Innovation, Sciences et Développement économique Canada
Office de la Propriété Intellectuelle du Canada

Innovation, Science and Economic Development Canada
Canadian Intellectual Property Office

CA 3070635 A1 2020/08/22

(21) 3 070 635

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(22) Date de dépôt/Filing Date: 2020/01/31

(41) Mise à la disp. pub./Open to Public Insp.: 2020/08/22

(30) Priorité/Priority: 2019/02/22 (DE10 2019 104 621.1)

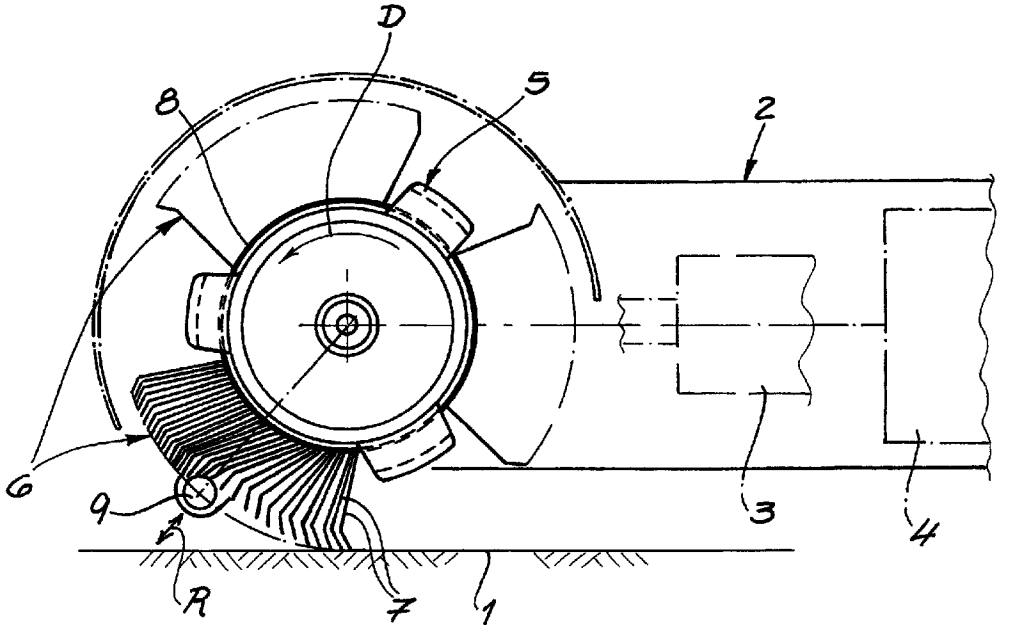
(51) Cl.Int./Int.Cl. *A46B 13/04* (2006.01), *A46B 13/02* (2006.01), *B24B 29/00* (2006.01)

(71) Demandeur/Applicant:
MONTI-WERKZEUGE GMBH, DE

(72) Inventeurs/Inventors:
DODDEMA, JAN FREDERIK, NL;
HOFSTEE, SANDER HENDRIKUS JOHANNES, BE

(74) Agent: OSLER, HOSKIN & HARCOURT LLP

(54) Titre : ENSEMBLE DE BROSSE
(54) Title: BRUSH ASSEMBLY



(57) Abrégé/Abstract:
Object of the invention is a brush assembly for treating a surface of a workpiece (1). To this end the brush assembly has a rotationally drivable brush holder (5) and a ring brush (6, 8) with an annular array (6) of outwardly projecting bristles (7). According to the invention the ring brush (6, 8) is preferably designed to be reciprocably axially movable.

Abstract

Object of the invention is a brush assembly for treating a surface of a workpiece (1). To this end the brush assembly has a rotationally drivable brush holder (5) and a ring brush (6, 8) with an annular array (6) of outwardly projecting bristles (7). According to the invention the ring brush (6, 8) is preferably designed to be reciprocably axially movable.

BRUSH ASSEMBLY

The invention relates to a brush assembly for treating the surface of a workpiece, with a rotationally drivable brush holder carrying a ring brush having an annular array of radially outwardly projecting bristles.

Such brush assemblies are typically used to free the surface of the workpiece in question from corrosion, paint, or comparable coatings, for example, or to provide it with a desired roughness depth. In the generic prior art according to applicant's patent EP 1 834 733 [US 9,554,642], a brush assembly that is equipped with a stop is described for this purpose. This makes it possible to achieve roughness depths that could previously only be achieved by sandblasting. The indicated roughness depths are referred to collectively as mean roughness values Ra (as the arithmetic mean of the absolute values of profile deviations within a sampling length according to DIN 4764 and DIN ISO 1302). This has been found to be reliable in principle and is widely used in practice. EP 2 618 965 [US 9,918,544], also of this applicant, represents comparable prior art in which the stop acts simultaneously as an abrasive body for the bristles. The stop is displaceable for this purpose, being designed to be displaced for example radially and/or tangentially.

Brush assemblies and rotary brush tools equipped therewith can be used stationarily, for example in connection with a machine in a machine room. However, it is also possible for the rotary brush tool in question to be designed for manual operation. In both cases, there is often the problem in practice of guiding the brush assembly along the workpiece to be machined,

more particularly the surface thereof. As described, this can be done mechanically and/or manually. As a result, there is often the risk of score marks or at least uniform structures forming on the surface of the workpiece. These are detrimental to uniform surface treatment and may make the subsequent adhesion of a coating, a paint, etc., difficult. This is where the invention comes in.

The invention is based on the technical object of further developing such a brush assembly for treating the surface of a workpiece in such a way that a uniformly treated surface is made available.

To attain this technical object, a brush assembly of this generic type is characterized in the context of the invention in that the ring brush is movable. Normal, the ring brush is reciprocal.

The invention proceeds here from the discovery that the ring brush is held with the aid of the brush holder that is rotationally drivable. The movement of the ring brush that is provided according to the invention thus implies that the rotationally drivable brush holder holding the ring brush performs an adjusting movement in addition to its rotational movement. Generally, the ring brush is preferably reciprocably movable. As a result, the ring brush, more particularly the brush holder holding the ring brush, reciprocates such that, in combination with a manual and/or machine advancing movement has the overall effect that the surface of the machined workpiece is machined uniformly and a uniform distribution of the roughness depth is present and observed overall.

According to an advantageous embodiment, the ring brush can be radially and/or axially movable. Normally, only an axial

movement of the ring brush and, consequently, of the brush holder receiving and holding the ring brush is employed here. This means that an additional radial movement of the ring brush is possible but only used in practice for machine-operated brush assemblies in order to position the brush assembly and, consequently, the ring brush against the respective workpiece to be treated, more particularly the surface thereof. According to the invention, however, it is primarily a matter of manually operated brush assemblies and, consequently, of a hand-operated rotary brush tool in particular. This rotary brush tool is equipped with the brush assembly in question and an additional drive for the brush assembly.

In fact, such a hand-operated rotary brush tool can be designed overall as a handheld power tool or as a hand-operated rotary brush tool. A drive with an electric motor and optionally a gear transmission advantageously powered by one or more rechargeable batteries is typically used for this purpose. In principle, the hand-operated rotary brush tool can also be driven pneumatically. Either way, movement of the rotary brush tool and, consequently, of the brush assembly is generally performed by hand. Any radial adjusting movement or positioning of the brush assembly against the surface of the workpiece to be machined is also done manually. In contrast, movement of the ring brush and, in particular, the axial movement thereof is performed by motorized means, particularly with the aid of the drive, which is present anyway and which rotates the brush holder and, consequently, the ring brush. This means that, according to the invention, the drive, as part of the rotary brush tool equipped with the brush assembly, works rotationally on the brush holder on the one hand and in the axial direction thereof,

preferably reciprocatingly, on the other hand. The drive can be equipped for this purpose with a motor, more particularly an electric motor, for rotation, for example, and an additional motor, more particularly an electric motor, for axial reciprocation. However, it is also possible for both movements to be achieved and effected by a single electric motor.

As explained above, the ring brush is predominantly axially movable, with a reciprocating movement generally being employed here. That is, the axis of the brush holder carrying or holding the ring brush is reciprocated back and forth in the axial direction with the aid of the drive. The axially reciprocating movement can follow a sinusoidal movement over time. Such a sinusoidal movement can be achieved and implemented in an especially advantageous manner by having the axis of the brush holder be acted upon, for example, by a cam working on the axis that works against the force of a spring and thereby brings about the previously described sinusoidal axial movement of the shaft of the brush holder and, consequently, of the axis of the ring brush. In fact, the ring brush and the brush holder are generally each designed to be rotationally symmetrical and coaxial with one another.

In order to be able to implement and achieve the above-described axial movement of the ring brush of the brush holder in detail, the brush holder is generally embodied in at least two parts. Actually, the brush holder is composed predominantly of a stationary bearing part and a brush part that can be displaced axially relative thereto. The brush part of the brush holder provides predominantly for the guiding and holding the ring brush, whereas the bearing part assumes primarily and exclusively a bearing function for the brush part. Accordingly, the bearing

part is designed to be stationary, whereas the brush part is not only designed to be axially movable, but also rotates, whereby the ring brush is also rotated.

Specifically, the stationary bearing part is equipped for this purpose with a splined bore for a splined shaft of the axially movable brush part that engages therein. The shaft of the axially displaceable brush part is overhung and may be connected to a base of the displaceable brush part. This enables the stationary bearing part with the splined bore to perform the required rotational movement on the shaft for the ring brush.

In another embodiment, to this end the stationary bearing part also has a sleeve for a drive shaft engaging therein that is acted upon by the drive in a rotational and axial manner. In addition, and more often than not, the axial loading also takes place with reciprocation, so that the drive shaft is acted upon in a rotational and axially reciprocable manner with the aid of the drive.

In order to achieve and implement this in detail, the sleeve is generally provided with grooves in which ridges engage that are radially connected to the drive shaft. As a result, the sleeve and the drive shaft provide for frictional coupling in the direction of rotation in order to enable the ring brush carried by the brush part to be driven rotationally as desired on the one hand. At the same time, and on the other hand, the interfit between the grooves and the ridges engaging therein ensures that the drive shaft can execute the desired axial movement relative to the sleeve and, consequently, to the stationary bearing part. Together with the sleeve, this also ensures that the drive shaft also rotates. For this purpose, at least two splines that are radially connected to the drive shafts engage complementarily in

corresponding grooves of the sleeve. In principle, it is of course also possible to approach this differently from a structural perspective.

It is of special additional importance for the invention that a stop is also provided that dips into the rotating annular bristle array and ensures that the rotating bristles and/or a brush belt carrying the bristles are elastically deformed as part of the ring brush. As a result, the bristles and/or the brush belt are able to store kinetic energy, so that after they are released, the bristles not only process the surface of the workpiece rotationally, but also percussively as a result of the stored kinetic energy that is released after the passing of the stop. For the sake of example, the basic functionality of such a stop is described in the applicant's patent EP 1 834 733, to which reference was already made above.

According to the invention, the stop can now also be designed to be movable, as is known in principle from EP 2 618 965, which was also cited in the introduction to the description. In order to implement the movement of the stop in detail, the stop can generally be moved radially relative to the axis of the rotating ring brush by changing its distance. This radial actuating movement can be implemented in detail in such a way that the stop is moved with the aid of an eccentric and/or a linear actuator.

Due to the inventive additional and optional possibility of implementing a stop and moving it, the option exists not only to process the surface uniformly in terms of the roughness profile generated; rather, movement of the stop in the radial direction relative to the axis of the ring brush also

results in a change in the kinetic energy with which the bristles strike the surface of the workpiece to be treated.

The rule of thumb that generally applies in this context is that the shorter the radial spacing between the stop and the axis of the ring brush in question, the greater the kinetic energy. This is because an arrangement of the stop radially in an inner position increases and intensifies deformation of the bristles and consequently to increased kinetic energy with which the bristles act on the surface of the workpiece.

These fundamental relationships have been studied by Prof. Robert J. Stango et al and published in several publications. Reference is made to the two publications "Surface preparation of ship-construction steel/(ABS-A) via bristle blasting process," NACE Corrosion Conference & Expo 2010, paper no. 10385, and "Evaluation of bristle blasting process for surface preparation of ship-construction steel" (Nace Corrosion Conference & Expo 2012, paper no. C2012-0001442). According to a preferred embodiment, the stop is designed to be radially movable for the most part relative to the axis of the rotating ring brush for this purpose and/or can be moved radially relative to the axis. Similarly, the ring brush can also be placed against the surface and/or move axially.

The invention also relates to a rotary brush tool and, in particular, to a hand-operated rotary brush tool that is equipped with the previously described brush assembly and a drive for the brush assembly. In particular, this rotary brush tool can be designed to be portable if the drive works electrically and the power supply is equipped with rechargeable batteries that

are provided in a machine housing, or with at least a single rechargeable battery. Herein lie the fundamental advantages.

The invention is explained in further detail below with reference to a schematic drawing showing only one embodiment:

FIG. 1 is a schematic side view of the brush assembly according to the invention and a corresponding rotary brush tool,

FIG. 2 shows a first design variant of the stop and an adjuster for the stop,

FIG. 3 shows a second variant of the adjuster for the stop, and

FIG. 4 is a schematic view of the drive according to the invention for the rotational and also axial reciprocation of the brush assembly.

To begin with, FIG. 1 shows a highly schematic view of the brush assembly according to the invention for treating the surface of a workpiece 1. For this purpose, the brush assembly is connected to a machine housing 2 of a rotary brush tool. According to this embodiment, a drive 3 is located inside the machine housing 2 of the rotary brush tool on the one hand, and a power supply 4 for the electrically operating drive 3 is located therein on the other hand. The power supply 4 can be one or more rechargeable batteries. The one or more rechargeable batteries can each be recharged via a charging socket in or on the machine housing 2, inductively, or also by moving them from the machine housing 2 to an external charging cradle. In principle, however, the drive 3 can also function pneumatically, which is however not shown. The rotary brush tool with the machine housing 2 shown is advantageously a hand-operated rotary brush tool, i.e. an appropriately designed handheld tool.

Specifically, the brush assembly has a rotationally drivable brush holder 5 whose webs can be seen in FIG. 1. A ring brush 6, 8 comprised of an array 6 of radially outwardly projecting bristles 7 is held against or on the brush holder 5 and is driven rotationally by the drive 3. This corresponds to a clockwise rotational movement or direction of rotation D as shown in FIG. 1. The individual bristles 7 are anchored in an annular belt 8 of the ring brush 6, 8.

A stop 9 that dips into the rotating annular array 6 of bristles 7 can also be seen in this embodiment according to FIG. 1. According to this embodiment, the stop 9 is movable and can be moved particularly in a radial direction R indicated by a double arrow in FIG. 1. As already explained in the introduction and extensively described in the prior art according to EP 1 834 733, the bristles 7 and, optionally, the brush belt 8 are elastically deformed during their rotational movement in the direction of rotation D in the counterclockwise direction indicated in FIG. 1 by an arrow while passing over the stop 9. As a result, kinetic energy resulting from the associated elastic deformation is stored in the bristles 7 and brush belt 8. After their release, the bristles 7 consequently not only impact the surface of the workpiece 1 in a rotational manner but also in a percussive manner. To wit, the previously stored kinetic energy is released after passing the stop 9.

According to the invention, the ring brush 6, 8 can now be moved as shown in detail in FIG. 4. In fact, the ring brush 6, 8 is designed to be axially reciprocated. The drive 3 ensures this.

According to the embodiment shown in FIG. 4, the drive 3 is initially equipped for this purpose with a gear 10 in order

to rotate the ring brush 6, 8, more particularly the brush holder 5 indicated in FIG. 4, in the above-described direction of rotation D. For this purpose, the gear wheel 10 acts on a drive shaft 12 described in detail below and engaging in a splined bore 13 of a sleeve B of a axially fixed bearing part 5a as part of the brush holder 5. In addition to the stationary bearing part 5a, an axially movable brush part 5b to which the drive shaft 12 belongs is also implemented. The drive 3 also ensures that the drive shaft 12 in question is not only driven rotationally in order to get the rotational movement D, but additionally also produces the previously mentioned movement in the axial direction A.

For this purpose, an eccentric cam formation 11' that can be rotated about an axis by the drive 3 is provided on an eccentric gear wheel 11 which, as a further component of the movable brush part 5b, is acted upon by the drive 3. The eccentric cam formation 11' acts on the drive shaft 12 in the axial direction A with a pin Z. As a result, the drive shaft 12 and also the brush holder 5 reciprocate in the axial direction A in addition to the rotational movement D. In order to enable joint implementation of the movement of the brush holder 5 in the axial direction A and, in addition, the rotation thereof in the direction of rotation D, the gear wheel 10 acted upon by the drive 3 and the eccentric wheel 11 are each equipped with a corresponding toothing for driving by the drive 3.

As already explained, the brush holder 5 has a two-part design according to this embodiment. Specifically, the brush holder 5 has the axially fixed bearing part 5a and the axially movable brush part 5b. The stationary bearing part 5a has the splined bore 13 for the above-described pin Z of the movable

bearing part 5b, more particularly of the gear wheel 11. In addition, the drive shaft 12 engages in the splined bore 13 in the vicinity of a sleeve B with the aid of which drive shaft 12 the brush holder 5 is ultimately driven.

The drive 3 now works on both the gear wheel 10 and the eccentric wheel 11. The sleeve B is set in rotation via the gear wheel 10. This then also applies to the axially fixed bearing part 5a. The drive shaft 12 engages in a splined bore 13 of the sleeve B. For this purpose, radially outwardly projecting splines 14 on the drive shaft 12 fit into complementary axial grooves 14' in the splined bore 13. As a result, the drive shaft 12 is rotated in the direction of rotation D.

An additional axial movement of the drive shaft 12 in the axial direction A as shown by the double-headed arrow in FIG. 4 is now accomplished with the aid of an additional eccentric wheel 11. For this purpose, the eccentric wheel 11 is also rotated by the drive 3. The eccentric wheel 11 has one or more radially projecting eccentric cam formations 11' that interact with a stationary housing cam formation 2'. In this way, rotation of the eccentric wheel 11 is converted into an axial movement through the interaction between the cam formations 11' and 2'. As a result, the pin Z engaging in the splined bore 13 also reciprocates axially in the direction A.

The pin Z now acts on the drive shaft 12 with its rounded head, so that the drive shaft 12 follows the desired axial movement in the axial direction A in addition to its rotational movement in the direction of rotation D. This is possible because the splines 14 engage radially in the associated grooves 14' but at the same time allow the desired axial movement of the drive shaft 12 in the axial direction A. An additional

spring 15 ensures that the axial movement of the drive shaft 12 is carried out against the force of the spring 15, which resets the drive shaft 12 on each stroke.

FIG. 2 shows a first embodiment of how the stop 9 is moved in detail in the radial direction R relative to the annular bristle array 6 and the bristles 7. For this purpose, the stop 9 is carried on an arm 16 having a bore engaged around an eccentric 17. The eccentric 17, in turn, is rotated by the drive 3. Now, in conjunction with an additional guide 18 of the arm 16, rotation of the eccentric 17 in the bore of the arm 16 ensures that the stop 9 is moved in a radial direction R and optionally also in an angular direction U relative to the annular bristle array 6 or the bristles 7, as indicated by corresponding arrows in FIG. 2.

FIG. 3 now shows another variant for adjusting the stop 9 in the radial direction R relative to the ring brush 6, 8 and the bristles 7. The stop 9 is connected to a linear actuator 19, 20 for this purpose. The linear actuator 19, 20 is composed of a stationary spindle nut 19 and a spindle 20 that engages and reciprocates in the spindle nut 19. Rotation of the spindle 20 consequently has the effect that the arm 16 carrying the stop 9 is moved in this case in the direction indicated in FIG. 3, which, according to this embodiment, corresponds to the radial direction R with respect to the ring brush 6, 8 and bristles 7.

Claims:

1. A brush assembly for treating a surface of a workpiece (1), comprising a rotationally drivable brush holder (5) and a ring brush (6, 8) with an annular array (6) of outwardly projecting bristles (7), characterized in that the ring brush (6 , 8) is preferably designed to be reciprocably movable.

2. The brush assembly according to claim 1, characterized in that the ring brush (6, 8) is radially and/or axially movable.

3. The brush assembly according to claim 2, characterized in that, for axial movement of the ring brush (6, 8), the brush holder (5) has an at least two-part design with a stationary bearing part (5a) and axially movable brush part (5b).

4. The brush assembly according to claim 3, characterized in that the axially fixed bearing part (5a) has a splined bore (13) for a pin (Z) of the movable brush part (5b) engaging therein.

5. The brush assembly according to claim 3 or 4, characterized in that the stationary bearing part (5a) also has a sleeve (B) for a drive shaft (12) engaging therein that is rotatable and axially reciprocal by the drive (3).

6. The brush assembly according to any one of claims 1 to 5, characterized in that a stop (9) is provided that dips into the rotating annular bristle array (6) and elastically

deforms the bristles (7) and/or a brush belt (8) as part of the ring brush (6, 8) while storing kinetic energy.

7. The brush assembly according to claim 6, characterized in that the stop (9) is movable.

8. The brush assembly according to claim 7, characterized in that the stop (9) is movable in a radial direction (R) relative to a rotation axis of the ring brush (6, 8).

9. The brush assembly according to claim 7 or 8, characterized in that the stop (9) is moved by an eccentric (17) and/or a linear actuator (19, 20).

10. A rotary brush tool, in particular a hand-operated rotary brush tool, with a brush assembly and a drive (3) for the brush assembly, characterized in that the brush assembly is embodied according to any one of claims 1 to 9.

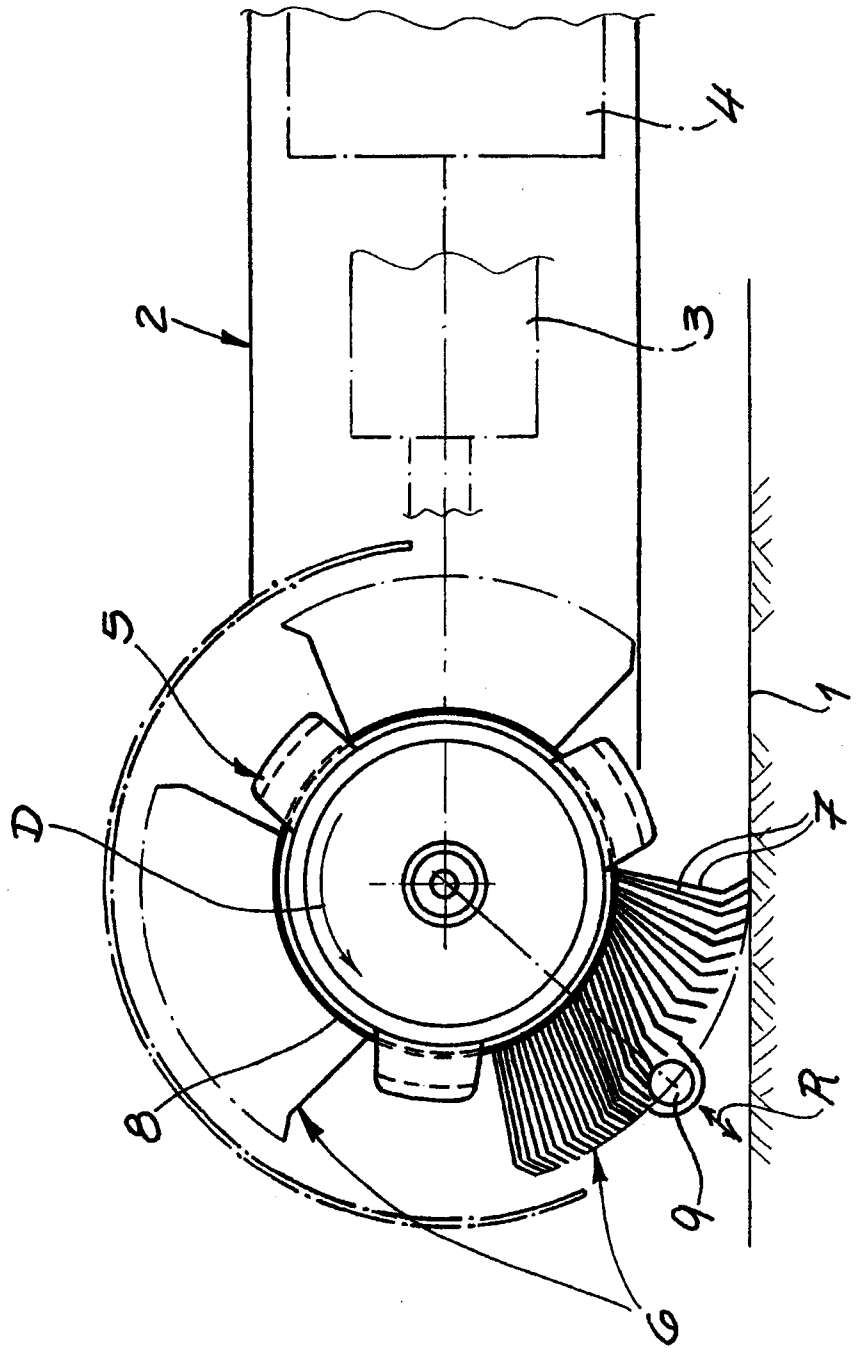


Fig.1

Fig.2

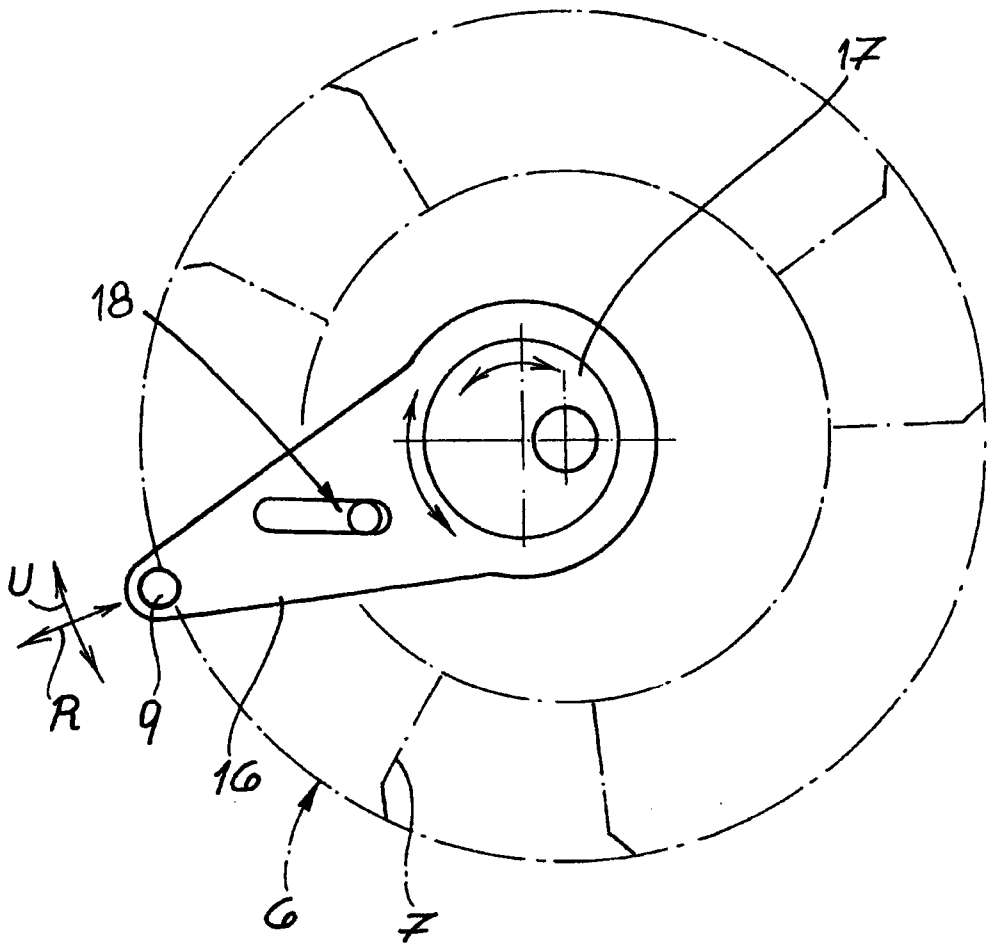
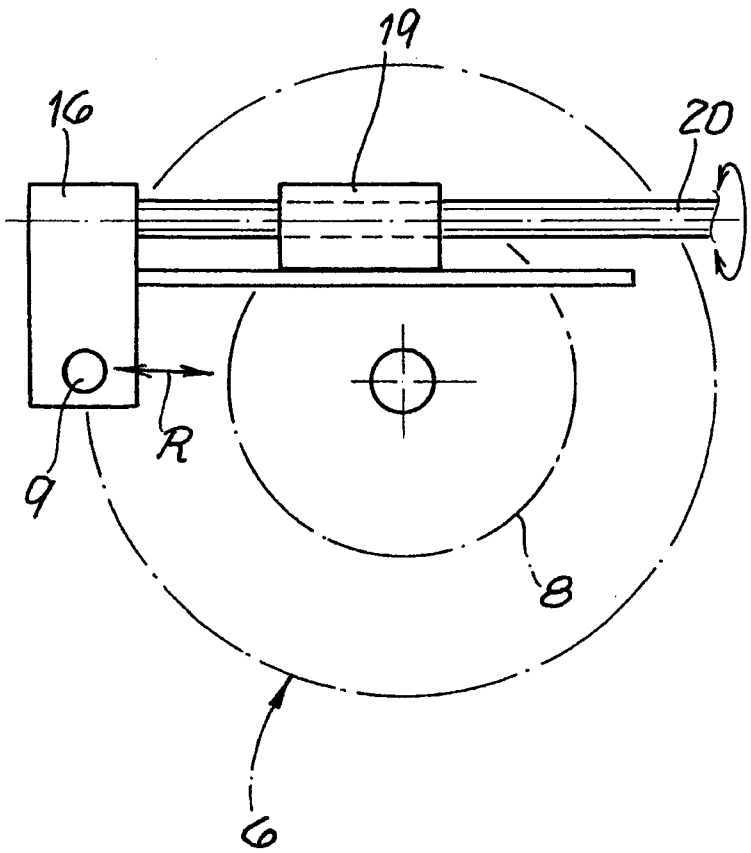


Fig.3



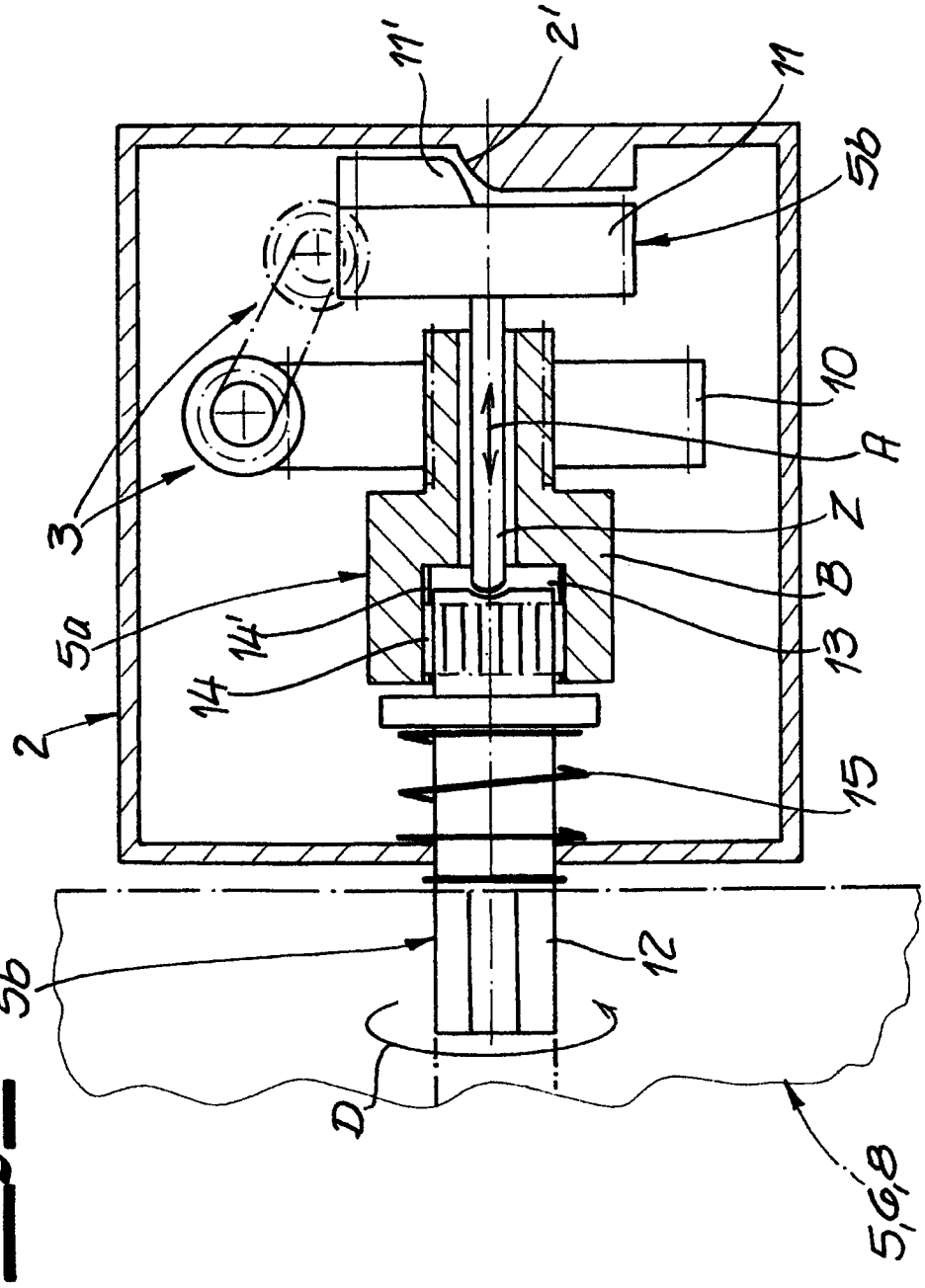
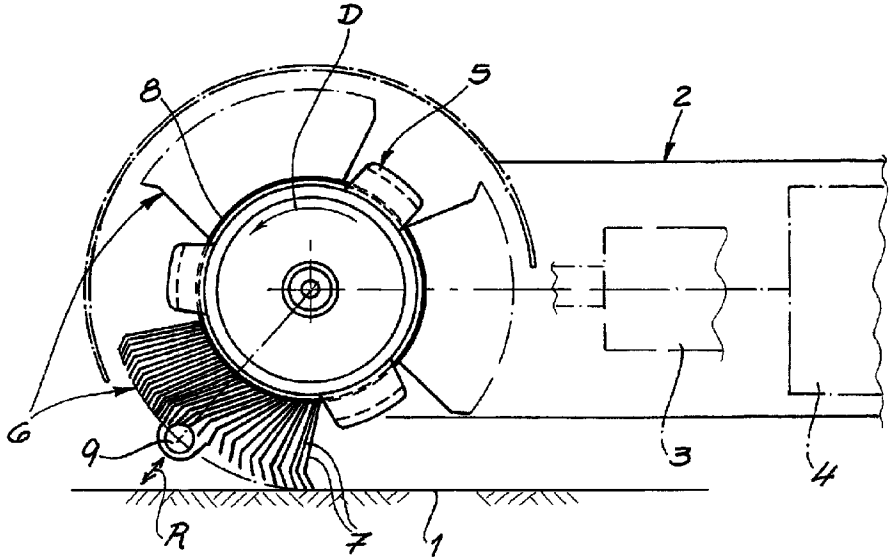


Fig.4


D
8
5
2
6
9
3
4
R
7
1