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(54) SCREEDING MACHINE AND METHOD FOR LEVELING FLOOR BASES

ABZIEHMASCHINE UND VERFAHREN ZUM NIVELLIEREN VON BODENUNTERLAGEN

PROCÉDÉ ET MACHINE À ARASER POUR LE NIVELLEMENT DE CHAPES

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Description

[0001] The present invention relates to a screeding machine for leveling floor bases and to a method thereof.

[0002] More particularly, the invention concerns an improved screeding machine for leveling floor bases, comprising two tracks, parallel to each other, which support and move in two directions a frame or chassis, on which an articulated arm carrying a rotating tool is mounted; moreover, an automatic adjustment electronic system allows to carry out a continuous control of elevation, with respect to a plane generated by a laser projector, so that the accuracy of the plane made with the continuous control of elevation is such as not to affect the essential continuity effect of the plane which is produced, despite the succession of multiple adjacent screeding workings.

[0003] The floors are generally constituted by sand or cement layers and they may be made with or without foundations.

[0004] In particular, the floors with foundations are placed on a foundation screed (also called "cardana-screed"), which is placed and smoothed on the layer to be floored and which is normally a semi-humid mixture of sand, cement and water, in which the concentration of cement is low and the water is dosed as required to obtain a mixture having a semi-dry consistency (a moist-sand mixture), which is able to obtain a product with well defined geometrical characteristics, also avoiding the cropping up of plasticity features, that would occur were the mixture was dosed with too much water and which would generate unwanted movements of the mixture during and after the laying on the floor, and therefore unwanted variations of quality and geometry of the floor plain during and after drying.

[0005] The above mentioned mixtures are produced using pre-mixed products or they are manually dosed by the operator.

[0006] The mixture, lying on the unfinished floor of the building, with a thickness of about 3-15 cm and smoothed to obtain a finished surface, forms the laying bed on which are placed all types of coating, such as ceramic, marble, parquet, carpet, resins, etc.; a further object of the screed is also to have a space in which to install the water pipes, the electricity cables and/or cables of other services.

[0007] The semi-dry mixtures having a thickness of 3-15 cm, in a pasty state, have a compression strength of between 0.05 and 0.15 Kg/cm² and the operation of screeding said mixtures is mainly composed of the following steps.

[0008] Firstly, in a first step, the elevation and orientation of the plane is determined, by defining at least three points for which the plain to be made must cross; during this operation, in order to obtain the above reference points, necessary to define the plain to be made, a prefixed elevation, established by the management of the construction yard, located on each floor of the building and used by all professionals (electricians, plumbers, carpenters, floor layers, etc.) as a reference point for the instal-

lation of various devices, is used as a reference.

[0009] Small islands or points, made using the same material of the screed, are spaced apart, so that an aluminum rod or bar of suitable length rests on at least two of said islands and in such a way that their horizontal plane is placed, with respect to a vertical line (lead line), at a prefixed distance from the reference elevation established by the construction yard.

[0010] During a second working step parallel stripes (called bands), suitably spaced, are made with the same mixture material and are manually obtained by using the rod, thus creating a continuity of the plane among the points which are previously determined.

[0011] During a third working step the mixed material is placed within the parallel strips or bands, which have been previously made, while during a fourth working step the so-called leveling operation is made, i.e. an operation according to which a kneeling operator swipes the rod on the bands to remove the excess material, placed between the bands during the previous step, in order to create in this way a single and continuous plane.

[0012] Such leveling operation may also be performed with suitable appropriate mechanical equipment, such as bridge screeding machines of the type described for example in EP1163408B1, in which respective carriages move forward on lateral guides and are connected to two sections, belonging to the bridge structure, which are sliding on each other and one of which is fixed to a mechanical structure supporting a milling cutter; a suitable combination between the motion of rotation of the cutter (which rotates in a direction depending on the direction of the side carriages) and the motions of the carriage supporting the milling cutter and of the side carriages of the machine allow to automatically obtain a displacement and compression of the screed up to an appropriate optimal leveling.

[0013] In a further processing step it is possible, by means of a manual trowel or by means of a suitable mechanical equipment, to tamper the foundation and to smooth and level the screed, in order to obtain a homogeneous and leveled plain (which allows to obtain a screed which is less porous and which can absorb less adhesive during the coating material laying step).

[0014] However, the above known operations which can be made for leveling the screed have several drawbacks, including the drawback consisting in having to position the screeding machine in correspondence of the screed to be leveled, for each portion of the foundation which has to be processed.

[0015] Furthermore, such operations, whether they are manual or realized by means of known screeding machines, however, give a screed which is not perfectly flat, but undulating, as the only reference for the operator is the same plane on which the machine or the manual trowel leans.

[0016] A screeding machine for leveling floor bases having the technical features of the preamble of the appended claim 1 is known for example from

US2008/031687.

[0017] An object of the present invention is therefore to overcome the above technical drawbacks and, in particular, to indicate a screeding machine for leveling floor bases, which can be moved, simply and quickly, directly on the screed of the foundation, without having previously made supporting guides or bands, for the entire surface to be leveled, when the material of the screed is yet in a mixture and in any case before the beginning of the curing effect due to drying.

[0018] Another object of the present invention is to provide a screeding machine for leveling floor bases, which allows to obtain, simply and by a single operation, a surface layer of the screed, which is smooth, suitably compressed and perfectly leveled in a plane, without making a tamping operation, in correspondence with the entire surface to be walked on or to be floored and for every type of material used as foundation.

[0019] Another object of the present invention is to provide a screeding machine for leveling floor bases, which allows to drastically reduce the processing times and the floor installation costs, with respect to the prior art.

[0020] A further object of the invention is to provide a method for making floor foundations, which is provided by means of the above mentioned machine.

[0021] These and other objects, which will become apparent in the following discussion, are achieved by a screeding machine for leveling floor bases, according to the appended claim 1, and by a method thereof, according to the appended claim 4; further detailed technical features are also contained in the dependent claims.

[0022] Advantageously, it is enough to place the mixture of the screed over the entire surface to be floored and operate the screeding machine, in order to obtain, by means of a single processing step and regardless of the size and geometry of the surface, a layer of screed having a desired thickness, compact and perfectly leveled and flat, so that the subsequent laying of the floor is perfectly flat and/or without undulations, disconnections, cracks or depressions.

[0023] Moreover, the screeding machine has a size that can pass through all the interior doors of the flats, and this feature allows to not have to lift and move manually the machine to go through the rooms, but to continue the work through the passage of the doors and to pass in the hallways with continuity.

[0024] Further characteristics and advantages of the screeding machine for leveling floor bases, which is the object of the present invention, will become clear from the description of a preferred and illustrative, but not limiting, embodiment of the machine, and from the alleged drawings, wherein:

- figure 1 shows a front perspective view of the screeding machine for leveling floor bases in a first operating position, according to the present invention;
- figures 2, 2A and 2B show, respectively, two partial side views and a partial below perspective view of

the machine of figure 1, according to the present invention;

- figure 3 shows a partial perspective view of the machine of figure 1;
- 5 - figure 4 shows the enlarged detail A of figure 3, according to the present invention;
- figure 5 shows a front perspective view of the machine of figure 1, in a second operating position;
- figure 6 is a total side view of the machine of figure 5;
- 10 - figure 7 shows the enlarged detail B of figure 6, according to the present invention;
- figure 8 is a front view of the machine of figure 1, according to the present invention;
- figure 9 is a top plan view of the machine of figure 1, according to the invention;
- 15 - figure 10 shows a schematic diagram in a further operating position of the machine, according to the present invention;
- figure 11 shows the enlarged detail C of figure 10, according to the present invention;
- 20 - figure 12 is a top perspective view of the machine of figure 1, in the operating position shown in figure 10, according to the present invention;
- figures 13 and 14 show further operation diagrams of the machine according to the invention;
- 25 - figure 15 is a partial side view of the machine shown in figure 5, according to the present invention;
- figure 16 shows the enlarged detail D of figure 15, according to the present invention;
- 30 - figures 17, 18, 19, 20 and 21 show perspective exploded and sectional views of a portion of the machine shown in figure 5, according to the present invention;
- 35 - figure 22 is a top plan view of the portion of the machine shown in figures from 17 to 21, according to the present invention.

[0025] With reference to the mentioned figures, the screeding machine for leveling floor bases, which is the object of the present invention, has two tracks AA, parallel to each other, which directly move on the screed to level and which support and move in at least two directions the machine frame or chassis BB, on which an articulated arm CC is mounted; moreover, a turret or adjusting device DD is associated in turn with said articulated arm CC and has, as a terminal element, a rotary tool EE.

[0026] During the moving forward and back of the machine, the overall weight of said machine weighs on the screed in correspondence of the total area of the tracks AA, each of which resting on the sliding blocks B1, being moved by the drive roller A1 and also having an idle roller D1, a tensioning roller E1 and a belt F1 (as shown in figures 1, 3, 4 and 5).

[0027] The drive roller A1 transmits the motion to the belt F1, which rotates on the idle roller D1 and on the tensioning roller E1 and leans on the sliding blocks B1, so that the tangent of the drive roller A1 is the continuation of the tangent of the idle roller D1 (Figs. 3-4); furthermore,

the quick displacement of the idle roller D1 make easier the assembly and dismantling operations for maintenance and/or replacement of the belt F1.

[0028] In particular, the size of the belt F1 contact surface of each track AA between the sliding blocks B1 is such that the track AA makes a specific pressure on the screed below at least a value of between 0.05 and 0.15 Kg/cm², as the pasty semi-dry mixtures, which constitute the screeds having varying thicknesses between 3 and 15 cm, have a resistance to compression between the values 0.05 and 0.15 kg/cm²; this allows the machine to directly move on the screed that the same machine makes, without sinking into the screed substrate and/or leave traces on the screed.

[0029] The machine also includes a plate C1, positioned below the machine frame BB and between the tracks AA (figs. 2, 2A, 2B), whose size is such that the specific pressure produced on the screed is less than at least a value in the range 0.05-0.15 kg/cm²; the plate C1 can also be translated, projecting beyond the plane defined by the tracks AA of a predetermined measure FF, in order to lift the entire machine frame BB and to move the lower surface of the belt F1 of the tracks AA away from the screed surface during the direction changes of the machine (in fact, the direction change takes place by performing a mechanical rotation of the machine frame BB, which, during the lifting, does not make any pressure and/or material slaver on the finished screed).

[0030] Moreover, the machine is extremely easy to handle, since, because the axis of rotation of the plate C1 passes through the center of gravity of the machine frame BB, the lowering of said plate C1 beyond the lower surface of the tracks AA and the subsequent mechanical rotation of the machine frame BB allows to orient the above machine in all directions, including the possibility to make a complete rotation of the machine itself.

[0031] The plate C1 is associated with a first reduction gear R12, which in turn is mounted on a lifting bridge PS; moreover, the lifting bridge PS is associated with two articulations SN1, SN2, mounted on respective shafts AL1, AL2, so that a second reduction gear RI1 rotates the first shaft AL1, which, through a tie rod TR, produces the rotation of the same angular amount of the second shaft AL2.

[0032] Thus, the rotation of the shaft AL1, by means of the reduction gear RI1, causes a displacement of the joints SN1, SN2, which, in turn, move the lifting bridge PS and, consequently, the plate C1, while the reduction gear RI2 causes the rotation of the plate C1 and then the orientation of the camera body BB and of the whole machine (see in particular figs. 6, 7, in which plate C1 is in a rest position, and figs. 15, 16, in which the plate C1 is moved in a vertical direction by a quantity H to rest on the screed)

[0033] The articulated arm CC is able to move the adjustment turret DD and the attached tool EE on a straight line GG which is parallel to the line HH, the latter joining the joints J, K which connect the articulated arm CC to

the machine frame BB (figs. 13-14).

[0034] The movement of the articulated arm CC, starting from a rest position, according to which the overall dimensions of the arm CC, of the adjustment turret DD and of the tool EE is included in a cylinder M which contains the whole machine (figs. 8-9), allows the tool EE to run a distance, along the line GG, which is equal to the distance X+Y, moving the weight of the tool EE, of the adjustment turret DD and of the same articulated arm CC near the center of gravity of the machine frame BB (Figs. 13-14); the distances X, Y and X+Y are adjustable and in any case the distance X+Y is greater than the overall width U of the machine frame BB, while the tool EE has overall dimensions greater than any other mechanical device for supporting the adjustment turret DD (which thus has a width smaller than the tool EE overall dimensions of at least a quantity Z).

[0035] Furthermore, the articulated arm CC is formed by two parallelograms having sides, respectively, E, L, N, O and P, Q, R, S, where the lengths of the arms E, L, P and Q are equal, the length O is equal to the length N, the length of R is equal to the length S and the joints 1, 2, 3 and 4 of the arms E, L, P, Q are positioned on a same straight line JJ; under these conditions, the straight line GG passing through the joints 5 and 6 of the arms P and Q on the turret DD is always parallel to the line HH passing through the joints J, K of the arms E, L on the machine frame BB and the distance KK between the lines JJ and HH changes when the angle α varies (α is the angle comprised between the arm E or L and the straight line LL perpendicular to the lines JJ and HH), since $KK = \cos \alpha$ (see figures 10, 11 and 12 for details).

[0036] The cross-bar T1 of the articulated arm CC is bound to the arms E, L at a distance F from the joints 1 and 4 of the jointing cross-bar MM and the cross-bar T2 is bound to the arms P and Q at the same distance F from the joints 2 and 3 of the jointing cross-bar MM, while the upright G of the articulated arm CC is bound to the cross-bar T1 and is equipped with a linear guide YL on which the cross-bar T2 slides.

[0037] The angular variation α between the arms E, L and the straight line LL, which is perpendicular to the jointing cross-bar T2, causes a displacement of the cross-bar T1 with respect to the jointing cross-bar MM and the cross-bar T1 transmits to the cross-bar T2, via the guide YL, the same displacement.

[0038] However, since the cross-bar T2 is bound to the arms P and Q, the same cross-bar T2 will cause on said arms P and Q an angular displacement which is equal to said angle α variation; practically, an angular movement of a predetermined angle α of the arms E, L cause the same angular movement of the same angle α of the arms P and Q and, therefore, the straight line DD is spatially parallel to the line HH (while the plane containing the straight line HH is parallel to the contact surface NN of the tracks AA on the screed).

[0039] Finally, the angular movement of the arms E, L is generated by the angular movement of the sprocket

TR, which is associated with the cross-bar T3 of the articulated arm CC, said cross-bar T3 being parallel to the cross-bars T1 and T2 and to the jointing cross-bar MM; since the angular sprocket TR is driven by a gear motor, the movement of the entire articulated arm CC can be stopped in any position, including the useful position which meets the conditions relating to the rest position and to the displacement of the total weight of the tool EE, of the adjustment turret DD and of the arm CC near the center of gravity of the machine frame BB.

[0040] The adjusting turret or device DD allows to have a continuous control of the tool EE elevation, with reference to a plane generated by a laser projector of a known type, and the precision of the plane realized with said elevation continuous control is such as not to affect the essential effect of continuity of the screed, despite more adjacent workings that the screeding machine is able to perform.

[0041] The elevation control is carried out by using at least 3 sensors SE, placed on the same plane PR and oriented and spaced from each other by 120°, which are able to receive the radiation produced by a laser source coming from any direction (as shown in detail in figs. 20-21-22).

[0042] Since the laser projectors of the traditional type generate a plan which has a variable thickness (between 2 and 10 mm), depending on the distance between the laser source and the point of reading (unlike an ideal plane which should have a zero thickness), the adjustment turret DD allows to achieve appreciable levels of accuracy (of the order of tenths of a millimeter) for making a floor base (for making a floor base one cannot accept differences of 2-10 mm between a plurality of points that are adjacent and/or close together) using the above mentioned sensors SE.

[0043] In fact, each sensor SE measures the change in intensity of the laser radiation through the thickness of the plane produced by the known laser projector and the diagram of the intensity of radiation V as a function of the elevation W has a shape that is instrumentally detectable.

[0044] Therefore, by analyzing the radiation peak and by developing a calculation system able to estimate the two semi-areas AR1, AR2 of the peak, it is possible to obtain the direction according to which the sensor SE is to be moved, by calculating the elevation variable W (corresponding to the radiation peak), assuming that $AR1=AR2$ and taking into account the fact that the intensity of radiation V, the direction of movement of the sensor SE and the elevation variable W appear in the integral calculation of the areas AR1 and AR2.

[0045] In this way, the system is suffering neither the thickness of the radiation plane produced by the laser nor the intensity of the laser radiation.

[0046] Thus, a microprocessor control system processes the information coming from the sensors SE and generates a command for activating the motor MT of the turret DD to adjust continuously the elevation so that the tool EE carries out the working that is provided and is

able to create a screed which is perfectly flat.

[0047] In particular, the motor MT rotates a worm VI, which rotates inside a spiral CH producing a displacement of the body PP with respect to the support QQ; the body PP is associated, by means of the middle body RR and the spindle SS, with the tool EE, while the support QQ is integral to the terminal joints 5 and 6 of the arms P and Q on the turret DD frame (figs. 17-18-19). Therefore, the displacement of the tool EE is always referred to the plane of contact NN between the tracks AA and the screed of the floor.

[0048] Said screed is thus substantially made using the following method.

[0049] At first, a known-type laser, equipped with a support, is positioned at a prefixed elevation and oriented according to a desired plane where the screed will be built, also with reference to the plane determined by the construction yard.

[0050] Now, the screeding machine object of the present invention, by means of a milling operation obtained by combining the speed of the rotary tool EE, its rotation versus and the shifting of the articulated arm CC, as well as through a height continuous control of said tool EE which is made by means of the adjustment turret DD, is able to produce a plane always parallel to the reference plane previously determined by the laser source.

[0051] The rotation speed of the tool EE, which is programmable according to the invention, generates a relative speed between said tool EE (a rotary cutter) and the screed, such as to obtain a surface finishing whose accuracy is extremely higher than what it could be achieved by a manual or mechanical tamping operation.

[0052] Therefore, using the machine object of the invention, it is not necessary to realize the parallel bands that allow to create a plane continuity according to the prior art, as well as it is not necessary to distribute the mixed material within the bands, as the filling operation is replaced by a simple distribution of the mixture on the screed in a necessary amount.

[0053] Moreover, the milling operation made by the screeding machine replaces the traditional operation of leveling a floor base, thus considerably improving the accuracy of flatness of the screed.

[0054] Finally, since, using the machine according to the invention, the finishing operation is made at the same time of the milling operation and is always obtained with a continuous control in the plane determination, it is possible to completely avoid all the inaccuracies due to a mechanical or manual finishing operation; furthermore, the geometry of the cutter generates rotary force torques, whose resultants produce a localized pressing of the screed at the same time the displacement of the mixed material, during the screed processing.

[0055] The invention thus conceived is susceptible of numerous modifications and variations, all falling within the scope of the appended claims.

[0056] Where the features and techniques mentioned

in any claim are followed by reference signs, said reference signs have been included for the sole purpose of increasing the intelligibility of the claims and, accordingly, such reference signs do not have any limiting effect on the interpretation of each element which is identified by way of example by such reference signs.

Claims

1. Screeding machine for leveling floor bases, comprising a main frame or body (BB), support and handling means (AA) of the frame (BB) in at least two directions, which are connected to said frame (BB), and support and handling means (CC) for shifting of at least one milling device (DD), which are also fixed to said frame (BB), said milling device (DD) having, as an end part, at least one rolling tool (EE) for leveling and smoothing a floor base in order to obtain a finished surface on which it is possible to place at least one type of covering surface, wherein said milling device (DD) includes control means for controlling the height of said rolling tool (EE) with respect to the surface of the floor base and with reference to a plane which is generated by a laser source and wherein said rolling tool or cutter (EE) has a programmable rotation speed which causes a relative velocity between said tool (EE) and said surface of the floor base, so as to have a highly accurate finished surface, the rotation speed of the rolling tool (EE) being combined with the shifting of the support and handling means (CC) and with the height control of said rolling tool (EE) which is made by means of the control means, in order to produce a plane always parallel to the reference plane previously determined by the laser source, **characterized in that** said control means include at least three sensors (SE), placed on a same plane (PR) and which are spaced one from each other around a vertical axis by 120°, said sensors (SE) being thus able to receive, in any direction, the radiation produced by said laser source and each sensor (SE) being also able to measure the intensity variation of the laser radiation along the thickness of said plane generated by said laser source and the intensity of the laser radiation (V) with respect to the height (W) of said sensor (SE) and of said rolling tool (EE), so as to obtain the direction of movement of said sensor (SE).
2. Screeding machine according to at least one of the previous claims, **characterized in that** an electronic control system elaborates the information coming from said sensors (SE) and generates a command to operate a motor (MT), which continuously regulates the height of said milling device (DD) and of said rolling tool (EE).
3. Screeding machine according to at least one of the

previous claims, **characterized in that** said motor (TM) drives a worm screw (VI), which rotates inside a lead nut (CH), producing a movement of a first body (PP), which is associated, by means of at least one spindle (SS), with said rolling tool (EE), with respect to a support second body (QQ), which is integral with said support and handling means (CC) of the milling device (DD), so that the movement of said rolling tool (EE) is always referred to a contact plane (NN) between said support and handling means (AA) of the frame or body (BB) of the machine and the surface of the floor base.

4. Method for leveling and smoothing floor bases using the screeding machine of claim 1, **characterized in that** it involves the following steps:

- positioning a laser source to a prefixed height and orienting said laser source according to a predetermined plane on which the floor base is built;
- measuring, through at least three sensors (SE) which are placed on a same plane (PR) and which are oriented and spaced one to each other around a vertical axis by 120° and which are able to receive the radiation produced by said laser source in any direction, a variation of intensity of said radiation along the thickness of said prefixed plane generated by the laser source;
- measuring the radiation intensity (V), which is received by said sensors (SE) and which is produced by said laser source, depending on the position of at least one of said sensors (SE), said position being detected on the same direction of the height (W) of said rolling tool (EE) and said height (W) being equal to the distance between said rolling tool (EE) and the surface plane of the floor base;
- analyzing the peak of said radiation intensity (V);
- integral calculus of the areas (AR1, AR2) adjacent to said peak of the radiation intensity (V);
- calculating said position of at least one of said sensors (SE) over said height (W), said position corresponding to said peak of the radiation intensity (V) and said calculation being performed by putting $AR1=AR2$ and being known said radiation intensity (V), depending on the position of said at least one sensor (SE), and the length, along said height (W), of said at least one sensor (SE);
- obtaining the direction of movement of said at least one sensor (SE) to reach said position corresponding to the maximum of the radiation intensity, thus obtaining a plane which is always parallel to said prefixed plane obtained with said laser source.

Patentansprüche

1. Abziehmaschine zum Nivellieren von Bodenunterlagen, umfassend einen Hauptrahmen oder -körper (BB), Träger- und Handhabungsmittel (AA) des Rahmens (BB) in wenigstens zwei Richtungen, die mit dem Rahmen (BB) verbunden sind, und Träger- und Handhabungsmittel (CC) zum Verschieben von wenigstens einer Fräsvorrichtung (DD), die ebenfalls am Rahmen (BB) befestigt sind, wobei die Fräsvorrichtung (DD), als ein Endteil, wenigstens ein Walzwerkzeug (EE) zum Nivellieren und Glätten einer Bodenunterlage aufweist, um eine fertige Oberfläche zu erhalten, auf der es möglich ist, wenigstens eine Art von Deckfläche zu platzieren, wobei die Fräsvorrichtung (DD) Steuerungsmittel zum Steuern der Höhe des Walzwerkzeugs (EE) in Bezug auf die Oberfläche der Bodenunterlage und mit Referenz auf eine Ebene enthält, die von einer Laserquelle generiert wird, und wobei das Walzwerkzeug oder die Fräse (EE) eine programmierbare Drehgeschwindigkeit aufweist, die eine relative Geschwindigkeit zwischen dem Werkzeug (EE) und der Oberfläche der Bodenunterlage bewirkt, um eine hochgenaue fertige Oberfläche zu haben, wobei die Drehgeschwindigkeit des Walzwerkzeugs (EE) mit dem Verschieben der Träger- und Handhabungsmittel (CC) und mit der Höhensteuerung des Walzwerkzeugs (EE) kombiniert wird, die mithilfe der Steuerungsmittel vorgenommen wird, um eine Ebene immer parallel zur Referenzebene zu produzieren, die vorher von der Laserquelle bestimmt wurde, **dadurch gekennzeichnet, dass** die Steuerungsmittel wenigstens drei Sensoren (SE) enthalten, die auf einer gleichen Ebene (PR) platziert sind und die voneinander um eine vertikale Achse um 120° beabstandet sind, wobei die Sensoren (SE) somit in der Lage sind, in jeder Richtung die Strahlung zu empfangen, die von der Laserquelle erzeugt wurde, und jeder Sensor (SE) außerdem fähig ist, die Variation der Intensität der Laserstrahlung entlang der Dicke der Ebene, die von der Laserquelle erzeugt wurde, und die Intensität der Laserstrahlung (V) in Bezug auf die Höhe (W) des Sensors (SE) und des Walzwerkzeugs (EE) zu messen, um so die Bewegungsrichtung des Sensors (SE) zu erhalten.
2. Abziehmaschine gemäß wenigstens einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** ein elektronisches Steuerungssystem die von den Sensoren (SE) kommende Information verarbeitet und einen Befehl generiert, um einen Motor (MT) zu betreiben, der die Höhe der Fräsvorrichtung (DD) und des Walzwerkzeugs (EE) kontinuierlich reguliert.
3. Abziehmaschine gemäß wenigstens einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Motor (TM) eine Schneckenschraube (VI) antreibt, die sich innerhalb einer Leitmutter (CH) dreht, was eine Bewegung eines ersten Körpers (PP) erzeugt, der, mithilfe von wenigstens einer Spindel (SS), mit dem Walzwerkzeug (EE), in Bezug auf einen stützenden zweiten Körper (QQ) assoziiert ist, der integral mit den Träger- und Handhabungsmitteln (CC) der Fräsvorrichtung (DD) ist, so dass die Bewegung des genannten Walzwerkzeugs (EE) immer auf eine Kontaktebene (NN) zwischen den Träger- und Handhabungsmitteln (AA) des Rahmens oder Körpers (BB) der Maschine und der Oberfläche der Bodenunterlage bezogen wird.
4. Verfahren zum Nivellieren und Glätten von Bodenunterlagen unter Verwendung der Abziehmaschine gemäß Anspruch 1, **dadurch gekennzeichnet, dass** es die folgenden Schritte enthält:
 - Positionieren einer Laserquelle auf einer vorbestimmten Höhe und Orientieren der Laserquelle entsprechend einer vorbestimmten Ebene, auf welche die Bodenunterlage gebaut ist;
 - Messen, durch wenigstens drei Sensoren (SE), die auf der gleichen Ebene (PR) platziert sind und die zueinander um eine vertikale Achse herum um 120° orientiert und beabstandet sind und die fähig sind, die von der Laserquelle produzierte Strahlung in jeder Richtung zu empfangen, einer Variation der Intensität der Strahlung entlang der Dicke der vorbestimmten Ebene, die von der Laserquelle generiert wurde;
 - Messen der Strahlungsintensität (V), die von den Sensoren (SE) empfangen wird und die von der Laserquelle, in Abhängigkeit von der Position wenigstens eines der Sensoren (SE) erzeugt wird, wobei die Position auf der selben Richtung der Höhe (W) des Walzwerkzeugs (EE) detektiert wird und die Höhe (W) gleich dem Abstand zwischen dem Walzwerkzeug (EE) und der Oberflächenebene der Bodenunterlage ist;
 - Analysieren des Höchstwertes der Strahlungsintensität (V);
 - Integralrechnung der Bereiche (AR1, AR2) angrenzend an den Höchstwert der Strahlungsintensität (V);
 - Berechnen der Position von wenigstens einem der Sensoren (SE) über der Höhe (W), wobei die Position dem Höchstwert der Strahlungsintensität (V) entspricht und die Berechnung durch Eingeben von $AR1 = AR2$ ausgeführt wird und die Strahlungsintensität (V), abhängig von der Position des wenigstens einen Sensors (SE), und der Länge, entlang der Höhe (W), des wenigstens einen Sensors (SE) bekannt ist;
 - Erhalten der Bewegungsrichtung des wenigstens einen Sensors (SE), um die Position zu erreichen, die dem Maximum der Strahlungsinten-

sität entspricht, um somit eine Ebene zu erhalten, die immer parallel zu der vorbestimmten Ebene ist, die mit der Laserquelle erhalten wurde.

Revendications

1. Machine d'aplanissement pour aplanir des bases de plancher, comprenant un bâti ou corps principal (BB), des moyens de support et de manipulation (AA) du bâti (BB) dans au moins deux directions, qui sont reliés audit bâti (BB), et des moyens de support et de manipulation (CC) pour le déplacement d'au moins un dispositif de ponçage (DD), qui sont également fixés audit bâti (BB), ledit dispositif de ponçage (DD) comportant, comme partie d'extrémité, au moins un outil de ponçage (EE) pour aplanir et lisser une base de plancher de façon à obtenir une surface finie sur laquelle il est possible de disposer au moins un type de surface de revêtement, dans laquelle ledit dispositif de ponçage (DD) comprend des moyens de commande pour commander la hauteur dudit outil de ponçage (EE) par rapport à la surface de la base de plancher et par référence à un plan qui est généré par une source de laser, et dans laquelle ledit outil de ponçage ou de coupe (EE) comporte une vitesse de rotation programmable qui provoque une vitesse relative entre ledit outil (EE) et ladite surface de la base de plancher, de façon à avoir une surface finie hautement précise, la vitesse de rotation de l'outil de ponçage (EE) étant combinée avec le déplacement des moyens de support et de manipulation (CC) et avec la commande de hauteur dudit outil de ponçage (EE) qui est effectuée à l'aide des moyens de commande, de façon à produire un plan toujours parallèle au plan de référence précédemment déterminé par la source de laser, **caractérisée en ce que** lesdits moyens de commande comprennent au moins trois capteurs (SE), disposés sur un même plan (PR), et qui sont espacés les uns des autres de 120° autour d'un axe vertical, lesdits capteurs (SE) étant ainsi susceptibles de recevoir, dans n'importe quelle direction, le rayonnement produit par ladite source de laser, et chaque capteur (SE) étant également susceptible de mesurer la variation d'intensité du rayonnement de laser le long de l'épaisseur dudit plan généré par ladite source de laser et l'intensité du rayonnement de laser (V) par rapport à la hauteur (W) dudit capteur (SE) et dudit outil de ponçage (EE), de façon à obtenir la direction de déplacement dudit capteur (SE).
2. Machine d'aplanissement selon au moins l'une des revendications précédentes, **caractérisée en ce qu'un** système de commande électronique élabore l'information venant desdits capteurs (SE) et génère un ordre pour actionner un moteur (MT), qui régule

de façon continue la hauteur dudit dispositif de ponçage (DD) et dudit outil de ponçage (EE).

3. Machine d'aplanissement selon au moins l'une des revendications précédentes, **caractérisée en ce que** ledit moteur (TM) entraîne une vis sans fin (VI), qui tourne à l'intérieur d'un écrou fileté (CH), produisant un mouvement d'un premier corps (PP), qui est associé, à l'aide d'au moins un arbre rotatif (SS), audit outil de ponçage (EE), par rapport à un deuxième corps de support (QQ), qui est intégré auxdits moyens de support et de manipulation (CC) du dispositif de ponçage (DD), de telle sorte que le mouvement dudit outil de ponçage (EE) se fasse toujours en référence à un plan de contact (NN) entre lesdits moyens de support et de manipulation (AA) du bâti ou corps (BB) de la machine et la surface de la base de plancher.
4. Procédé pour aplanir et lisser des bases de plancher à l'aide de la machine d'aplanissement selon la revendication 1, **caractérisé en ce qu'il** comprend les étapes suivantes, consistant à :
 - positionner une source de laser à une hauteur préfixée et orienter ladite source de laser selon un plan prédéterminé sur lequel est construite la base de plancher ;
 - mesurer, à l'aide d'au moins trois capteurs (SE) qui sont disposés sur un même plan (PR) et qui sont orientés et espacés les uns par rapport aux autres de 120° autour d'un axe vertical, et qui sont susceptibles de recevoir le rayonnement produit par ladite source de laser dans n'importe quelle direction, une variation d'intensité dudit rayonnement le long de l'épaisseur dudit plan préfixé généré par la source de laser ;
 - mesurer l'intensité de rayonnement (V), qui est reçue par lesdits capteurs (SE) et qui est produite par ladite source de laser, en fonction de la position d'au moins l'un desdits capteurs (SE), ladite position étant détectée sur la même direction de la hauteur (W) dudit outil de ponçage (EE), et ladite hauteur (W) étant égale à la distance entre ledit outil de ponçage (EE) et la surface plane de la base de plancher ;
 - analyser le pic de ladite intensité de rayonnement (V) ;
 - effectuer un calcul intégral des surfaces (AR1, AR2) au voisinage dudit pic de l'intensité de rayonnement (V) ;
 - calculer ladite position d'au moins l'un desdits capteurs (SE) sur ladite hauteur (W), ladite position correspondant audit pic de l'intensité de rayonnement (V), et ledit calcul étant effectué par le fait de poser $AR1 = AR2$, et ladite intensité de rayonnement (V) étant connue, en fonction de la position dudit capteur au nombre d'au

moins un (SE), et de la longueur, le long de ladite hauteur (W), dudit capteur au nombre d'au moins un (SE) ;

- obtenir la direction de déplacement dudit capteur au nombre d'au moins un (SE) pour atteindre ladite position correspondant au maximum de l'intensité de rayonnement, de façon à obtenir ainsi un plan qui est toujours parallèle audit plan préfixé obtenu avec ladite source de laser.

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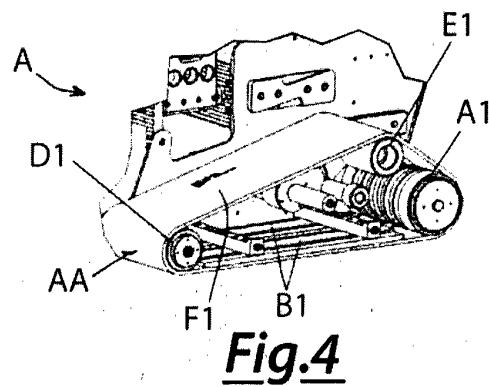
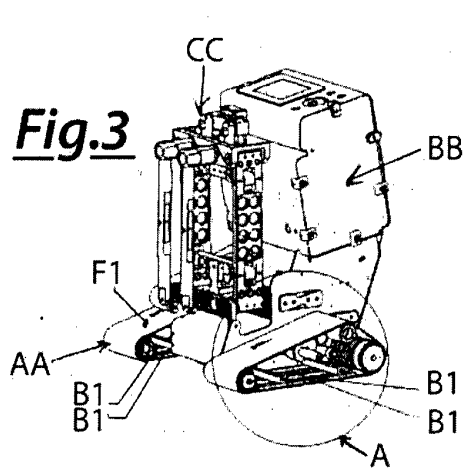
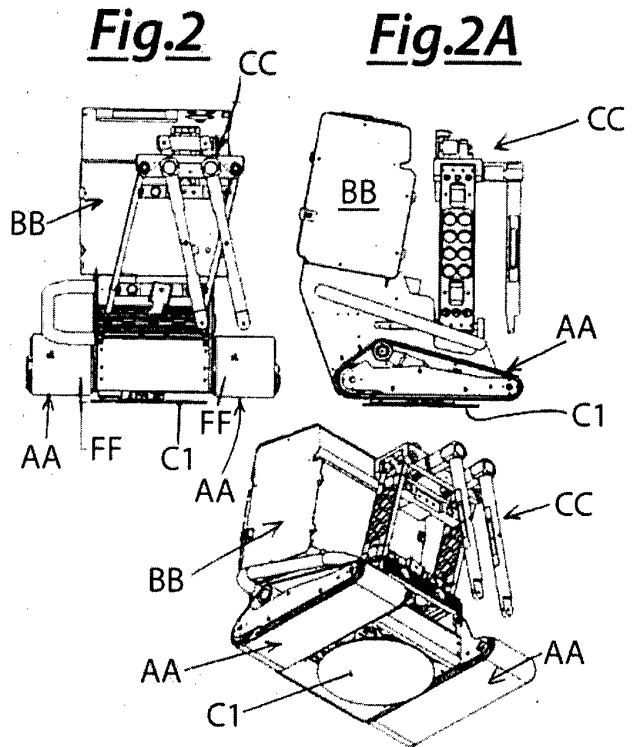
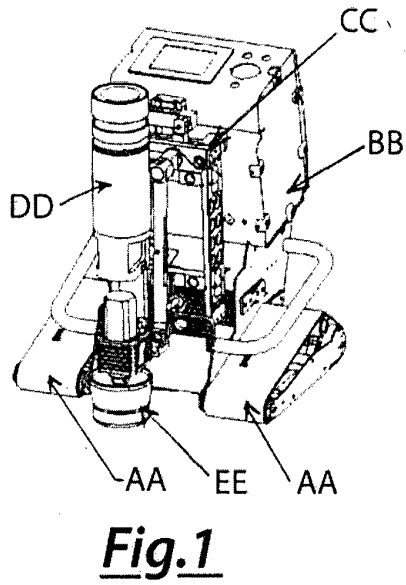
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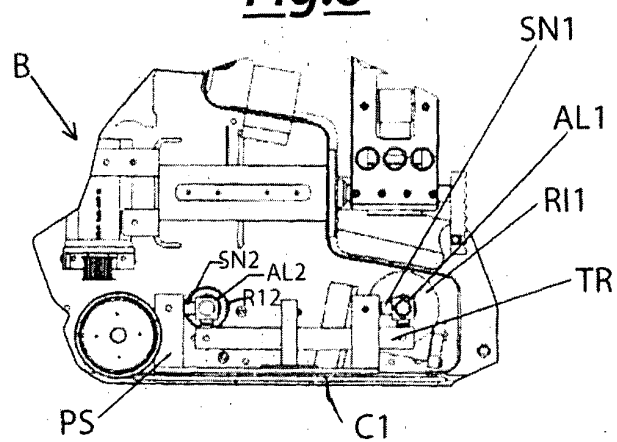
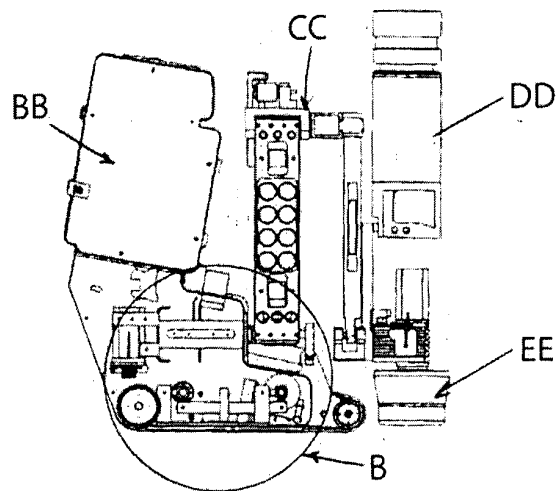
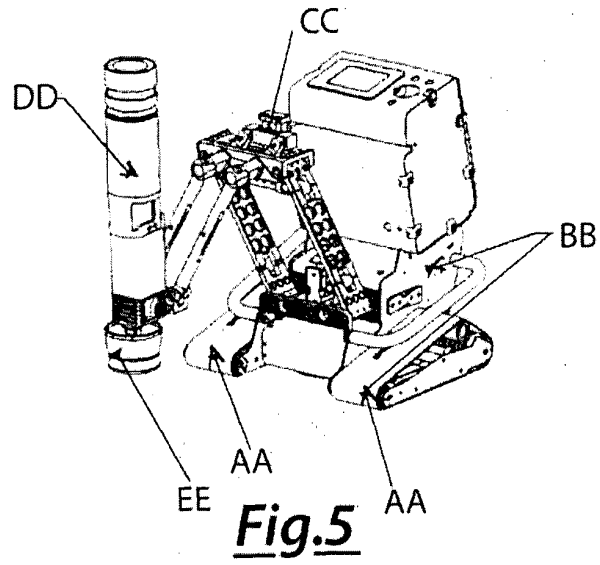


Fig.8

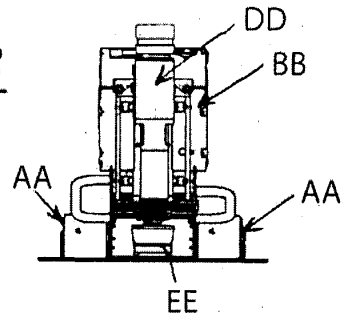


Fig.9

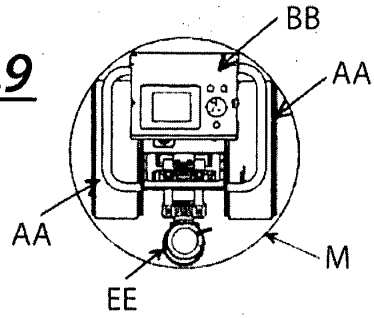


Fig.10

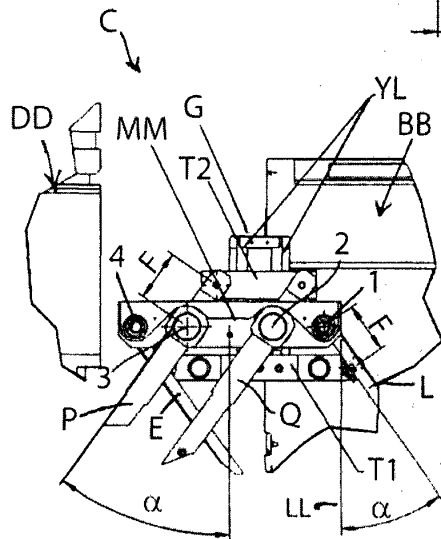
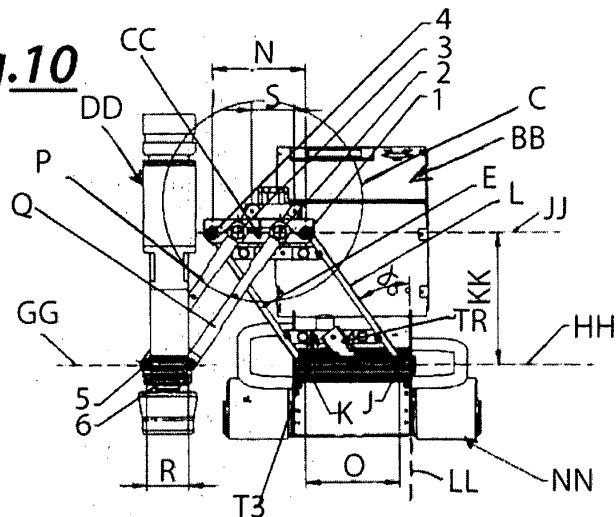


Fig.11

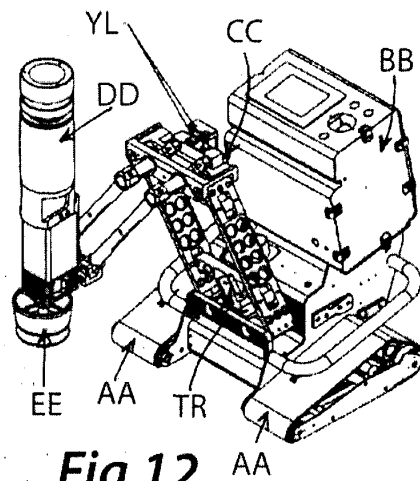


Fig.12

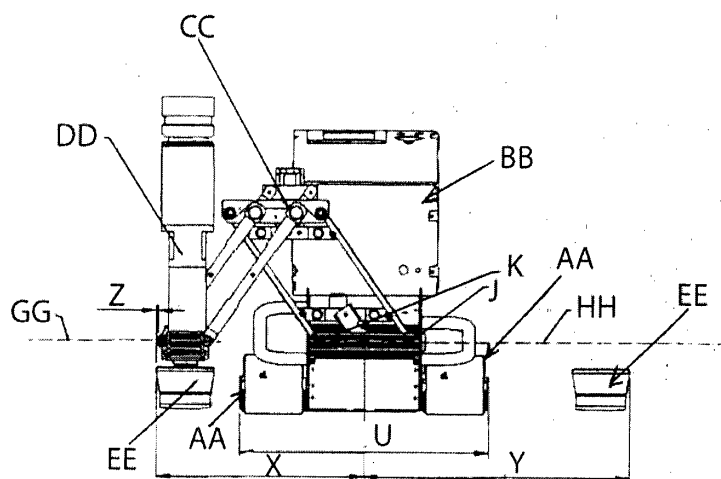


Fig.13

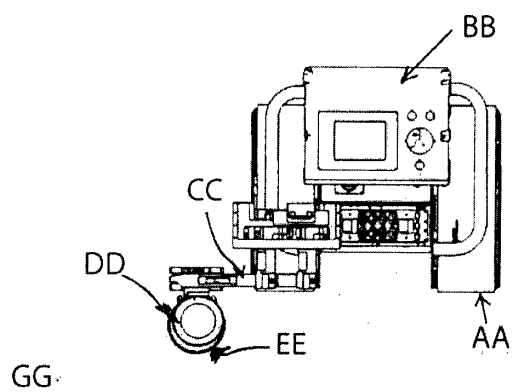


Fig.14

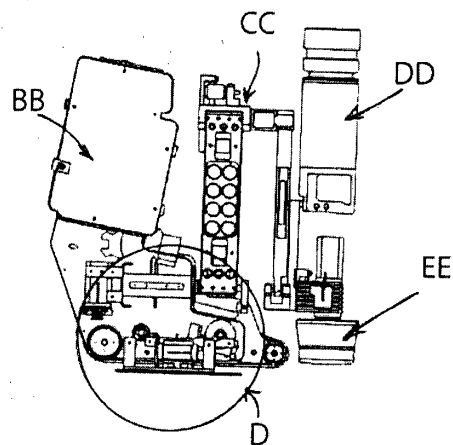


Fig.15

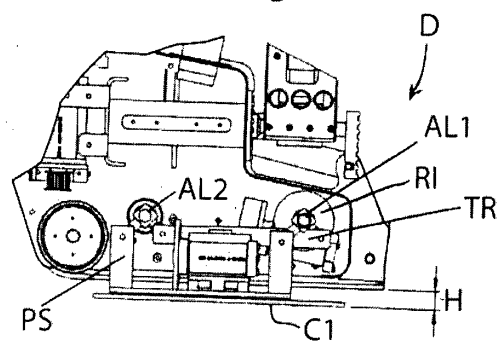


Fig.16

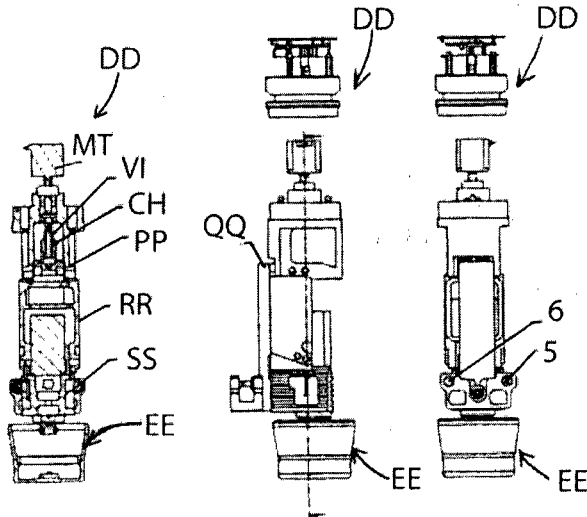


Fig.17

Fig.18

Fig.19

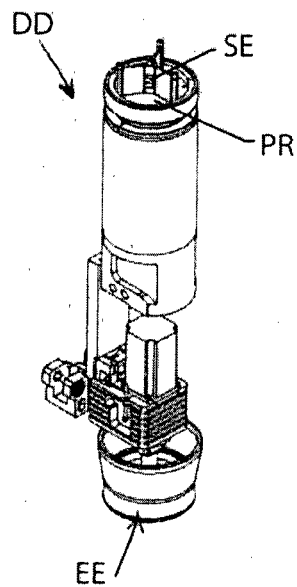


Fig.20

Fig.21

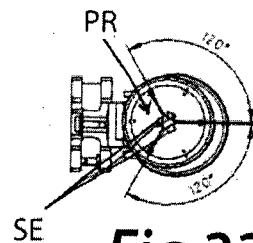
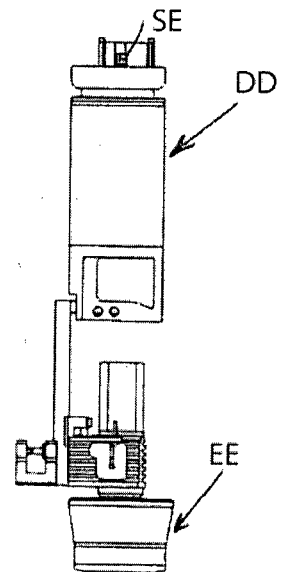


Fig.22

REFERENCES CITED IN THE DESCRIPTION

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