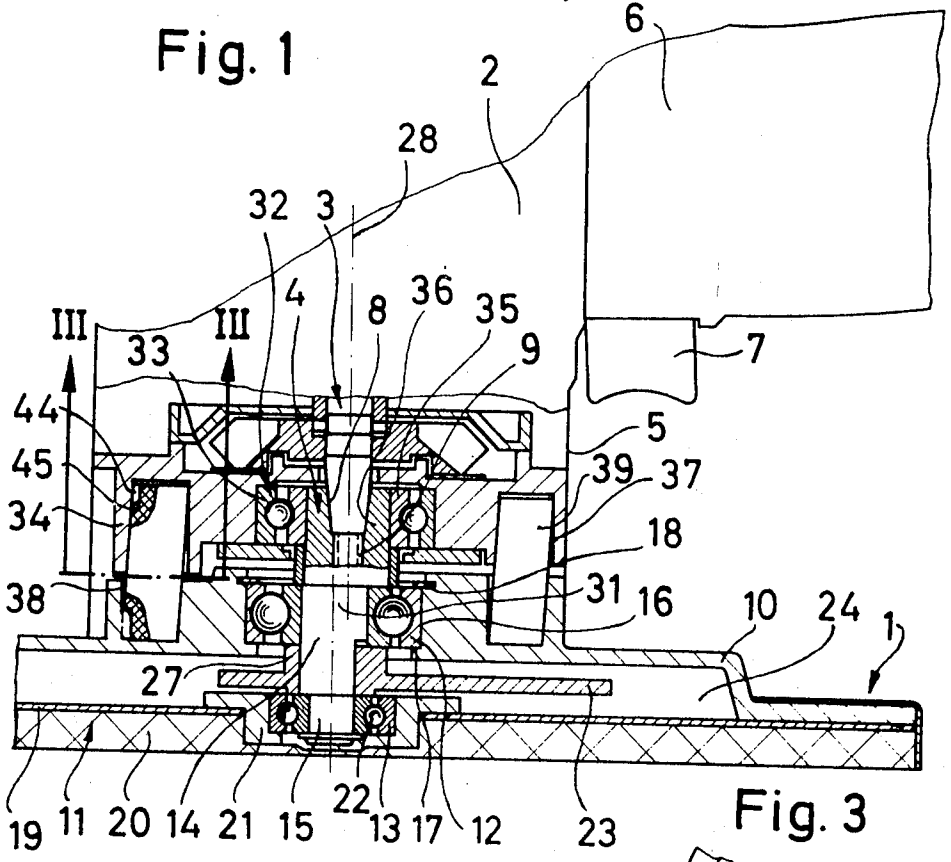


Fig. 2

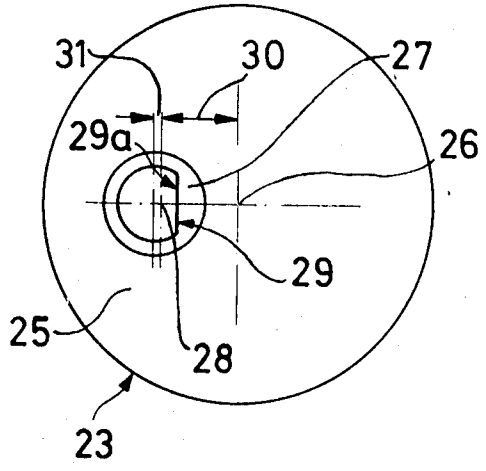


Fig. 3

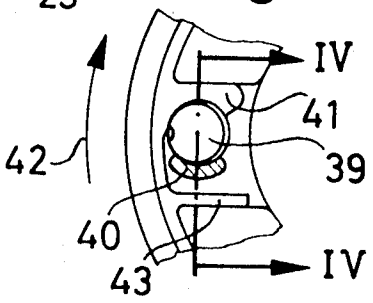
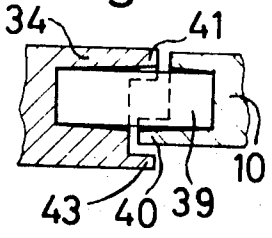


Fig. 4



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ORBITAL SANDER

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ABSTRACT OF THE DISCLOSURE

An orbital sander wherein the output shaft of a motor carries an eccentric intermediate shaft connected with a disk-shaped counterweight which rotates in a compartment defined by two sections of the sanding pad. Each section of the pad is provided with an antifriction bearing for the intermediate shaft. The pad is articularly connected with the housing of the sander by several elastic pins which extend into registering recesses tapering in directions away from each other and respectively provided in the upper section of the pad and in a closure for the motor.

BACKGROUND OF THE INVENTION

The present invention relates to power tools in general, and more particularly to improvements in portable orbital sanders, also known as pad sanders.

It is already known to assemble the sanding pad of an orbital sander of two sections including a lower or outer section which is surrounded by sandpaper and an inner or upper section which is mounted for axial movement on an eccentric motion-transmitting shaft by means of a needle bearing accommodated in a cup of the upper section. The output shaft of the motor which drives the motion transmitting shaft is formed with a collar which partially surrounds the cup and carries several counterweights. The coupling means for articulately connecting the pad to the housing of the sander comprises an elastic ring which is secured to selected portions of the housing and to selected portions of the pad. A drawback of such sanders is that the useful life of the elastic ring is very short and that the assembly of balancing weights consumes much time. Also, such sanders comprise an excessive number of parts.

SUMMARY OF THE INVENTION

An object of our invention is to provide an orbital sander or pad sander wherein the sanding pad and the counterweight are constructed and mounted in a novel way and wherein the couping means between the pad and the housing of the sander undergoes less wear than in presently known sanders.

Another object of the invention is to provide an orbital sander which is constructed in such a way that the hand of the operator is subjected to negligible shaking forces when the sander is in use and which comprises a relatively small number of simple parts.

A further object of the invention is to provide an orbital sander which can be assembled or taken apart with little loss in time, which can employ a relatively small and light counterweight, and wherein such counterweight need not be assembled of two or more parts.

Still another object of the invention is to provide novel and improved bearings for that part in an orbital sander which imparts orbital movements to the pad.

The improved orbital sander comprises a housing, an electric motor or other suitable prime mover secured to the housing and having a composite or one-piece output

member including a first portion rotatable about a first axis and a second portion having a second axis which is parallel to the first axis, a sanding pad including two interconnected sections defining between themselves a compartment for a preferably disk-shaped counterweight which is non-rotatably mounted on the second portion of the output member, and a pair of antifriction bearings for the second portion of the output member; these bearings flank the counterweight and each thereof is provided or mounted in one section of the sanding pad. The coupling means for articularly connecting the sanding pad to the housing comprises rod-shaped bolts or pins each of which extends into a tapering recess of the housing and into a registering tapering recess in that section of the pad which is located between the counterweight and the prime mover. The counterweight is preferably provided with an eccentric hub which is mounted on the second portion of the output member between the two bearings and has a flat abutting against a complementary flat on the second portion of the output member.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved orbital sander itself, however, both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of certain specific embodiments with reference to the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a fragmentary partly elevational and partly longitudinal sectional view of an orbital sander which embodies our invention;

FIG. 2 is a plan view of the counterweight;

FIG. 3 is a fragmentary horizontal sectional view as seen in the direction of arrows from the line III—III of FIG. 1; and

FIG. 4 is a sectional view as seen in the direction of arrows from the line IV—IV of FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIG. 1, there is shown a portion of an orbital sander or pad sander which comprises a sanding pad **1** orbitable in response to rotation of the output shaft **3** of a prime mover **2**, preferably an electric motor. The means for imparting orbital motion to the sanding pad **1** comprises an intermediate shaft **4** parts of which are eccentric with reference to the output shaft **3**. The shafts **3**, **4** constitute first and second portions of a composite output member. The shaft **3** is rotatably mounted in a radial antifriction bearing **32** which is installed in an extension or lower portion **5** of a housing **6**. The latter supports the motor **2** and is provided with a trigger **7** which is depressible to complete the motor circuit. The output shaft **3** has a conical part **8** which is received in a complementary socket of the intermediate shaft **4**. The latter is further formed with internal threads meshing with the externally threaded tip **9** of the output shaft **3**. If desired the shafts **3** and **4** can form an integral one-piece output member.

The sanding pad **1** comprises two sections including a plate-like lower section **11** (hereinafter called plate for short) and a cupped upper section **10** (hereinafter called cover). Antifriction bearings **13** and **12** for the intermediate shaft **4** are respectively mounted in the plate **11** and cover **10**. The bearing **13** in the plate **11** is lighter than the bearing **12** in the cover **10**. The inner races of the bearings **12**, **13** respectively surround eccentric median and lower end portions **14**, **15** of the intermediate shaft **4**. The cover **10** has a hub which is formed with a cylindrical recess **16** for the outer race of the bearing **12**.

This outer race is held against axial movement toward the output shaft 3 by a split ring 18. The lower end face of the outer race of the bearing 12 abuts against an internal annular shoulder 17 of the cover 10. The plate 11 comprises a panel 20 of rubber which is immediately adjacent to the smooth side of a sheet of sandpaper (not shown) and is overlapped by a liner 19 of sheet metal. The central portion of the liner 19 is formed with an opening for a bearing sleeve 21 which is recessed into the elastic panel 20 and has an annular flange which overlies the adjoining portion of the liner 19. The sleeve 21 accommodates the outer race of the antifriction bearing 13. The mounting of the bearing 13 is preferably such that the centers of spherical rolling elements 22 are located in or close to the plane of the liner 19.

In accordance with a feature of our invention, the counterweight 23 is mounted in a compartment 24 at the underside of the cover 10. The counterweight 23 comprises a circular disk 25 (see FIG. 2) whose axis is shown at 26. The disk 25 has a hub 27 which is spaced from the axis 26 and is non-rotatably mounted on the median portion 14 of the intermediate shaft 4. To this end, the median portion 14 is preferably provided with at least one flat 29 and the through bore of the hub 28 is surrounded by an internal surface having a complementary flat 29*a* and snugly receiving the median portion 14 to thus insure that the counterweight 23 shares all angular movements of the intermediate shaft 4. If desired, the hub 27 can be mounted on a specially machined second median portion of the intermediate shaft 4 between the median portion 14 and the end portion 15. The axis of the hub 27 coincides with the axis 28 of the output shaft 3. The centers of gravity of the counterweight 23 and sanding pad 1 are preferably located on a line which is parallel with the axis 28. This insures that the shaft 3 is not subjected to any appreciable bending stresses and that the sander does not shake the hand of the operator when the motor 2 is on. The numeral 30 denotes in FIG. 2 the eccentricity of the counterweight 23; the extent of such eccentricity is preferably substantial because there is enough room in the compartment 24 to permit rotary movement of the counterweight with the intermediate shaft 4. This is of advantage because the weight of the disk 25 can be reduced proportionally with increasing eccentricity. A perfect balance is achieved if the weight of the disk 25 plus the weight of the hub 27 multiplied by eccentricity 30 equals the weight of the sanding pad 1 multiplied by the much smaller eccentricity 31 of the portions 14, 15 (bearings 12, 13) with reference to the axis 28 of the output shaft 3.

During assembly of the sander, the cover 10 is installed in a first step, followed by the counterweight 23 and thereupon by the plate 11. The latter is then secured to the cover 10 by screws, bolts or analogous fasteners, not shown. The outer race 33 of the antifriction bearing 32 for the output shaft 3 is mounted in a closure 34 which forms part of or is secured to the aforementioned extension 5 of the housing 6. The inner race 35 of the bearing 32 is mounted on the upper part 36 of the intermediate shaft 4; this upper part 36 is coaxial with the output shaft 3.

The coupling means for articulately connecting the pad 1 to the housing 6 and for limiting the extent of angular displacement of the pad with reference to the closure 34 of the extension 5 comprises pins or bolts 39 which consist of rubber or other suitable elastomeric material. These bolts 39 extend into recesses or bores 37, 38 respectively provided in the lower end face of the closure 34 and in the upper end face of the cover 10. The elasticity of bolts 39 is such that they permit orbital movements of the pad 1 to the extent determined by eccentricity 31 of the bearings 12, 13 with reference to the axis 28 of the output shaft 3. The recesses 37, 38 taper inwardly, namely, away from the respective end faces, and each thereof is surrounded by a frustoconical internal surface of the closure 34 or cover 10. The conicity is selected in such a way that it corresponds to the inclination of the corresponding portion of the respective bolt 39 when the sander is in use. Each bolt 39 preferably resembles a solid circular cylinder (see FIG. 3) and its external surface abuts against the surfaces surrounding the respective recesses 37, 38 to thereby reduce friction to a minimum. The bolts 39 are subjected only to compressive stresses. The aforementioned end faces of the cover 10 and closure 34 are preferably immediately or closely adjacent to each other (see FIG. 4) to thus limit the freedom of movement of bolts 39. In order to reduce or eliminate bending stresses on the bolts 39, the closure 34 is preferably provided with projections or noses 41 which extend into complementary depressions or recesses of the cover 10. The latter is formed with projections or noses 40 which extend with minimal freedom into corresponding depressions or recesses of the closure 34. If the output member including the shafts 3 and 4 is rotated in the direction indicated by arrow 42 (FIG. 3), the projection 40 pushes the adjoining bolt 39 against the corresponding projection 41 to thus prevent excessive angular displacement of the pad 1 counter to the direction indicated by arrow 42. The closure 34 of the extension 5 is further provided with stops 43 which serve as abutments for the projections 40 of the cover 10 (see FIG. 4). In order to avoid excessive impacts, each stop 43 can be provided with a cushion (not shown) of rubber or the like. The bolts 39 are held against rotation in their recesses 37, 38 by keys or protuberances 44 which are provided in the recess 37 and/or 38 and extend into grooves or recesses 45 provided in the peripheral surfaces of the bolts. External stresses which arise when the sander is in use tend to rotate the bolts counter to the direction of rotation of output shaft 3.

An important advantage of the improved sander is that the hand of the operator holding the housing 6 is subjected to negligible shaking forces or to no shaking forces at all. This is due to novel mounting of the counterweight 23 and pad 1 which insures that the output shaft 3 is not subjected to any bending stresses. Another important advantage of the sander is that it can be used for extended periods of time without necessitating replacement of any parts excepting the sandpaper which is mounted on the pad 1 in the customary way, for example, by means of lever action fasteners or the like, not shown. The bolts 39, namely, such parts which correspond to parts most likely to wear away and to require frequent replacement in conventional orbital sanders, can stand long periods of use because they are subjected to negligible bending stresses and wear. Furthermore, the bolts 39 insure very satisfactory guidance of the pad 1. Still another advantage of the sander is that it comprises a relatively small number of simple parts which can be readily assembled and taken apart for periodic inspection and/or cleaning. This applies particularly for the machining of plate 11, cover 10, counterweight 23 and intermediate shaft 4 as well as for the mounting of bearings 12, 13 and 32. The overall length of the tool as seen in the axial direction of the output shaft 3 is small so that the tool is handy and can be used for light as well as heavy-duty sanding.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying ccurrent knowledge, readily adapt it for various applications without omitting features which fairly constitute essential characteristics of the generic and specific aspects of our contribution to the art.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims:

1. In an orbital sander, a combination comprising a housing; a prime mover secured to said housing and having an output member including a first portion rotatable about a first axis and a second portion defining a second axis which is parallel to said first axis; a pad including two interconnected sections defining between themselves

a compartment; coupling means articulately securing said pad to said housing; said coupling means comprising a plurality of elastic bolts, said housing and said pad being provided with registering recesses in which opposite end portions of said bolts are received; a counterweight accommodated in said compartment and fixed to the second portion of said output member; and a pair of bearings for the second portion of said output member, said bearings flanking said counterweight and each thereof being provided in one of said sections to effect orbital movements of said pad in response to rotation of said output member.

2. A combination as defined in claim **1**, wherein one of said sections is located between said counterweight and said prime mover and is provided with a recess constituting said compartment.

3. A combination as defined in claim **1**, wherein said counterweight comprises a disk and a hub surrounding the second portion of said output member.

4. A combination as defined in claim **3**, wherein said disk is a circular disk and said hub is adjacent to the axis of said circular disk.

5. A combination as defined in claim **3**, wherein said hub and the second portion of said output member comprise abutting flats which prevent rotation of the output member with reference to said counterweight.

6. A combination as defined in claim **1**, wherein the second portion of said output member comprises a part which transmits torque to said counterweight and has an axis coinciding with said first axis.

7. A combination as defined in claim **1**, wherein one section of said pad is located between said counterweight and said prime mover and wherein the other section of said pad comprises an elastic panel and a liner of metallic material overlying said panel adjacent to said compartment.

8. A combination as defined in claim **7**, further comprising a sleeve fixed to said liner and surrounding that bearing which is provided in said other section.

9. A combination as defined in claim **7**, wherein the bearing which is provided in said other section comprises an annulus of rolling elements having centers located in the general plane of said liner.

10. A combination as defined in claim **7**, wherein the bearing which is provided in said other section is lighter than the bearing provided in said one section.

11. A combination as defined in claim **1**, wherein the second portion of said output member is provided with a tapering socket receiving a conical part of said first portion.

12. A combination as defined in claim **1**, wherein one portion of said output member is provided with external threads and the other portion of said output member is provided with internal threads mating with said external threads.

13. A combination as defined in claim **1**, further comprising a third bearing having an outer race mounted in said housing and an inner race surrounding a part of the second portion of said output member, said part having an axis which coincides with said first axis.

14. A combination as defined in claim **13**, wherein said housing comprises a closure for said prime mover and wherein the outer race of said third bearing is mounted in said closure.

15. A combination as defined in claim **1**, wherein the portions of said output member are integral with each other.

16. A combination as defined in claim **1**, wherein said housing comprises a closure for said prime mover and one section of said pad is adjacent to said closure, said recesses being provided in said one section and in said closure.

17. A combination as defined in claim **1**, wherein one of each pair of said recesses tapers in a direction away from the other recess.

18. A combination as defined in claim **17**, wherein the taper of said recesses is a function of the distance between said axes.

19. A combination as defined in claim **1**, further comprising means for preventing rotation of said bolts in the respective recesses.

20. A combination as defined in claim **19**, wherein said last mentioned means comprises protuberances provided in at least one of each pair of registering recesses and a groove provided for such protuberance in the respective bolt.

21. A combination as defined in claim **1**, wherein said pad is provided with first projections each adjacent to one of said bolts and each extending into a recess provided therefor in said housing and wherein said housing is provided with second projections adjacent to said bolts and each extending into a recess provided therefor in said pad.

22. A combination as defined in claim **21**, wherein each of said first projections is located substantially diametrically opposite one of said second projections with reference to the axis of the respective bolt.

23. A combination as defined in claim **21**, further comprising stops provided on said housing and each adjacent to one of said first projections.

24. A combination as defined in claim **1**, wherein each of said bolts is of circular cross-sectional outline.

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U.S. Cl. X.R.

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