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(54) Grinding apparatus.

(57) Grinding apparatus (16) comprising a motor (25) having a body portion (24) and an output shaft (26) extending from the body portion, and grinding means (13) mounted for rotation on the body portion of the motor and drivingly connected to the output shaft of the motor. The grinding apparatus may be embodied in a lens edging machine.

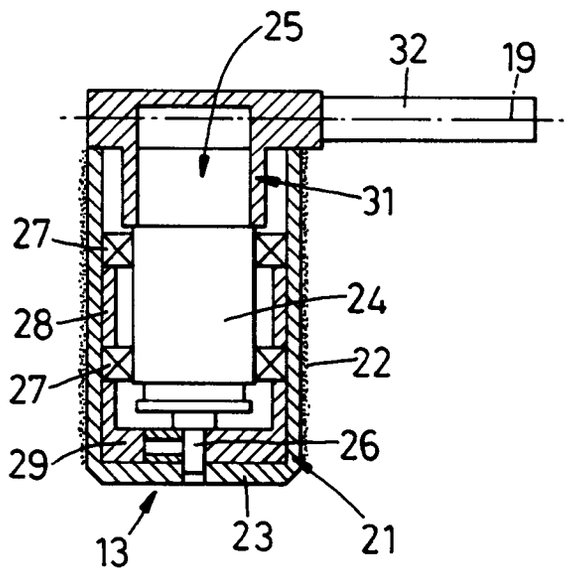

Fig. 5

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This invention relates to grinding apparatus, more particularly, but not exclusively, to such apparatus for grinding lenses, and still more particularly, but again not exclusively, to such apparatus for grinding the edge or periphery of lenses for fitting into pairs of spectacle frames. For convenience, the invention will , in the main, be discussed in the context of grinding lenses for spectacle frames. From another aspect, the invention also relates to an edge grinding machine to which reference will be made hereinafter.

The normal procedure for fitting a person with a pair of spectacles is for an optician to prescribe the appropriate lenses, following an eye test, and then for the person to choose a pair of frames into which the prescribed lenses are to be fitted. There is a wide range of sizes and shapes of frames and in order to accommodate these, the lens manufacturer produces over-size lenses to a variety of prescriptions, whether single or bi-focal, and an ophthalmic laboratory or the like will shape the required lenses to fit the chosen spectacle frames.

Lenses are shaped on a so-called lens edging machine which grinds the periphery of a lens to the required shape using a physical or electronically-memorized replica of the required shape. These lens edging machines can handle both glass lenses and lenses of synthetic plastics material and it is known first to grind a lens to the required shape using a relative course grinding wheel, and then to finish the lens by exposing it to a V-shaped grinding wheel in order to produce an outwardly-extending, peripheral ridge or apex on the lens, which ridge is received by the associated frame, whereby each lens is located and retained in position in the pair of frames.

This preparation of a lens often leads to the production of a sharp edge to the lens which, in turn, can lead to chipping when the lens is fitted to the spectacle frame. The sharp edge and/or chipping can, of course, be potentially dangerous to the wearer, whereby it is also known to provide a safety bevel on the otherwise finished lens, on at least the side of the lens which in use faces the wearer, the safety bevel being provided automatically or by hand. An edge grinding machine incorporating an automatic grinding of a safety bevel is disclosed in the Applicant's US-A-5,056,270.

More specifically, US-A-5,056,270 discloses grinding apparatus for producing a safety bevel, the apparatus being relatively complex and occupying a considerable volume. The actual grinding wheel is mounted on the shaft of a motor, the motor being pivotally mounted on a slider and/or an actuator, whereby the grinding wheel can be moved essentially in two orthogonal directions.

No edge grinding machine on the market at the present time embodies grinding apparatus to produce a safety bevel, whereby such apparatus has to be fitted retrospectively. In order to avoid having to manufacture grinding apparatus specific to a number of different machines, it is of course necessary to manufacture universal apparatus and this means that it must be as small as possible so as to be accommodated in different types of machine and to fit spaces which have not been designed to receive further grinding apparatus.

EP-A-0,098,950 discloses grinding apparatus for hand edging a lens in which the output shaft of a motor carries one form of processing or grinding means, and the rotor of this motor carries a grinding wheel. In operation, the body of the motor remain stationary whilst the output shaft and rotor rotate. This is a specially engineered arrangement which is relatively complex in that, for example, the body of the motor has to be opened up to gain access to the rotor for the mounting thereon of the grinding wheel. Furthermore, the opening in the body has to be sealed against the ingress of grinding fluids and/or foreign matter. The smaller the arrangement, the more complex it becomes.

According to one aspect of the present invention, there is provided grinding apparatus comprising a motor having a body portion and an output shaft extending from the body portion, and grinding means mounted for rotation on the body portion of the motor and drivingly connected to the output shaft of the motor.

The grinding means may be in the form of a sleeve mounted on the body portion of the motor via two spaced ball or roller bearings, with the outer surface of the sleeve provided with a grinding medium. Preferably, the outer surface of the sleeve is impregnated with the grinding medium such as diamond dust. One end of the sleeve may be closed to form means for mounting the sleeve on the output shaft of the motor.

The grinding apparatus in accordance with this aspect of the invention can be made extremely compact and may have a diameter, for example, of 30 mm and an overall length of 56 mm.

According to a second aspect of the present invention there is provided a lens edging machine comprising first grinding means operable to grind a lens to a required basic size and shape, second grinding means operable to grind an outwardly-extending peripheral ridge or an inwardly-extending peripheral groove on the lens, and third grinding means operable automatically to grind a safety bevel on the lens, the third grinding means being in the form of grinding apparatus in accordance with the first aspect of the invention.

The third grinding means may be mounted on slide means, which may be the rack of a rack and pinion mechanism, for movement between operative and inoperative positions. Preferably, the third grinding means is pivotally mounted and arranged to contact the lens essentially under gravity only, whereby the

grinding means can readily follow the contour of a lens and also be under minimal contact pressure with the lens.

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

Figure 1 is a side view of a lens edging machine embodying the present invention;

Figure 2 is a partial plan view of Figure 1 with certain components removed;

Figure 3 is a plan view from below of a certain component of Figure 2;

Figure 4 is a section on the line IV-IV of Figure 3, and

Figure 5 is a section on the line V-V of Figure 3.

Referring to the drawings, the basic lens edging machine comprises a chuck 1 for a lens 2, the chuck being arranged to hold the lens centrally so as to free the edge of the lens for grinding. The chuck 1 is provided in housing 3 below which a further housing (not shown) accommodates a pair of grinding wheel 4 and 5 representing first and second grinding means. The housing 3 accommodates further grinding apparatus generally indicated at 6 and representing third grinding means. The housing 3 has a cover 7 part of which 8 is hinged at 9 for upward movement to a generally vertical position. An overall cover 11 is hinged at 12, again for movement to a generally vertical position. These hinged covers 7,11 facilitate the loading of the machine with a lens 2, the covers, when in the closed position preventing the ingress of foreign matter and also the egress of any grinding liquid and/or ground pieces of glass of plastic from the lens 2.

The grinding apparatus 6 is constructed in accordance with the present invention and comprises a grinding wheel 13 which is moved between operative and inoperative positions by a rack and pinion mechanism 14. The rack 15 of the rack and pinion mechanism 14 is mounted generally horizontally and has a toothed section 16 which is engaged by the pinion 17 driven by an electric motor 18. The grinding wheel 13 is mounted on one end of the rack 15 and is mounted for pivotal movement in a generally vertical plane about a generally horizontal pivot axis 19.

The grinding wheel 13 is in the form of a sleeve 21 impregnated or surfaced with a grinding medium 22 such as diamond dust. The sleeve 21 is closed at one end 23 and open at the opposite end through which it is placed over the body 24 of an electric motor 25 having an output shaft 26. The motor may be a standard, readily available motor. The sleeve 21 is mounted for rotation on the motor body 24 by two spaced ball or roller bearings 27 which are separated by a spacer 28. The output shaft 26 is attached to the sleeve 21 via an element 29 fitted into the closed end of the sleeve for rotation therewith.

The motor 25 is mounted in a housing 31 fitted with a sleeve 32 through which electric leads for the motor are taken and which provides the pivot axis 19 for the grinding apparatus 6. It will be seen that when the motor is energised, the output shaft 26 rotates and hence drives with it the sleeve 21.

The grinding apparatus 6 is extremely compact and a motor 17mm in diameter has been successfully used which gives an overall grinding wheel 13 diameter of 31mm, and length of 56mm.

In use of the lens edging machine, a lens 2 is loaded into the chuck 1 through the lids or covers 7,11 which are then closed. The lens 2 is then automatically ground to the required shape and size by the relative course grinding wheel 4 which follows a physical or electronically memorised replica of the required shape (not shown). The grinding wheel 5 is then automatically brought to the lens 2 and a peripheral ridge ground thereon. The lens 2 is now finished except for the provision of a safety bevel at least in the edge of the lens in use facing the wearer.

When the grinding wheel 5 has completed its operation, the motors 18 and 25 are energised, the former driving the pinion 17 relative to the rack 15, whereby the grinding apparatus 6 is moved from its inoperative position of Figure 2 to the operative position in which it contacts the edge of the lens 2, the rack still being driven after initial contact between lens and grinding wheel 13 which the latter pivots about axis 19. As the sleeve 21 is already rotating as it engages the lens 2, the latter also rotating, the safety bevel is immediately ground with the contact pressure between the sleeve 21 and the lens 2 being essentially only due to pivoting. The safety bevel grinding operation typically lasts for a few seconds as only a fraction of a millimetre has to be ground off the lens.

After the safety bevel has been ground, the grinding wheel 13 is retracted to its inoperative position by reversing the motor 18 and the latter, together with the motor 25, de-energised when the grinding wheel is in the inoperative position. All sizes of lenses can be accommodated without any adjustment of the height of the grinding apparatus 6 because the slightly different angle of the bevel as between one size of lens and another which will result in immaterial as only a fraction of a millimetre (¼-½ mm) of material is removed during the grinding of the safety bevel.

Claims

1. Grinding apparatus (16) comprising a motor (25) having a body portion (24) and an output shaft (26) extending from the body portion, characterised in that the apparatus further comprises grinding means (13) mounted for rotation on the body portion (24) of the motor (25) and drivingly connected to the output shaft (26) of the motor.

2. Grinding apparatus according to claim 1, wherein

the grinding means is in the form of a sleeve (21) mounted on the body portion (24) of the motor (25) via two spaced ball or roller bearings (27), with the outer surface of the sleeve provided with a grinding medium (22).

3. Grinding apparatus according to claim 2, wherein the outer surface of the sleeve (21) is impregnated with the grinding medium (22).

4. Grinding apparatus according to claim 2 or 3, wherein one end (23) of the sleeve (21) is closed to form means for mounting the sleeve on the output shaft (26) of the motor (25).

5. Grinding apparatus according to any of the preceding claims, wherein the motor (25) is mounted in a housing (31) arranged for pivotal movement.

6. A lens edging machine comprising first grinding means (4) operable to grind a lens to a required basic size and shape, second grinding means (5) operable to grind an outwardly-extending peripheral ridge or an inwardly-extending peripheral groove on the lens, and third grinding means (13) operable automatically to grind a safety bevel on the lens, characterised in that the third grinding means is in the form of grinding apparatus in accordance with any of the preceding claims.

7. A machine according to claim 6, wherein the third grinding means (13)is mounted on a slide means (14)for movement between operative and inoperative positions.

8. A machine according to claim 7, wherein the slide means is the rack of a rack and pinion mechanism (14).

9. A machine according to any of claims 6 to 8, wherein the third grinding (13) means is pivotally mounted and arranged to contact the lens essentially under gravity only, whereby the grinding means can readily follow the contour of a lens and also be under minimal contact pressure with the lens.

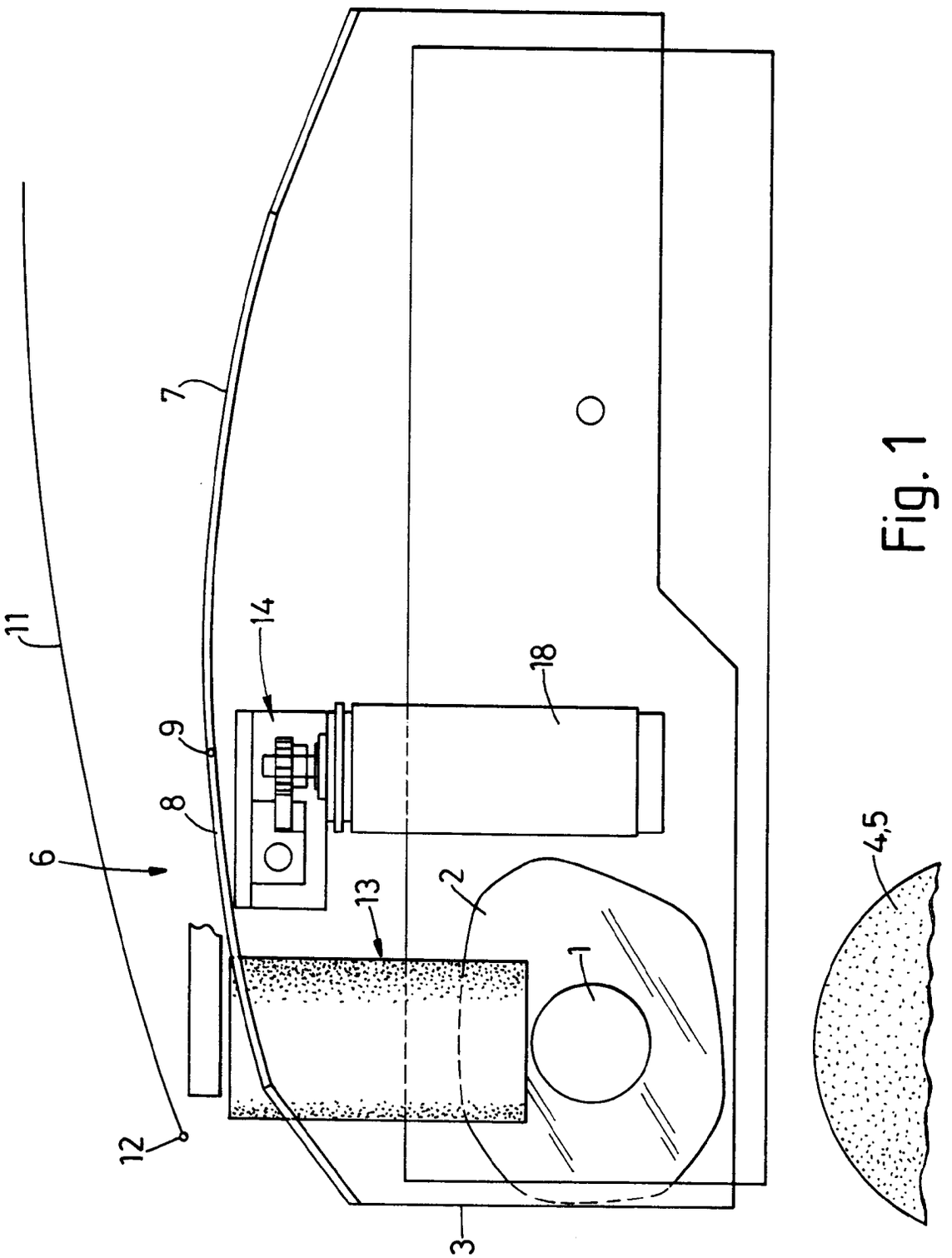

Fig. 1

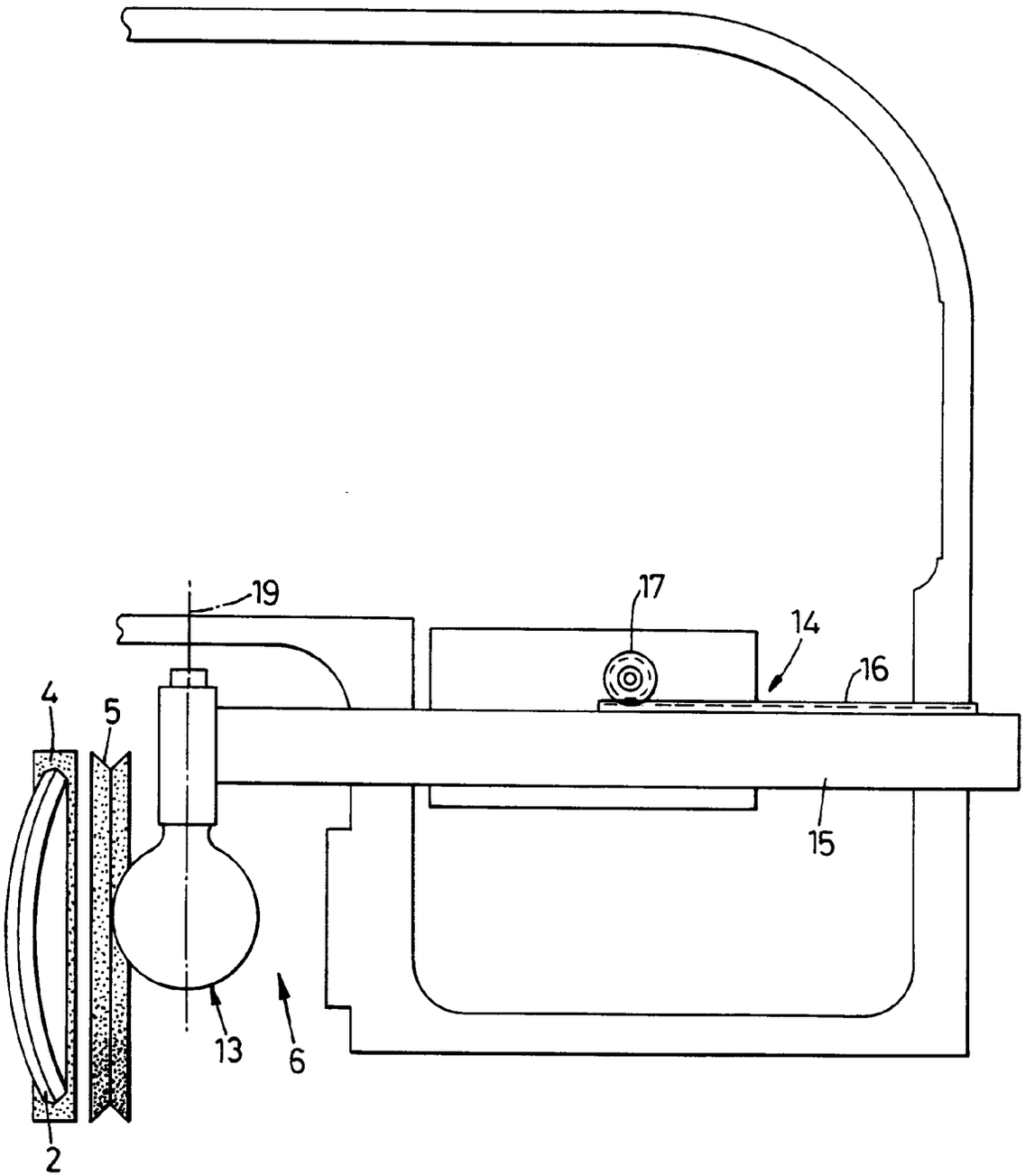

Fig. 2

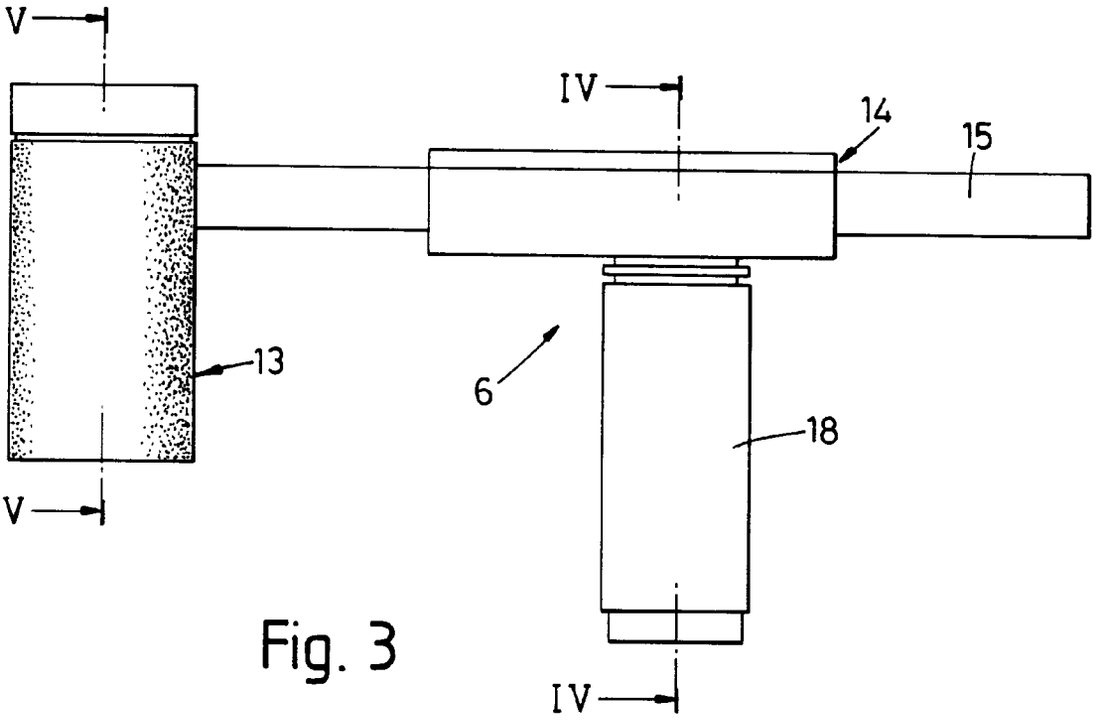

Fig. 3

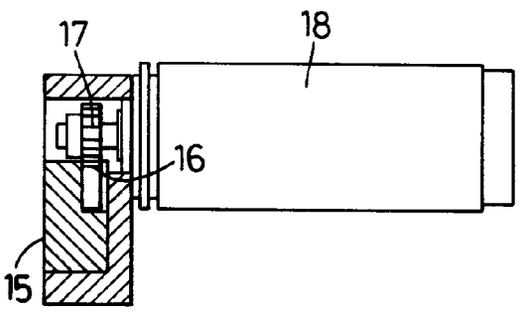

Fig. 4

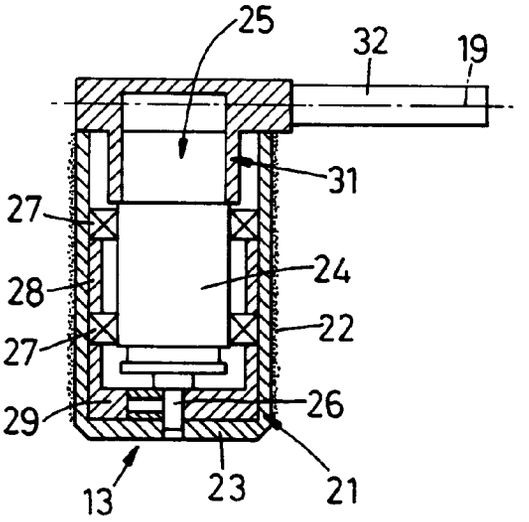

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 93 30 7342

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	DE-U-8 708 313 (WERNICKE & CO GMBH) * page 3, line 8 - page 6, line 8; claims 1-4; figure 1 *	1,2,4	B24B9/14 B24B23/02
X	DE-A-3 831 860 (VEB WERKZEUGMASCHINENKOMBINAT " 7. OKTOBER " BERLIN) * column 2, line 30 - column 3, line 13; figure 1 *	1	
A	DE-A-2 931 822 (FESTO - MASCHINENFABRIK GOTTLIEB STOLL) * page 5, line 21 - page 8, line 4; figures 1,2 *	1,2,4,5	
A	AT-B-178 560 (ING. F. NEUMÜLLER) * page 1, right column, line 80 - page 2, left column, line 11; figure 1 *	1,2,4	
D,A	US-A-5 056 270 (D. V. CURCHER) * figures 1-12 *	6-9	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
D,A	EP-A-0 098 950 (WERNICKE & CO. GMBH) * claims 1-4; figure 1 *	1	B24B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	30 DECEMBER 1993	WUNDERLICH J.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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