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(54) **Method of taking up wear of a grinding wheel on a machine for grinding sheets of glass, and grinding machine implementing such a method**

(57) A method of taking up wear of a grinding wheel (7) on a machine (1) for grinding sheets (2) of glass, whereby the position of an abrasive surface (12) of the grinding wheel, initially set to an ideal work position such as to obtain a sheet of a given size, is adjusted, following wear of the grinding wheel (7), by moving the abrasive surface (12) towards a reference surface (31) on the machine (1), positioned facing and at a predetermined distance (A) from the abrasive surface (12) when the abrasive surface (12) is in the ideal work position; determining the instant of contact between the abrasive surface (12) and the reference surface (31); arresting the grinding wheel (7) at the instant of contact; and moving the abrasive surface (12) away from the reference surface (31) to an adjustment distance at least equal to the predetermined distance (A).

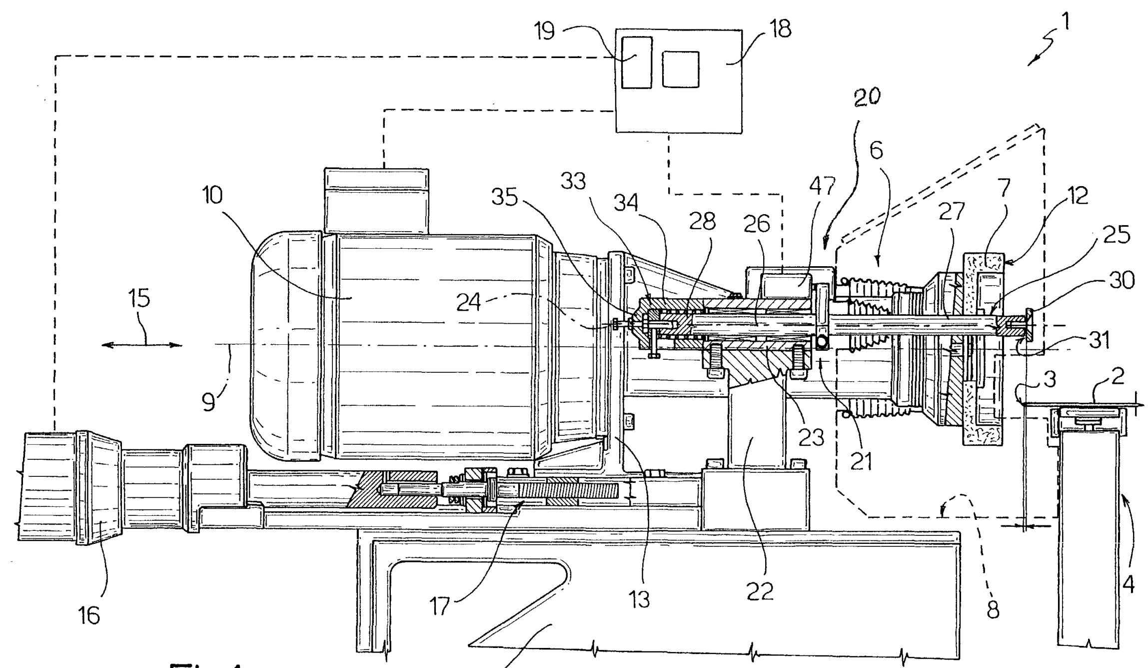


Fig.1



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## Description

**[0001]** The present invention relates to a machine for grinding sheets of glass.

**[0002]** To grind outer peripheral portions of a sheet of glass, grinding machines are used, which comprise, for each side of the work sheet, a number of side by side grinding heads, each comprising a powered grinding wheel set to a respective zero position to remove a respective quantity of material to form beveled sheets or sheets to a given size or shape.

**[0003]** To obtain sheets all of the same size and/or shape, all the wheels must be supervised constantly and the initial zero positions adjusted to take into account inevitable wear of the wheels. For which purpose, each wheel is normally fitted to a respective slide in turn fitted to the machine frame, and which is activated by a supervisor who, on detecting any deviation in size, shape and/or surface finish of the sheet coming off the machine, adjusts the wheels until the sheets coming off the machine are restored to the desired characteristics.

**[0004]** Though widely used, the above method of checking and adjusting the wheels fails to provide for obtaining sheets all of the same shape, size and surface finish. The reason for this substantially lies in the zero position adjustment depending on the skill and experience of the supervisor, who, knowing the expected working life of the wheel under normal working conditions, and by constantly checking the characteristics of the finished sheets, manually adjusts the position of one or more wheels accordingly. When the adjustment is made, however, there is no guarantee that each wheel is actually set to the ideal work position, even if the sheets coming off the machine are, at least initially, within the given tolerance range, so that one or more wheels subjected to greater stress may undergo sudden, rapid wear, while others are subjected to less severe stress than expected.

**[0005]** Whichever the case, adjustment as described above is a particularly time-consuming job, which is directly proportional to the number of wheels being supervised.

**[0006]** It is an object of the present invention to provide a wheel wear take-up method designed to solve the aforementioned problems in a straightforward, low-cost manner.

**[0007]** According to the present invention, there is provided a method of taking up wear of a grinding wheel on a machine for grinding sheets of glass; the method comprising the steps of setting an abrasive surface of the grinding wheel to an ideal work position, such as to obtain a sheet of desired characteristics; and adjusting the position of the grinding wheel to restore said abrasive surface to said ideal work position following wear of the grinding wheel; characterized in that adjustment of the position of the grinding wheel comprises the steps of moving said abrasive surface towards reference means on said machine, positioned facing and a predetermined distance from said abrasive surface when the abrasive surface is in said ideal work position; determining the instant of interference between said abrasive surface and said reference means; arresting said grinding wheel at said instant of interference; and moving said abrasive surface away from said reference means to an adjustment distance at least equal to said predetermined distance.

**[0008]** The present invention also relates to a machine for grinding sheets of glass.

**[0009]** According to the present invention, there is provided a machine for working sheets of glass, comprising a supporting frame; a grinding wheel defined by an abrasive surface; actuating means for setting and maintaining said abrasive surface in an ideal work position such as to obtain a sheet of desired characteristics; and adjusting means for adjusting the position of the grinding wheel with respect to said supporting frame, and restoring said abrasive surface to said ideal work position following wear of the grinding wheel; characterized in that said adjusting means comprise reference means fitted to said supporting frame and facing and a predetermined distance from said abrasive surface when the abrasive surface is in said ideal work position; first actuating means for moving said abrasive surface towards said reference means; detecting means for determining the instant of interference between said abrasive surface and said reference means; stop means for arresting said grinding wheel at the instant of interference; and second actuating means for moving said abrasive surface away from said reference means and to an adjustment distance at least equal to said predetermined distance.

**[0010]** A non-limiting embodiment of the invention will be described by way of example with reference to the accompanying drawings, in which:

> Figure 1 shows a section of a preferred embodiment of a unit for taking up wear of a grinding wheel on a machine (shown partly) for grinding sheets of glass;
> Figure 2 shows a larger-scale section of a detail in Figure 1.

**[0011]** Number 1 in Figure 1 indicates as a whole a machine (shown partly) for grinding a sheet 2 of glass having a lateral surface 3 for grinding and placed horizontally on a known supporting device 4 of machine 1.

**[0012]** Machine 1 comprises a frame 5; and a number of adjustable grinding heads 6, only one of which is shown in Figure 1. Each head 6 comprises a grinding wheel 7, which is housed inside a sealed chamber 8 containing cutting fluid, is rotated about a respective axis 9 - in this case, a horizontal axis - by a respective electric motor 10, and is defined by an abrasive face surface 12, in this case, perpendicular to axis 9 and parallel to surface 3. Motor 10 is located outside chamber 8 and is supported, together with grinding wheel 7, by a respective slide 13, which is fitted movably to frame 5 and is moved, with respect to frame 5 and in a direction 15 parallel to axis 9, by a respective, conveniently step-type, motor 16 fitted in known manner to frame 5 and connected to slide 13 by a known screw-nut screw assembly 17 (not described in detail) to move respective grinding wheel 7 to and from supporting device 4 under the control of a central control unit 18 comprising a memory 19 for storing a number of values, each corresponding to a reference or zero axial position of slide 13.

**[0013]** Still with reference to Figure 1, motor 16, assembly 17 and slide 13 form part of a positioning and adjusting assembly 20 for regulating the position of grinding wheel 7 in direction 15 as a function of the wear of grinding wheel 7.

**[0014]** Each assembly 20 also comprises an adjustable detecting device 21 in turn comprising a fastening frame 22 connected integrally to frame 5 of machine 1 on one side, and supporting, on the other side, a tubular body 23 having an axis 24 parallel to axis 9, and connected integrally to frame 22 to the side of respective grinding head 6. Each device 21 comprises a rod 25, which has an intermediate portion 26 extending inside tubular body 23, and is connected to tubular body 23 in axially-sliding, angularly-fixed manner. Each rod 25 also comprises two opposite lateral portions 27 and 28. Portion 27 projects frontwards on the same side as and alongside grinding wheel 7, projects inside chamber 8 and beyond the plane of abrasive surface 12 of grinding wheel 7, and terminates with an eccentric plate 30. Plate 30 extends partly facing abrasive surface 12, and is defined by a flat surface 31 extending, in this case, over sheet 2, facing and parallel to surface 12, and withdrawn with respect to surface 3.

**[0015]** Portion 28 projects from tubular body 23 on the same side as motor 10 and inside a cup-shaped body 33 coaxial with axis 24 and comprising a cylindrical lateral wall 34 defining an extension of tubular body 23, and an end wall 35 having an inner shoulder 36 (Figure 2). A supporting body 37 is located between shoulder 36 and the end of portion 28, is connected integrally to portion 28, and projects radially beyond portion 28 to define a support for one end of a forcing spring 39 surrounding portion 28, and the opposite end of which rests on a retaining ring 40 engaged in sliding manner by rod 25 and gripped between tubular body 23 and lateral wall 34 of cup-shaped body 33.

**[0016]** Still with reference to Figure 2, device 21 also comprises a screw 42 coaxial with axis 24, the head of which projects outside cup-shaped body 33, and the threaded shank 43 of which engages a threaded hole in end wall 35, and rests against supporting body 37 to keep supporting body 37 and plate 30 in a given axial reference position.

**[0017]** Device 21 also comprises an angular stop screw 44, the shank of which engages a threaded hole in supporting body 37 and projects outwards of cup-shaped body 33 through an axial slot 45 which it engages in axially sliding manner.

**[0018]** With reference to Figure 1 and, particularly Figure 2, device 21 also comprises a switch 47, which is fitted integrally to a lateral wall of the tubular body, is connected electrically to central control unit 18, and has a switching member 48 on which acts an arm 49 connected integrally to portion 27 of rod 25 and extending perpendicularly to rod 25.

**[0019]** Operation of machine 1 and adjustment of the axial position of grinding wheel 7 as a function of the wear of grinding wheel 7 will now be described as of an ideal grinding condition, in which abrasive surface 12 of grinding wheel 7 is in an ideal work position such as to obtain a sheet 2 of desired shape, size and surface finish; screw 42 is set to keep member 48 of switch 47 pressed in a standby condition, and to keep surface 31 of plate 30 positioned over sheet 2 and at a predetermined distance A - conveniently of a few millimeters - from surfaces 3 and 12; and a zero value corresponding to the position of slide 13 and to said predetermined distance A is memorized in central control unit 18.

**[0020]** As of the above condition, and after a predetermined or random operating time of grinding wheel 7, the sheet 2, if any, on device 4 is removed; the grinding wheel is stopped; and central control unit 18 transmits a control signal to motor 16 to feed slide 13 forward so that abrasive surface 12 contacts surface 31 of plate 30. On contacting plate 30, grinding wheel 7 pushes plate 30 to overcome the action of spring 39 and feed rod 25 forward with respect to frame 5 to detach arm 49 from switch 47, which supplies central control unit 18 with a shift-start signal. In response to the incoming shift-start signal, central control unit 18 emits a control signal which first stops and then reverses motor 16 to back up grinding wheel 7 by an adjustment quantity equal to said predetermined distance A, so that abrasive surface 12 of grinding wheel 7 is restored to the ideal work position to obtain the desired characteristics of the next sheet 2.

**[0021]** To compensate for any slack in the linkage mechanism, grinding wheel 7 is conveniently backed up by an adjustment quantity greater than said predetermined distance A, and, once the grinding wheel is backed up, central control unit 18 again reverses motor 16 and feeds grinding wheel 7 forward by the difference between said adjustment quantity and predetermined distance A.

**[0022]** By backing up and, if necessary, feeding grinding wheel 7 further forward, the abrasive surface 12 of grinding wheel 7 is therefore restored at all times to the ideal work position, regardless of the wear of grinding wheel 7, so that, by selecting the best frequency with which to reposition grinding wheel 7, all the sheets coming off the machine are the same shape and size.

**[0023]** Using rod 25 and respective plate 30, switch 47 and all the electric components of device 21 in general may be located away from grinding wheel 7 and outside chamber 8 containing the cutting fluid, thus eliminating any hazards posed by the electric components and relative wiring coming into contact with the cutting fluid.

**[0024]** By providing each grinding wheel on the machine with a respective repositioning device, the grinding wheels can be controlled independently, in use, which is extremely useful when, for any reason, only one or some of the grinding wheels on the machine need adjusting or replacing.

**[0025]** Clearly, changes may be made to machine 1 in general, and to assembly 20 in particular, as described herein, without, however, departing from the scope of the present invention.

**[0026]** In particular, devices other than the one described may be provided to move grinding wheel 7, and devices other than device 21 may be provided to detect the instant surfaces 12 and 31 contact, and so control motor 16. Reference surface 31 may, obviously, be of any shape and size, and may be selected, for example, as a function of the geometry of the abrasive surface of the grinding wheel, which may, for example, be lateral and concave, as opposed to a flat face surface. In particular, plate 30 may, obviously, be replaced with a straightforward cylindrical rod, or a rod of any shape, positioned transversely so that the lateral surface of the rod cooperates with the abrasive surface of the grinding wheel, or frontally so that the end surface of the rod - which may, obviously, be the same or a different shape and size from the cross section of the rod - cooperates with the abrasive surface of the grinding wheel. In the case of a rod with a polygonal cross section, one longitudinal edge of the rod, and therefore substantially a line, is obviously sufficient to define a reference for the abrasive surface of the grinding wheel.

**[0027]** The reference surface may therefore be a surface other than the one described, and, in particular, a luminous surface, conveniently one defining a light beam. In which case, the instant of contact between the abrasive surface of the grinding wheel and the reference surface may be determined by detecting the variation in one or more characteristics of the light beam.

**[0028]** In the case of two or more side by side grinding wheels, the respective bodies/reference beams for the respective surfaces of the grinding wheels may obviously be replaced with a single body/reference beam common to all the respective devices 21 of the grinding wheels.

**[0029]** Finally, arm 49 and switch 47 may be replaced with other, e.g. optical or magnetic, devices.

## Claims

1. A method of taking up wear of a grinding wheel (7) on a machine (1) for grinding sheets (2) of glass; the method comprising the steps of setting an abrasive surface (12) of the grinding wheel to an ideal work position, such as to obtain a sheet of desired characteristics; and adjusting the position of the grinding wheel (7) to restore said abrasive surface (12) to said ideal work position following wear of the grinding wheel (7); **characterized in that** adjustment of the position of the grinding wheel (7) comprises the steps of moving said abrasive surface (12) towards reference means (31) on said machine (1), positioned facing and a predetermined distance (A) from said abrasive surface (12) when the abrasive surface (12) is in said ideal work position; determining the instant of interference between said abrasive surface (12) and said reference means (31); arresting said grinding wheel (7) at said instant of interference; and moving said abrasive surface (12) away from said reference means (31) to an adjustment distance at least equal to said predetermined distance (A).

2. A method as claimed in Claim 1, **characterized in that** said adjustment distance is greater than said predetermined distance (A); and by comprising the further step of moving said abrasive surface (12) towards said reference means (31) by a quantity equal to the difference between said adjustment distance and said predetermined distance (A).

3. A method as claimed in Claim 1 or 2, **characterized in that** the instant of interference is determined by detecting a shift-start condition of said reference means (31) with respect to a frame (5) of the machine (1).

4. A method as claimed in Claim 3, **characterized in that** the instant of interference is determined by elastically locking said reference means (31) with respect to the frame (5) of the machine (1).

5. A method as claimed in Claim 3 or 4, **characterized in that** the shift-start condition of said reference means (31) is detected by detecting a variation in a shift signal.

6. A method as claimed in Claim 5, **characterized in that** the shift-start condition of said reference means (31) is detected by detecting a variation in an electric signal emitted by an electric detector (47) connected to said reference means (31).

7. A machine (1) for working sheets (2) of glass, comprising a supporting frame (5); a grinding wheel (7) defined by an abrasive surface (12); actuating means (16, 17) for setting and maintaining said abrasive surface (12) in an ideal work position such as to obtain a sheet of desired characteristics; and adjusting means (20) for adjusting the position of the grinding wheel (7) with respect to said supporting frame (5), and restoring said abrasive surface (12) to said ideal work position following wear of the grinding wheel (7); **characterized in that** said ad-

justing means (20) comprise reference means (31) fitted to said supporting frame (5) and facing and a predetermined distance (A) from said abrasive surface (12) when the abrasive surface (12) is in said ideal work position; first actuating means (16, 17, 18) for moving said abrasive surface (12) towards said reference means (31); detecting means (21) for determining the instant of interference between said abrasive surface (12) and said reference means (31); stop means (16, 17, 18) for arresting said grinding wheel at the instant of interference; and second actuating means (16, 17, 18) for moving said abrasive surface (12) away from said reference means (31) and to an adjustment distance at least equal to said predetermined distance (A).

**8.** A machine as claimed in Claim 7, **characterized in that** said first and said second actuating means comprise a single drive motor (16), and a respective slide (13) supporting said grinding wheel (7).

**9.** A machine as claimed in Claim 7 or 8, **characterized in that** said reference means comprise a reference surface (31).

**10.** A machine as claimed in Claim 9, **characterized in that** said reference surface (31) is parallel to said abrasive surface (12).

**11.** A machine as claimed in Claim 7 or 8, **characterized in that** said reference means (31) comprise a reference line.

**12.** A machine as claimed in one of Claims 7 to 11, **characterized by** comprising relatively movable means (23, 25, 39) interposed between said supporting frame (5) and said reference means (31); and in that said detecting means (21) comprise sensor means (47) for detecting movement of said reference means (31) with respect to said supporting frame (5).

**13.** A machine as claimed in Claim 12, **characterized in that** said sensor means comprises an electric switch (47); connecting means (25, 49) being provided to connect said electric switch (47) to said reference means (31).

**14.** A machine as claimed in Claim 13, **characterized by** comprising elastic forcing means (39) for locking said reference means (31) elastically with respect to said supporting frame (5).

**15.** A machine as claimed in Claim 14, **characterized in that** said relatively movable means and said connecting means comprise a rod (25) fitted to said supporting frame (5) to slide in a longitudinal direction (15); said elastic means (39) forcing said rod (25) against a stop (42) carried by said supporting frame (5).

**16.** A machine as claimed in Claim 15, **characterized in that** said rod (25) extends to the side of said grinding wheel (7); said reference means (31) projecting from an end portion of said rod (25); and said sensor means(47) extending on the opposite side of said grinding wheel (7) to said reference means (31), and at a distance from the grinding wheel (7).

**17.** A machine as claimed in Claim 16, **characterized by** comprising adjusting means (25, 42) for adjusting the position of said reference means (31) with respect to said supporting frame (5).

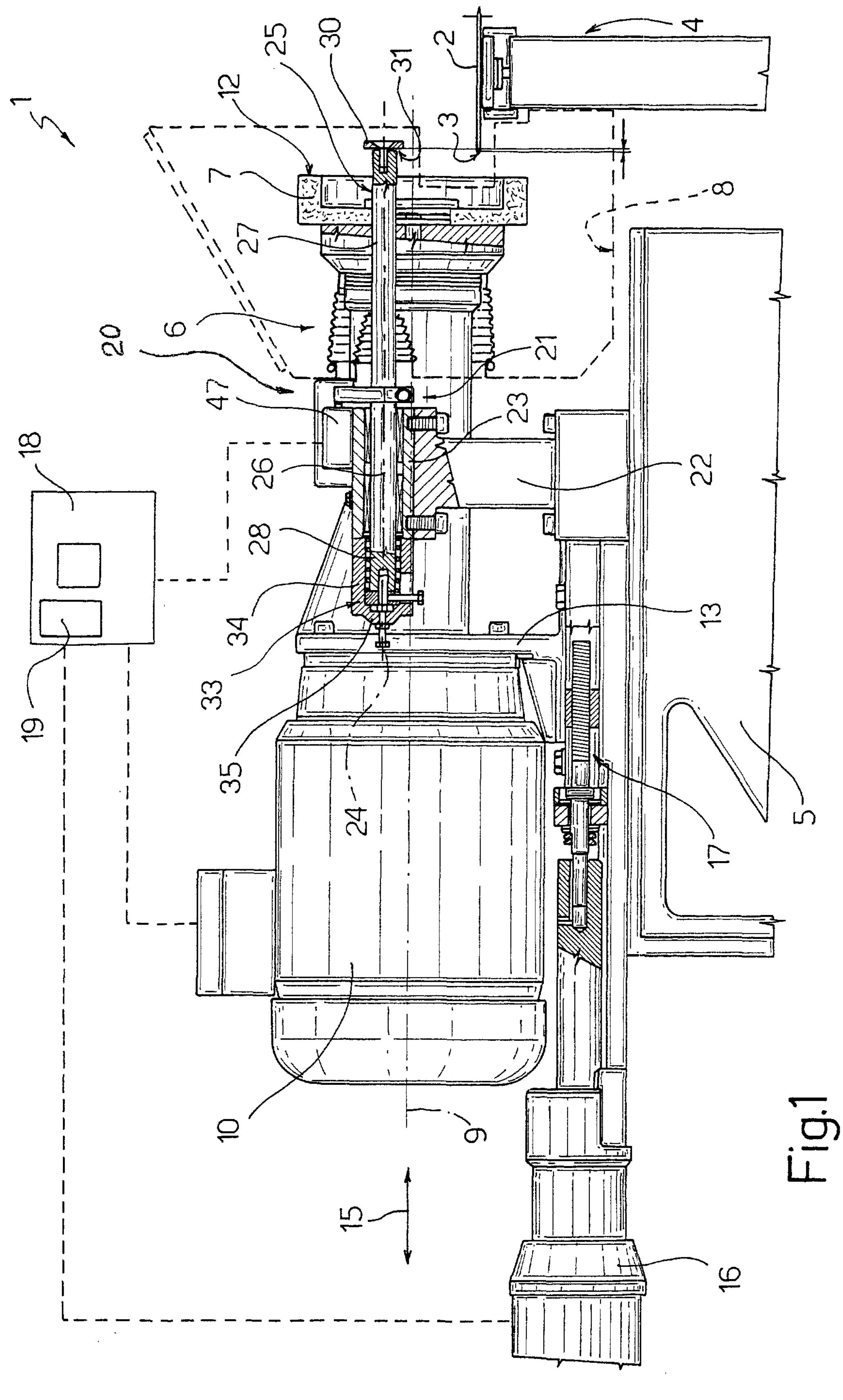
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Fig.1

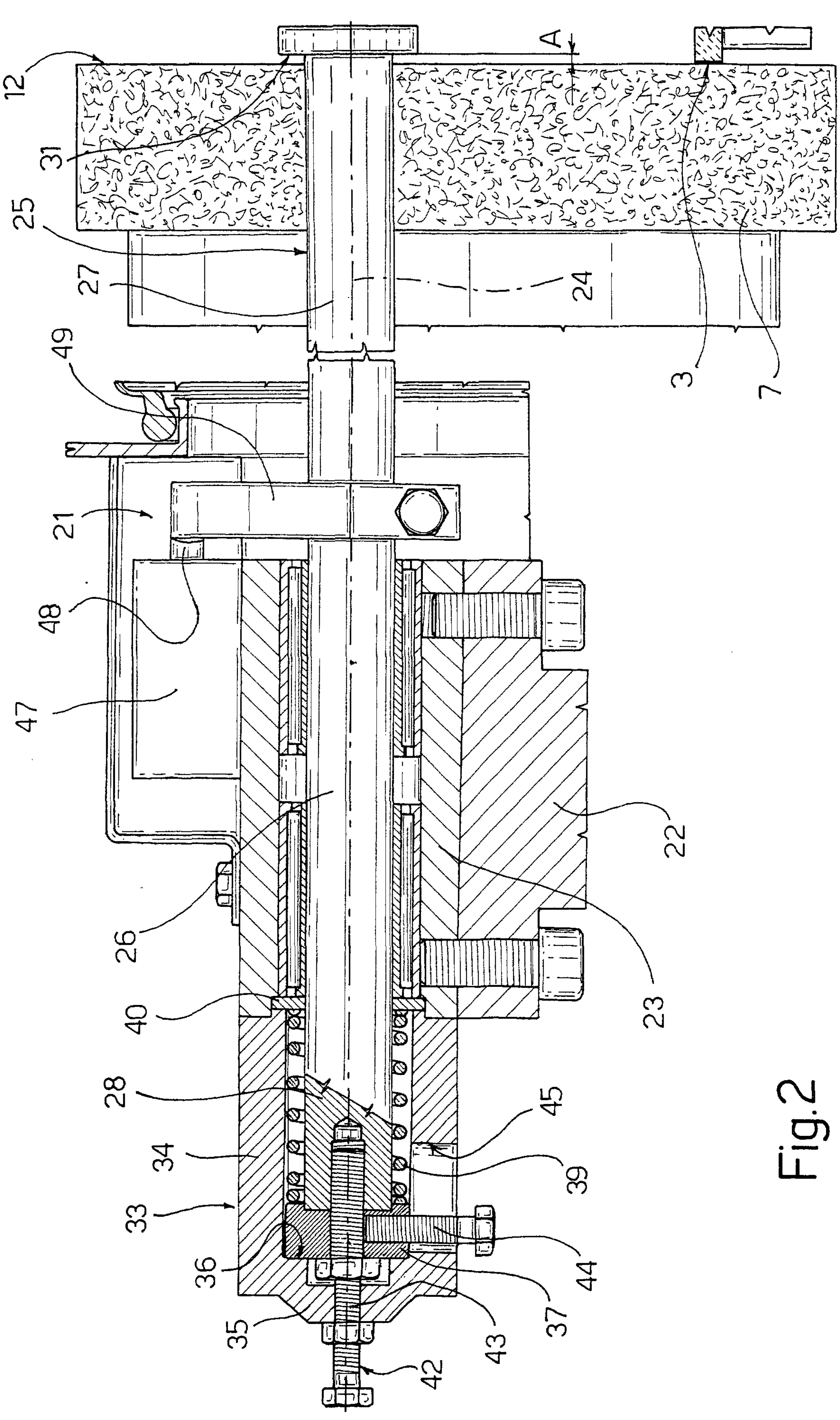
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Fig.2