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(54) Electro-manual smoothing planer

(57) Portable electro-manual smoothing planer, of the type in which it comprises:

- two planes for the resting on the surface to be worked (3, 4) of which:
- a fixed rear resting plane (3) and
- a movable (1) front (4) resting plane, at least retracted respect to the plane of the first one (3);
- a tool-holder operating roll (13), placed between said two planes (3, 4), rotatably motorised on horizontal axis transversal respect to the advancement direction by manual thrust of said portable electro-manual smoothing machine (20-19, 9, 16, 8, 7), operator on the surface to be worked, with operating surface substantially around said fixed rear plane (4)
- a first control main handgrip (2) above said rear resting plane;
- operation electric control means (12) on said control handgrip (2);
- a second substantially knob-shaped handgrip (1), above said front resting plane (4), rotatably operable manually, for rotating axial means with resting screw to said front resting plane for lifting or lowering it respect to said rear resting plane (3),

characterised in that said tool-holder operating roll (13) is structured for housing in it at least an abrasive coating (22).

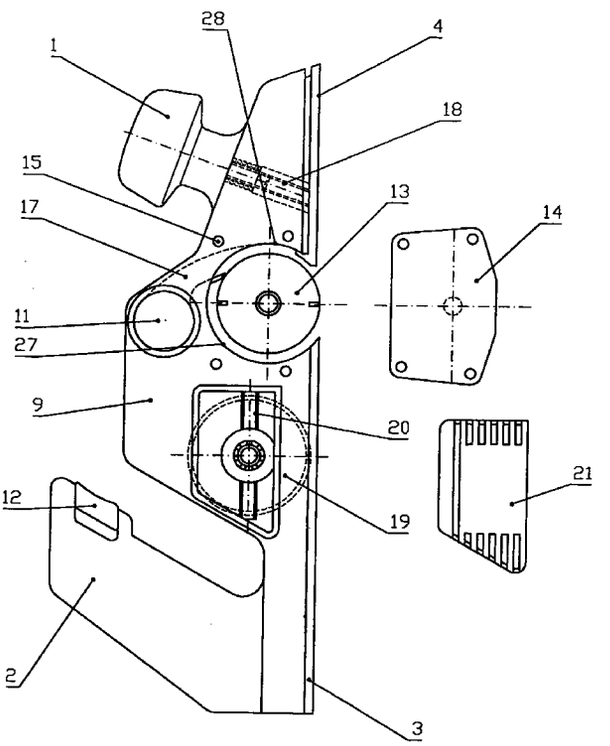

Fig. 1

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Description

Object of the invention

The present invention concerns an electrically operated portable smoothing planer.

Prior art

In the handicraft activity of wind-surf manufacturing the most important and engaging step is that of obtaining the shape of what will be the surf inner form. This surf for weight reasons is obtained from the manufacturing of low density foam polystyrene blocks. For this purpose the commonly used tool is the electric planer. The particular ergonomical shape, the handling, the presence of resting planes and the consequent possibility of adjusting the material removal make the traditional portable electric planer, suitable to smooth the surfaces and to join extended curved lines typical of the surf shape.

As almost the whole totality of the updated electric tools, though, also the electric planer proposes again already known tools which in the past were created and used mainly for working wood, recalling their essential characteristics and function, even though increasing their effectiveness with the aid of the electric motor. The old planer, in fact, as a definition, was made for the wood working and it is suitable to smooth by removing the material as chips, and its two essential elements, handgrips excluded, remain the resting plane, the chisel or cutting edge also called iron which is locked by a stub.

The structure of this planer was recently updated, instead of the chisel a tool-holder roll, rotating by an electric motor which in one of its notch, by screw means locks a respective knife which replaces the static old tool of the old planer.

But while in the old planer the rear resting plane and the front resting plane for the tool were fixed and was instead the tool which could be made protrude more or less, in the present solution for portable electric planer, said roll is fixed while said front resting plane is made movable by screw rotation of the knob which makes up the overhanging front handgrip.

The essential elements of the present portable electric planer remain: the resting planes and the blade-holder roll endowed with knives which by its vortical action carries out a removal of the wood, still in chips. Nowadays, just like in old times, the action remains a cutting one carried out by blades or chisels.

If all this is perfectly functional and consistent with the wood working, given its specifical density and consistency, it meets some limits in the working of other materials.

As previously stated the material which is interesting to work by using the electric planer is the foam polystyrene or other similar foam plastic material, having a low density and a poor consistency.

It is clear that on a material having such characteristics said planer blades, also known as jack plane, were not able to carry out the desired cutting action, but instead tended to strip and disjoin irregularly the worked material in small pieces giving a poorly finished and rough product.

On the other hand, the foam polystyrene is not even suitable for being used with any kind of electric smoothing machine presently on the market, which even if offering a more refined action, did not allow the resting on such a soft material, and thus a right control in the execution, furthermore the fast clogging of the granular structures on the abrasive surface makes its use scarcely convenient.

The only way for carrying out the finishing was doing it manually by using an abrasive buffer, but this operation resulted long, tiring, scarcely hygienical, not very updated and not consistent with a continuous production. The inventor tried to find a solution to this problem, arisen during the working on foam materials, by inventing and realising a suitable electric tool, a tool which could re-propose the handling and control of the electric planer but with an action more consistent with the material to be treated. Therefore the inventor decided to force the inseparable match mentioned before, which has the planer characterised by resting planes and chisels or blades as its characteristic working elements.

Purpose of the invention

Purpose of the invention is solving this problem by obviating the above mentioned drawbacks.

Disclosure of the invention

The problem is solved as in the enclosed claims by a portable electro-manual smoothing planer, of the type in which it comprises:

- two planes for the resting on the surface to be worked of which:
- a fixed rear resting plane and,
- a movable front resting plane, at least retracted respect to the plane of the first one;
- a tool-holder operating roll, placed between said two planes, rotatably motorised on horizontal axis transversal respect to the advancing direction by manual thrust of said portable electro-manual smoothing machine, operator on the surface to be worked, with operating surface substantially about said fixed rear plane;
- a first control main handgrip, above said rear resting plane;
- operating electric control means, on said control handgrip;
- a second substantially knob shaped handgrip, above said front resting plane, rotatably operable

manually, for rotating axial means with resting screw to said front resting plane for lifting it or lowering it respect to said rear resting plane,
characterised in that said tool-holder operating roll is substantially a full tool-holder roll, structured for receiving in it an abrasive coating.

The innovative idea is thus that of replacing the traditional jack plane roll with a roll which produces an abrasive action, instead of a chip removal, always with a high speed rotation of the roll, equal to not less than 10.000 revolutions a minute, and preferably 15.000 revolutions/minute.

Advantages of the invention

Thus all the problems up to now unsolved find a solution, in fact any material may be worked without being broken or scaled, always leaving a smooth surface.

But what is mainly important, is that, respect to the traditional electro-smoothing tools, such as for example the vibrating electric tools, this one has no clogging of the abrasive surface. In fact given the roll very high speed, the material removed from the abrasive surface peaks, remains always in shape of chips but having an infinitesimal shape respect to the chips of the traditional solution, and therefore the new roll works as if it had a great amount of very small cutting edges, in which each one makes its smoothing, and this, only for a section of the circle arc, being soon replaced with immediately following peaks of the abrasive surface of the same roll.

In this solution in fact the cutting edges are not only one like in the traditional jack plane, but are in an infinitely greater number and superficially extended:

- both in transversal direction,
- and in rotational direction.

Thus a continuos cutting on the surface is obtained, contrarily to the cutting single action for each revolution of the traditional planer.

The cut or removed material which otherwise would clog the spaces between the peaks of the abrasive surface, is instead continuously detached by centrifugal force and, by front discharge outlet, laterally convoyed outside of the tool.

Preferred solutions

In the preferred solution said roll consists of a steel cylinder with dimensions similar to those of the original blade-holder roll but with full and regular external surfaces to which the abrasive surface is fixed.

Even if the tool structure is only partly changed, being the essential member changed and consequently the action by it produced, a perfect result of removal and maximum performance is obtained.

This latter had changed into a fast and effective smoothing action with a good finishing degree.

The tool may comprise technical and aesthetical characteristics which may recall other tools but have peculiarities which give it abilities and application of use which are completely innovative and are absolutely not common to any other manual electrical tool nowadays available on the market.

Some doubt may arise considering the duration and the stresses to which the abrasive may be subjected due to the high number of roll revolutions (15.000). Furthermore, there might be the possibility that the abrasive was saturated, with a consequent effectiveness loss, by the material which it came in contact with considering the overheating caused by the high speed smoothing (170 km./hour).

But the high rotational speed not only avoids the clogging, but also favours the cooling and this also thanks to the continuous variation of the abrasive surface in contact.

The tests were carried out on polystyrene and the results obtained were fully satisfactory.

It was possible smoothing the polystyrene with a high finishing degree being able to dose the removal depth, to further use this tool with ease and control on such a soft material, for smoothing surfaces or join wide range curves. This essential result for the specific problem confirms the wide range of use in the most different sectors and materials, in alternative way respect to the electric planer, being able to provide also and only the change of the planing roll with the smoothing roll, all the rest remaining unchanged.

After many tests, it was noticed that the abrasive placed on the smoothing roll did not show any particular wear sign, rather remaining clean and effective for a long time, and at first all this was explained with the extreme inconsistency of the material subjected to working, but this was not considered the real reason. In the present windsurf manufacturing updated plastic materials of different kind: epoxidic resins - glass fabrics- carbon - "kevlar" - different kind of foams -"honeycomb", aluminium etc., are used and with the matching of these materials some multi-layer composite materials are formed, which are irreplaceable in solving the structural problems containing the finished product weight. These same structures and materials are always more used in high technology sectors such as aeronautics - building - automobilism - sport items etc., and in many cases they replace wood overcoming it for technical characteristics and application possibilities.

Having to work and give a shape to these assemblies of materials so different from one another and having extremely different density and strength, a new working problem arose, think for example to a polystyrene layer joined with a carbon fibre one and a PVC one, glued one with the other by epoxidic resins. By using any type of smoothing machine along their joint a poor finishing and yield result would be obtained, in fact

the different kind and hardness of these materials would show as an obvious result an excessive wear on the polystyrene, a scarce wear on the carbon fibre and a medium wear on PVC, thus giving a corrugated surface. If one wished to carry out the same operation by using an electric jack planer, a better final planarity between the joining faces may have been obtained but the finishing would anyway be poor: the polystyrene would be ginned like the foam PVC, while the carbon instead would damage the tool's blade edge.

Here the limit of the available electric tools was once again enhanced and the second practical problem to be solved arose. A tool which could work, smooth or remove, these mixes of heterogeneous materials all together without enhancing their mentioned consistency and strength differences.

The trial of the new tool surprisingly revealed how it could practically work the three different materials at the desired depth with no problem, without showing any kind of difference, neither of efficiency nor of finishing, obtaining a perfectly joined flat and smooth joining surface as if the three treated materials were of the same kind and hardness.

Once again the unknown factor was the abrasive wear this time concerning the strongest materials, but the life of the same after many tests appeared very acceptable.

At this point the innovative and original potential of this tool became even more clear. Such an extraordinary abrasive capacity in fact could only depend on the very high number of revolutions and consequent peripheral speed of the smoothing roll normally not common to other tools used for the smoothing; in fact, the roll by making a rotation of 15.000 revolutions a minute produces a peripheral speed higher than 150 km a hour and just one abrasive particle touches the material to be removed by orbiting 300 times a second. A second essential peculiarity of the abrasive roll action of the new tool is that of coming into contact with the material to be removed in a width equal to its advancing face but with a depth and a length of few mm., therefore the contact surface remains very small in any moment of the working. This causes an absolutely prevailing condition of the abrasive great power with regard to the treated material and avoids also overheating and melting due to friction. Another winning factor, as said, lies in the capacity of the smoothing roll of maintaining itself constantly clean and this is due to the centrifugal force to which the material is subjected once it is removed and then eliminated through the dust discharging channel also guaranteeing an exceptional cleanness on the working area.

This great power and effectiveness though, would not be easy to manage if the roll position and the action depth of the same were not determined and controlled by the rest of the tool structure which being in direct contact with the material to be treated provides such a function.

These characteristics, this abrasive power surplus, together with the action easy handling and control given by the tool resting plane, distinguish the new tool from all other available tools, making it able to carry out works which before were not satisfied.

Considered the needs and reasons which brought to the creation of the new tool, explained its characteristics and possibilities of usage, a more specially descriptive analysis of this tool and of its essential parts will be now carried out.

Description of a preferred form of the invention

The invention is described with the aid of the enclosed tables showing one of the possible preferred forms of embodiment, where:

Fig. 1 (Tab. 1) represents a side view on the side of the material discharge of the new tool;

Fig. 2 (Tab. 2) represents a side view of the tool on the opposite side;

Fig. 3 (Tab.3) represents a bottom view, that is on the resting side of the tool on the surface to be smoothed;

Fig.s 4 and 5 (Tab. 4) represent a side and a top view of the abrasive tubular ring intended to be inserted in interchangeable way on the supporting cylindrical roll.

Figures 6 and 7 (Tab. 4) represent a side and a top view of the tubular abrasive supporting cylindrical roll.

Fig. 8 (Tab. 4) represents the view of the tool intended to extract the abrasive from said roll.

Preferentially, this tool should preferably be light and compact for easing the handling (length 30-65 cm. - width and height about 15 cm.).

The machine frame or supporting body will be made up of two shells (6 , 5) in plastic material joined along the middle longitudinal line of the tool by self-threading screws.

Such shells will determine the same machine aesthetical shape and will have to support, contain and join all the manufacturing details. Both motor (19) and smoothing roll (34, 13) are housed inside of the shells transversally respect to the tool's longitudinal axis, both rest by means of pins on the relative bearings which in turn have their seat on the frame walls. Except for the bearing opposite to the roll transmission side which for practical reasons may be contained by the same roll or, in alternative, by the access flange (14) to the roll, also present on the side opposite to that of transmission. The motors used in the tested prototypes had rather low power such as 300 and 500 watt and allowed roll speeds respectively of 17.000 revolutions a minute for the first one, and 14.500 revolutions a minute for the second one. In the first case the abrasive roll had a diameter of 3,5 cm., in the second case of 5 cm. The

motors anyway in no case showed any kind of lacks or problems resulting very suitable for the use.

The two respectively resting and sliding planes are fixed to the shells: the fixed rear one (3) and the movable front one (4) The second one moves in height at a certain extent. The front handgrip, knob-like shaped, (1) may further have the function of carrying out by a joining screw (18) the lifting or lowering of said front resting plane also known as tool front resting plane.

The external carter on the left side (6) contains and protects the transmission pulleys (7, 9) respectively fixed in the roll and motor pins, protruding from the shell. The motor pulley has a diameter of about half the roll's. The coupling and transmission will be ensured by a toothed belt (8). In the right part the carter (21) covers and gives access to the motor main bearing and besides allows to carry out the brushes replacement (20) of the same. Always on the motor axis and inside of the frame shells on the left part a small turbine (16) is arranged, having a double function: the first one, of cooling the same motor sucking air from the slits placed on the right shell bottom and on the right carter (21); the second one of convoying and easing, by means of a channel (10), the dust downflow from the suitable discharging channel (11). In an advantageous solution the smoothing planer comprises the roll (13) interchangeable with a roll having cutting blades or with a roll having an abrasive surface (13, 22).

Thus a universal planer able to operate with both tools is obtained.

A particular roll shape for receiving alternatively either the cutting blade or the abrasive coating, with a normal design solution may be provided.

A typical and necessary detail of the new tool, found on the right side in correspondence of the smoothing roll seat is the flange or removable carter (14) which allows an easy access to the roll for replacing the abrasive material.

Said flange will preferably be of metal material requiring a good stiffness, will support the right bearing which in turn will house the roll pin or support a pin in case the bearing was included on the roll itself. A series of holes along its perimeter in correspondence of threaded pins fixed on the frame (15) of the smoothing planer which will ease its fixing by means of self-locking bolts or fixing ring nut and the centring respect to the roll axis is provided. Once closed, the flange hermetically matches with the shell for avoiding the dusts coming out from possible slits during the working. Inside of the shell, in the smoothing planer front part the suitable guides will be obtained which allow the vertical movement of the front resting plane (4) which, as known, will have to be lifted or lowered controlled by the front handgrip or by any other mechanism provided. The material which makes up the front resting plane (4) is aluminium. The machine rear handgrip (2) contains the electrical or electronical switch (12) and is made up of the same extension of the two shells forming the bearing frame. For handling reasons it would be desirable if this handgrip had an inclination of about 45° respect to the sliding planes.

The rear wall of the smoothing roll seat obtained inside of the shell (27) follows the shape of this same at a distance between about 3-5 mm, the front part (28) starting at the same distance from the roll in the contact point with the front resting plane it is progressively spaced for creating the exit channel (17) and the necessary hollow for the dust discharge, a typical functional scheme of the centrifugal fans. The dust discharging channel (17-11) is commonly placed above the smoothing roll and its exit hole may be located in the most suitable position, in the specific and suitable case, the lateral one. The smoothing roll (13) is with no doubt the essential most important and typical member of the smoothing planer, that is the part which combined with the other ones gives the innovative and special performances which distinguish this tool for effectiveness and purpose of usage. As stated, it is placed transversal to the smoothing planer longitudinal axis and its lower part is tangent to the plane formed by the two sliding planes (3 - 4) when placed in their rest position. The front resting plane being drawn into the shell will determine the smoothing and removal depth. (from 0-5 mm.).

The roll will meet the material to be worked by rotating in opposite direction respect to the tool advancement direction.

The roll (13) will have in particular the ability to support the abrasive (22) which will be interplaced on the same, both in case of wear, and if a change of the grain or quality is desired.

For allowing this interchangeability the abrasive will therefore be shaped like sleeves (22) which will be inserted over the smoothing rotating cylinder (13).

The essential characteristics for the abrasive-holder roll when in working position (22) on the roll (13) are:

1) the absolute balancing for avoiding any kind of vibration;
2) the shape which shall remain stable and unchanged both with a low and with a high revolutions number;
3) the weight which shall guarantee a certain inertia:;
4) the centring;
5) the outer surface which shall be the most stiff as possible without feeling the effects of the outer pressures.

These details have a direct influence both on the abrasive life and resistance and on the final work result for which the tool is thought.

In fact, during the tests it was noticed that the abrasive (22) had some irregular spaces only in the areas in which it could move and in which it was not supported firmly enough by the roll (13); the problem was not to be

ascribable to rubbing wear, but rather to the continuous bending movement to which the abrasive and its canvassed support were subjected, given the tool's high number of revolutions. Furthermore, it was considered that an important characteristic of the new smoothing planer was that of working on materials of different hardness matched one with the other without enhancing the differences, and its is understandable that, if the abrasive roll surface was not stiff, it would feel the effects of the pressure differences which the various materials would cause during the working thus limiting the abrasive life as above mentioned and not guaranteeing that planarity and finishing likeness which the tool may supply.

For the roll (13) manufacturing, metal materials such as aluminium and steel which may supply the needed requisites and guarantee a better heat absorption and dissipation will be therefore preferable.

The abrasive spares will be shaped as sleeves (22) with a length equal to the one of the roll which will support them (13) and shall have such a stiffness that will allow them to be inserted on it with a certain pressure without bending or becoming flabby. It is important that between roll and sleeve there is the least possible tolerance being though able to guarantee the insertion and extraction of this latter by a thrust of about 10 kg. This for guaranteeing the maximum integration and functionality between the two elements.

The tested sleeves prototypes are made up of some fibreglass layers impregnated with epoxidic resin on which later some strong abrasive canvas with a grain of 60 was fixed. Thus I obtained some tubes having a thickness of about one millimetre (but we could use also higher thicknesses), which once inserted in the abrasive-holder roll will be integral with it guaranteeing regularity and homogeneity of yield. On the sleeves internal surface two small protrusions (25) or guides in diametrically opposed position may be provided and will have the function of avoiding the rotation between roll and sleeve.

It is obvious that two fissures (26) in a corresponding position may be provided on the roll having both the function of housing the sleeve guides, and of allowing the extraction of this latter by using a simple extractor (24). In fact, if for the sleeve insertion on the roll a certain pressure will be necessary, anyway easily exertable from the outside, for the extraction, unless the whole roll is provided to be removed from the machine, there would not be enough grips and hold for exerting an equal pressure in the opposite direction. I therefore provided a simple and economical accessory which will allow to easily remove the sleeve from the roll. The extractor (24) will be made up of a steel fork at whose outwards turned ends there will be two small protrusions (fins).

By using the fissures (26) provided in the roll, the extractor will penetrate up to its base and hook the sleeve on the lower edge by the fins. Gripping the fork with two fingers and laying the hand palm on a small counter-thrust small rod (23) directed against the roll in the pin area, by an easy traction it will be possible to extract the sleeve without an excessive effort. This operation together with that of opening and closing the pin holder flange (14) of the roll by acting on the suitable bolts or spring ring nut will be the actions necessary to replace the abrasive, even if this possibility is not as frequent as in other types of smoothing machine.

If the sleeve on which the abrasive (22) is fixed will be instead obtained from tubes of stiff material and high thickness such to guarantee to these same the required external surface stiffness and shape stability (e.g. aluminium tube 5 cm. diameter thickness 2 mm), the self-expanding connecting systems between roll and sleeve will be possibly used with better comfort obtaining the same ensemble functionality.

The solutions which I explained are just some of the many which may be selected concerning the abrasive replacement, but any other system obtained shall anyway satisfy the basic characteristics which I previously listed, because they are essential for a proper yield of the abrasive roll in the functional context of the new smoothing planer.

Summarising we can say that the new smoothing planer, a tool created for solving single problems, in view of the facts has shown many abilities and absolutely innovative peculiarities. It is able to carry out working functions for which before there were no answers and it may be used in many both professional and hobby fields.

Its action can be graded with precision and may have both a strong impact and a finishing ability.

The materials to be worked are the most different ones and they may be treated also when coupled and with different or opposite characteristics.

It may work on a free field, that is being displaced on the worked product without being forced to be stationary.

The new smoothing planer offers optimal solutions for the planes grinding; for the joining of wide radius curved lines; for low density materials working; for fibrous and strong materials working; for removing surfacing or protrusions from flat surfaces also in very soft materials without touching or marking them; it is ideal for plastic laminates where chipping must be avoided; for fibreglass or the like; for wood when small shape corrections are necessary. It has a good working economy and use facility which make it suitable for any user.

As many times stated, the typical and essential element of this machine is the smoothing roll with its high potentialities and characteristics, but also the other single parts of new smoothing planer must be considered important, because all together they allow to control and graduate the action of the roll itself according to the previously described modalities.

A further consideration of the new smoothing planer handling and of the particular and often unique

functions which it may offer, will give us a complete view of the important content of novelty and utility which this tool may offer.

Further considerations and advantages

In synthesis it is a portable tool able to the smoothing or removal by abrasion carried out by an abrasive cylinder (12+22) with particular technical characteristics which will perform its action by rotating around its axis at a high speed. Said cylinder position with respect to the materials to be treated as well as the action depth will be controlled and determined both by the sliding planes (3- 4) and by the remaining tool structure (9-5). The new smoothing planer innovative content and the novelty requisites particularly appear when referring to the results which the tool is able to give in many applications which presently are not satisfied by other tools suitable to work on free field. It will be proper to remember that in the particular case the special needs found in the practical field stimulated the research for new solutions and the inventive effort which produced this new tool aims just at filling the existing technical gap.

As already widely explained in the description, this tool is able to carry out smoothing or removals with control and precision independently both on soft and friable materials and stiff ones with exceptional fastness and finishing degree in both cases.

Even more in particular is the ability to carry out the smoothing on matched mixed materials having opposite density and hardness is even more particular; the faces of these latter coupled to each other and treated by this new tool will be perfectly aligned and will show an alike working and finishing degree.

We have already talked about the ability of smoothing planes or joining wide radius curves also on friable materials non treatable by other tools and of the possibility of removing protrusions, bumps, protuberances from planes of any material also soft without marking their surfaces.

We have furthermore enhanced the handling, ergonomics and facility of use which allow it to be displaced on pleasure on what is wished to be treated.

When comparing the new smoothing planer action with the types of presently existing smoothing machines we can find many radical and substantial differences. A first great difference lies in the great abrasive power that is the quantity of work which is possible to carry out with respect to the time necessary for obtaining it. We already saw like the new smoothing planer thanks to the high number of the smoothing roll revolutions connected to the small contact surface on which it works time by time, is able to remove by smoothing a great amount of material with extreme facility and speed.

We also saw how it is possible to determine the removal depth by presetting it with precision acting on the resting planes (3-4) which the new smoothing planer is endowed with.

Also another difference can be noticed because the work which it can carry out neither depends on the pressure exerted during the smoothing action nor on the time during which this is expressed. All other manual smoothing tools able to smoothing are instead subjected to these two variances which are obviously related to the human factor. On the contrary, using this smoothing planer, just moving this tool in the smoothing direction neither worrying about how much pressure nor about for how long it must be exerted, it will be possible to obtain a predetermined smoothing degree with no possibility of error.

Irregardless of the many analysis carried out, the elements which combined together determine the new tool potential always remain the high smoothing capacity of the abrasive roll (13+22), due to its high working rotational speed besides to its specifical technical characteristics, to the precise control which may be performed on it by using the tool structure itself, and finally to the possibility of manually using the tool on free field in a wide range of situations.

These characteristics and capacities presently are not re-proposed in their combination by any other existing smoothing tool and therefore the new smoothing planer finds here its collocation and use

We talked about the modularity of the work carried out by the roll due to the presence of the two resting planes. Also the characteristic of remaining always parallel with its axis to the surface on which it is working (13) will depend on the remaining structure. It should be also mentioned that we may also obtain similar results by replacing the resting planes for example with a series of rolls, wheels or slides or otherwise we may move the smoothing roll on the machine front eliminating the front resting plane or we may provide the machine with two smoothing rolls instead of one, but at the end we would always obtain the usual functional scheme, and in case the effectiveness, aims and results of these machines were not substantially different from the ones of the new smoothing planer as it has now been conceived we would have only obtained equivalent solutions! Similarly, we would have an alike scheme even if for example we would replace the electric motor with a pneumatical movement system. The application fields as well as the practical results would not be different.

The abrasive roll (13+22), an essential and characterising member of the new smoothing planer, which as specified in the description will answer to particular requisites for fully carrying out the functions it must perform, has an important role by the patent point of view. Its basic characteristics will be:

- balancing and centring
- shape stability
- sufficient weight
- strength
- stiff external surface.

It may be provided with pins or bearings, it may be extractable or fixed, anyway it will be transversally engaged on the smoothing planer longitudinal axis, supported in axis by the frame and will rotate in the direction opposite to the tool's advancement. We advised aluminium or steel or other metals as preferable materials for its manufacturing. It will be moved by an electric motor (19) or by a turbine if the pneumatic system will be preferred. We said that it shall revolve at maximum speeds close to 15.000/20.000 revolutions/min., that if its diameter will be for example of 5 cm., its peripheral speed will be about 170 km/h thus performing 250 orbits in a second. And just considering these data and thinking about the small contact surface which it will have with the material to be removed, we will realise the potential and effectiveness guaranteed to the smoothing planer. It will have such a great smoothing power that the materials which it will meet even if being different will all be subjected to the same action without showing differences. The absolute balancing will avoid tool vibrations. The shape stability will avoid irregular wear and further vibrations to the abrasive. The weight will guarantee inertia. The strength will avoid further wear even if it should come into direct contact with the worked product, without interplaced abrasive. The stiff external surface will guarantee the proper abrasive life (27), whose deterioration, as found in the tests, does not depend much on the wear but rather on possible movements or on lack of adherence with the roll itself (13), and will further allow the possibility of working different materials, assembled one to the other, without feeling the effects of the different pressures which they would exert in the contact area. In one of the solutions I indicated it will have two small fissures 2 mm large and 5 mm deep placed in diametrically opposed position which will allow both the abrasive (22) sleeve locking both in rotation direction and in the lateral one besides the insertion of the extractor (24). It will alternatively be provided with self-expanding systems for the connection and fixing to the abrasive. In this hypothesis, shape stability, stiffness and surface resistance will be mainly due to the mechanical characteristics of the interchangeable abrasive sleeve (e.g. canvassed abrasive fixed to the aluminium tube having 50 mm diameter and 2 mm thickness). Many alternative solutions may concern the abrasive fixing to the roll, but any solution proposed will have to consider the ensemble characteristics suggested in order to guarantee the exact functionality of the smoothing element (22) on the roll (13) and therefore of the smoothing planer.

Another important detail of the smoothing planer will be the possibility of reaching the roll thanks to the removable flange (14) which will allow the abrasive replacements and will be fixed to the frame by three or four threading guides (15) on which some self-locking bolts will be screwed, or a locking ring nut will be placed. Needing stiffness and stability it will preferably be in steel, will be provided with a pin in case the roll is provided with bearing or vice-versa. If the roll had pins and transmissions only on the opposite part the flange may serve only for the structure protection and closing.

The abrasive sleeve (22) will also be another characteristical element. In the example I supplied it will be inserted by pressure around the smoothing roll, may have two small longitudinal internal protrusions in diametrically opposed position which will be inserted in the fissures provided in the roll. Having to be subjected to a certain pressure both for being inserted and extracted it shall have the proper consistency which will avoid also its breaking during the hard stresses. The prototypes I tested were obtained from tubes which I made up of fibreglass with a 1/2 mm thickness on which I subsequently glued a strong abrasive canvas of grain 60. Other materials such as cardboard, plastic or aluminium may be used for the abrasive canvas supporting structure if they are safe and strong when used. Their internal diameter with a minimum tolerance respect to the roll external diameter shall allow their insertion with about a 10 kg. thrust. For removing the abrasive from the roll an extractor will be used which will allow to exert the same force in the opposite direction.

The extractor (24): indispensable in case the possibility of removing completely the roll from the smoothing planer is not provided, or expansion systems are not provided, it will be necessary for extracting the abrasive sleeve from the roll. It will be made up of a fork as large as the roll's one and its stems will be 2 o 3 cm. longer than the same roll. On the ends it will have two external fins and once inserted along the fissures existing on the roll surfaces it will fasten the sleeve at its base. With two fingers on the fork and the hand palm laid on the counter-thrust small rod (23) directed towards the cylinder the sleeve will be extracted by an easy traction. The possibility that the fork is endowed with a threaded nut and that the also threaded counter-thrust small rod rotating on it determines the force necessary for the sleeve extraction may also be provided.

Resting planes not existing in other types of movable smoothing machine: - the front one (4) the shortest of the two shall be controlled in height and will determine the removal or smoothing depth which the roll shall carry out. An equivalent function may be carried out by rolls, wheels or slides able to cause both the smoothing planer sliding on the worked product and the control of the removal depth of the smoothing roll.

- the rear one (3) long about twice the other one it favours the sliding and guarantees the tool's trim and planarity on the material to be treated. Their action is indispensable and they contribute in defining the typical action of the smoothing planer.

The rear handgrip (2) influences the smoothing planer ergonomics and handling; it incorporates the electric or electronic control.

The front knob (1): it allows an handgrip at 360° and

may, once connected with screw and release spring (18), move the front resting plane in height.

The dust discharging channel (11): it channels the dusts outlet which is naturally caused by the system roll vortical motion which may recall the functional scheme of a centrifugal ventilator.

The electric motor (19) placed transversal to the longitudinal axis of the smoothing planer transfers the motion to the roll by means of pulleys and toothed belt (7 - 8 - 9). It does not need particular power. It may not be present in case the smoothing planer was realised in pneumatical version.

The frame (5 - 6): normally obtained in suitable plastic material and made up of two shells which besides defining the shape of the same tool supports, includes, and sometimes makes up the elements mentioned and described above. It shall have suitable mechanical and ergonomical characteristics. It may have an infinite series of aesthetical variations but it will always have the function of joining and connecting all the parts and members of the smoothing planer in order to realise the functional ensemble and the interactions which we specified and enhanced many times.

Claims

1. Portable electro-manual smoothing planer, of the type in which it comprises:

   - two planes for the resting on the surface to be worked (3, 4) of which:
   - a fixed rear resting plane (3) and
   - a movable (1) front (4) resting plane, at least retracted respect to the plane of the first one (3);
   - a tool-holder operating roll (13), placed between said two planes (3, 4), rotatably motorised on horizontal axis transversal respect to the advancement direction by manual thrust of said portable electro-manual smoothing machine (20-19, 9, 16, 8, 7), operator on the surface to be worked, with operating surface substantially around said fixed rear plane (4)
   - a first control main handgrip (2) above said rear resting plane;
   - operation electric control means (12) on said control handgrip (2);
   - a second substantially knob-shaped handgrip (1), above said front resting plane (4), rotatably operable manually, for rotating axial means with resting screw to said front resting plane for lifting or lowering it respect to said rear resting plane (3),

   characterised in that said tool-holder operating roll (13) is substantially a tool-holder roll, structured for receiving in it at least an abrasive coating (22).

2. Smoothing planer according to claim 1, characterised in that said tool-holder roll (13) is accessible on one side for the axial extraction and insertion of said abrasive coating, at the purpose, tubular interchangeable.

3. Smoothing planer according to any of previous claims, characterised in that said tool-holder roll (13) is longitudinally grooved (26) for coupling by axial insertion with said abrasive coating, at the purpose, tubular interchangeable.

4. Smoothing planer according to any of previous claims, characterised in that said tool-holder roll (13) comprises an abrasive coating in its surface.

5. Smoothing planer according to any of previous claims, characterised in that said tool-holder roll (13) is operated by electric motor which makes it rotate at least at 10000 revolutions a minute.

6. Smoothing planer according to any of previous claims, characterised in that said tool-holder roll (13) is operated by electric motor which makes it rotate of about 15000 revolutions a minute.

7. Smoothing planer according to any of previous claims, characterised in that in front of said tool-holder roll (13) a discharge opening (28) which protrudes upwards (17) with a duct which then substantially deviates on the side (17) for the discharge of the smoothed material by centrifugal projection is provided.

8. Smoothing planer according to any of previous claims, characterised in that it has by the side of the respective motor (19) an openable door (21) for the change and the maintenance of the respective brushes (20).

9. Smoothing planer according to any of previous claims, characterised in that said control handgrip is tilted forwards (2).

10. Smoothing planer according to any of previous claims, characterised in that said control handgrip is tilted forwards (2) for a value of about 45° respect to the underlying resting plane (3).

11. Smoothing planer according to any of previous claims, characterised in that said motor operating control (19) of said tool-holder roll (13), has a switch button (12) and is integrated upperly and frontally in said control handgrip (2).

12. Smoothing planer according to any of previous claims, characterised in that it is integrated with a fork-like extractor (24) with ends directed outwards

and central propping screw with extractor function (23) for said abrasive tubular coating (22).

13. Smoothing planer according to any of previous claims, characterised in that a turbine (16) is provided axially to the motor and on the side, with air convoying channel (10), on said discharging channel (11), having a double function: the first one, that of cooling the same motor by sucking air from the fissures placed in the low right shell and on the right carter (21), the second one, of convoying and easing the downflow of the dusts in the suitable discharging channel (11).

14. Smoothing planer according to any of previous claims, characterised in that it comprises said roll (13) interchangeable with roll having cutting knives or with roll having abrasive surface (13, 22).

15. Smoothing planer according to any of previous claims, characterised in that it comprises the configuration of said roll (13) so that it may receive alternatively:

- either cutting knives;
- or an abrasive coating (22).

16. Smoothing planer according to any of previous claims, characterised in that the rotation direction of said roll (13) is in opposite direction respect to the advancement one.

17. Kit comprising a smoothing planer, according to previous claims, characterised in that it comprises a traditional smoothing planer of the type having:

- two planes for the resting on the surface to be worked (3, 4) of which:
- a fixed rear resting plane (3) and
- a movable (1) front (4) resting plane, at least retracted respect to the plane of the first one (3);
- a tool-holder operating roll (13), placed between said two planes (3, 4), rotatably motorised on horizontal axis transversal respect to the advancement direction by manual thrust of said portable electro-manual smoothing machine (20-19, 9, 16, 8, 7), operator on the surface to be worked, with operating surface substantially around said fixed rear plane (4)
- a first control main handgrip (2) above said rear resting plane;
- operation electric control means (12) on said control handgrip (2);
- a second substantially knob-shaped handgrip (1), above said front resting plane (4), rotatably operable manually, for rotating axial means with resting screw to said front resting plane for lifting or lowering it respect to said rear resting plane (3),

characterised in that it comprises at least two of said tool-holder operating rolls (13), of which:

- one is substantially conceived for housing a cutting knife, and
- the other one is substantially a tool-holder roll, structured for operating with abrasive surface (22).

18. Kit comprising a smoothing planer, according to previous claims, characterised in that it comprises a traditional smoothing planer of the type having:

- two planes for the resting on the surface to be worked (3, 4) of which:
- a fixed rear resting plane (3) and
- a movable (1) front (4) resting plane, at least retracted respect to the plane of the first one (3);
- a tool-holder operating roll (13), placed between said two planes (3, 4), rotatably motorised on horizontal axis transversal respect to the advancement direction by manual thrust of said portable electro-manual smoothing machine (20-19, 9, 16, 8, 7), operator on the surface to be worked, with operating surface substantially around said fixed rear plane (4)
- a first control main handgrip (2) above said rear resting plane;
- operation electric control means (12) on said control handgrip (2);
- a second substantially knob-shaped handgrip (1), above said front resting plane (4), rotatably operable manually, for rotating axial means with resting screw to said front resting plane for lifting or lowering it respect to said rear resting plane (3),

characterised in that:

- said tool-holder roll (13) is shaped with transversal grooves for receiving and fixing alternatively:
- at least one cutting knife, or
- an abrasive coating surface (22).

19. Kit according to the previous claim, characterised in that it further comprises: a fork-like tool (24) with end spouts turned outwards and a thrusting screw means having extractor function (23), being provided:

- an access door for lateral insertion and extraction (14) and
- opposite grooves (26) in said roll (13) for housing an abrasive tube (22) with corresponding opposite longitudinal ribs (25) insertable in said

grooves of the roll (26), where the insertion of said fork (24) may be possible.

20. Interchangeable abrasive tubular coating for smoothing planer according to the characteristics as in previous claims, characterised in that it is substantially made up of substantially non-flabby but suitably self-supporting material, with internal diameter such to be inserted perfectly on said roll with no slacks and internally provided with longitudinal ribs (25), for fixing in said longitudinal grooves (26) present in said tool-holder roll (13).

21. Interchangeable abrasive tubular coating for smoothing planer according to the previous claim, characterised in that said abrasive tubular roll is made up of fibre layers impregnated with resin on which some strong abrasive canvas is fixed.

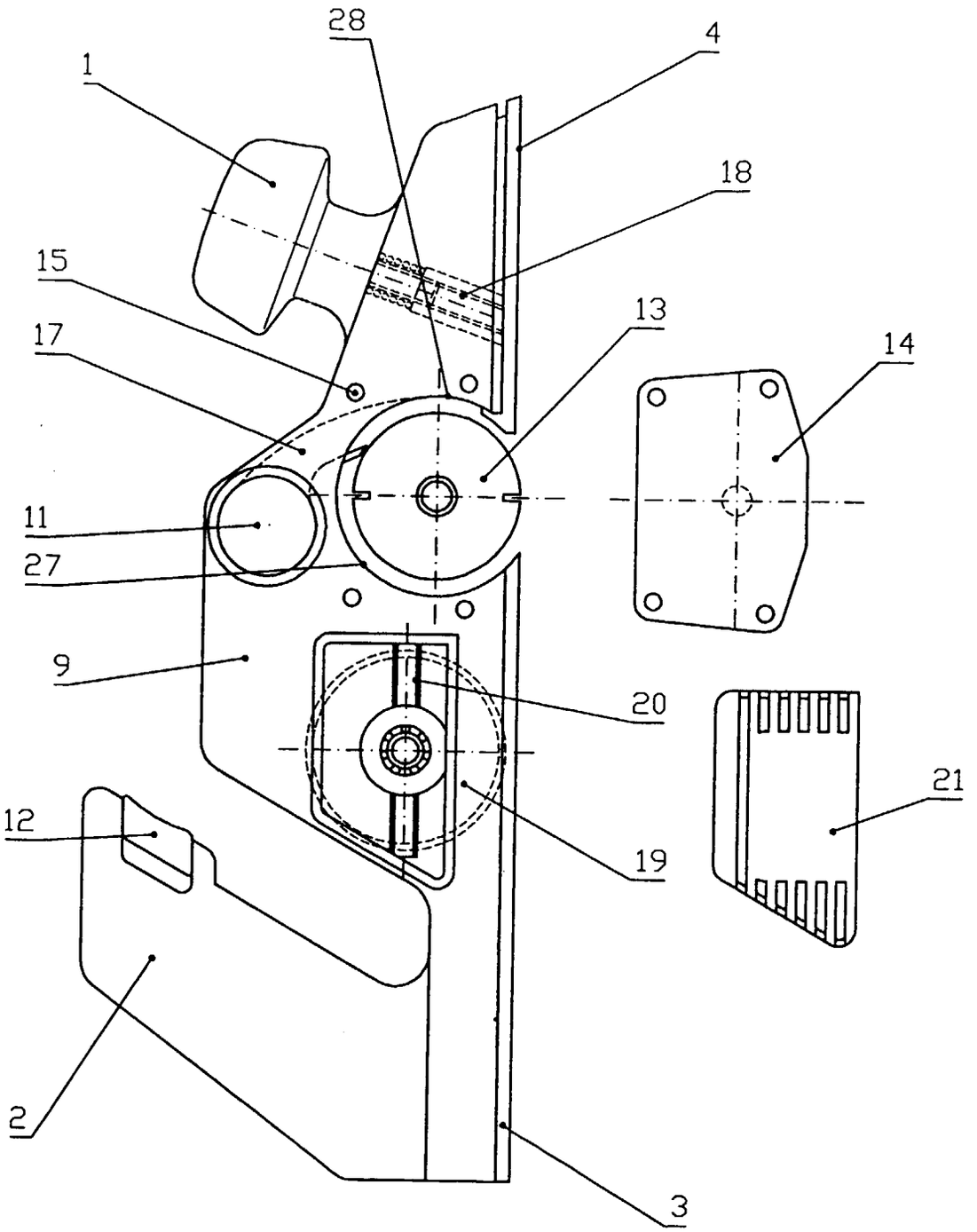

FIG. 1

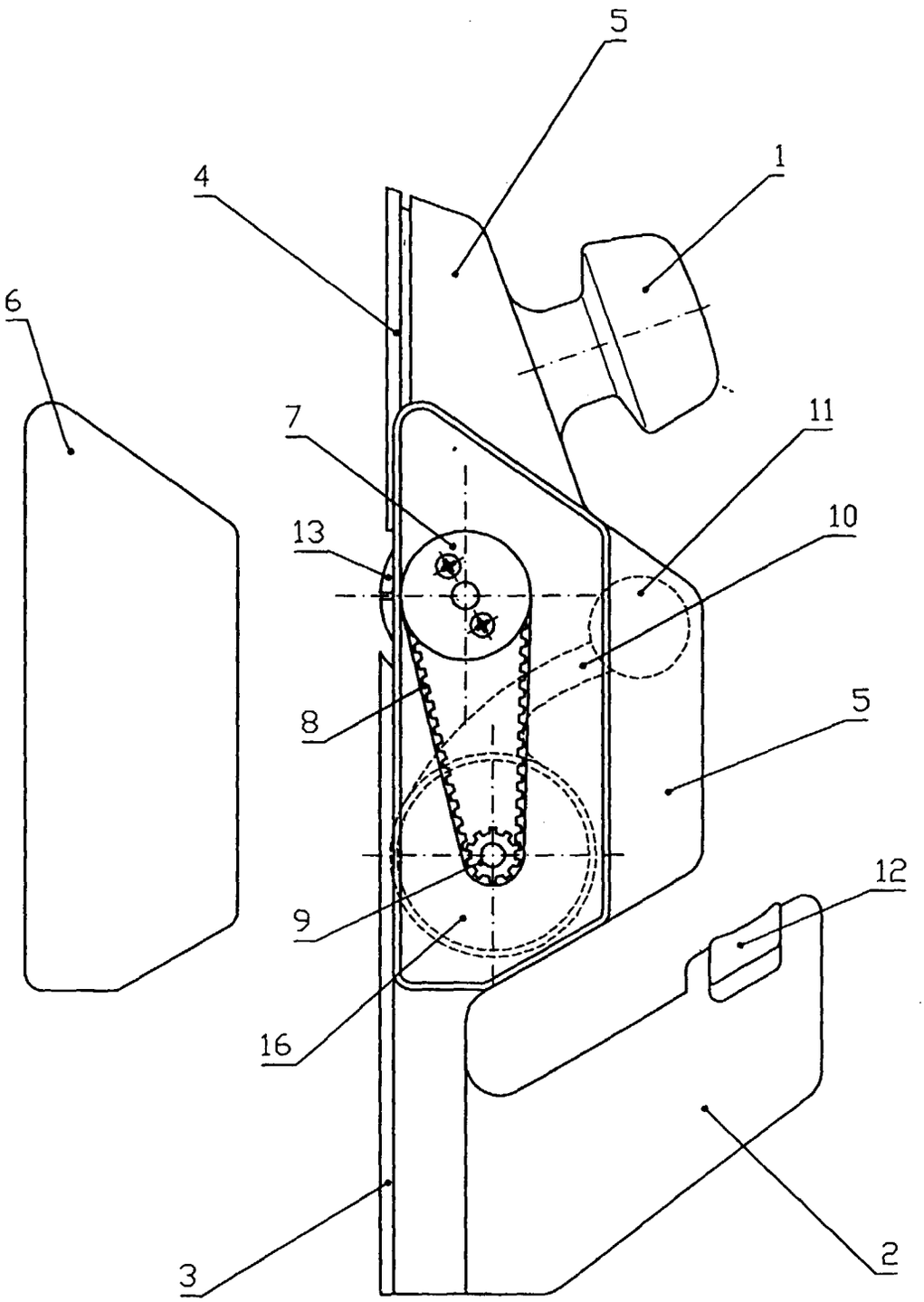

FIG.2

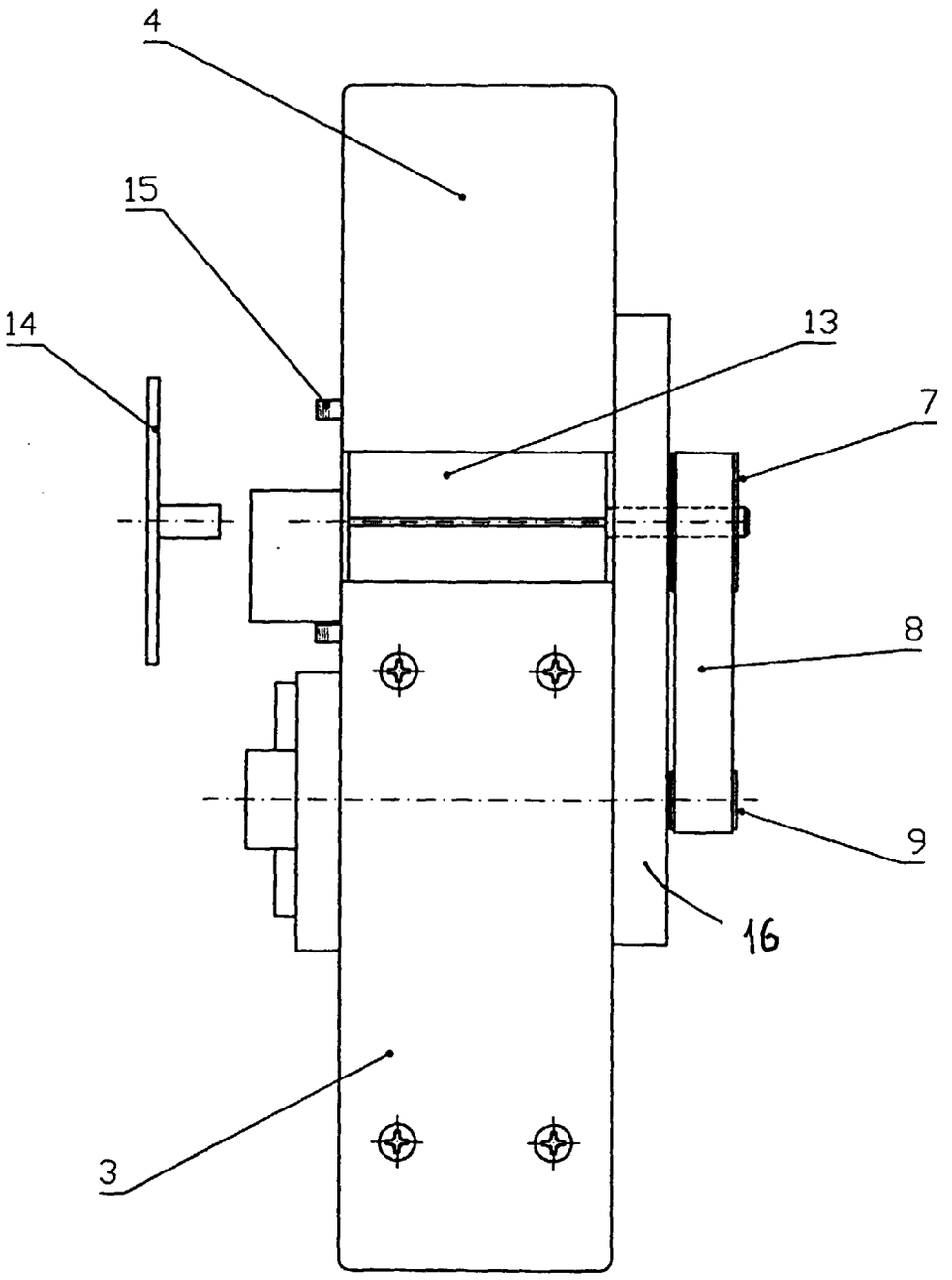

FIG.3

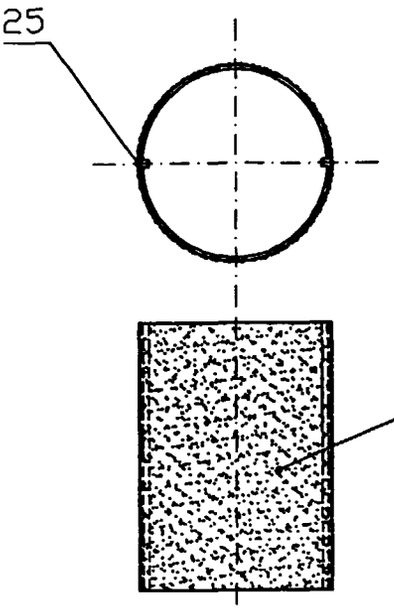

FIG.4

FIG.5

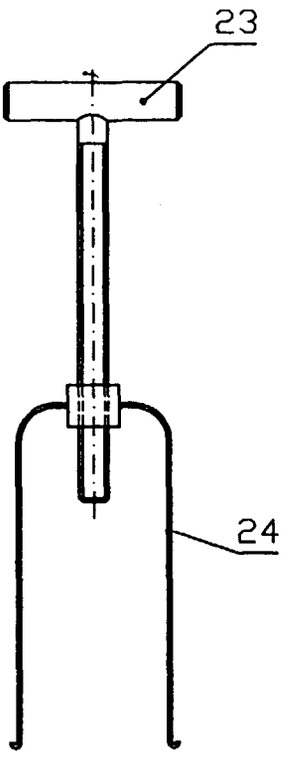

FIG.8

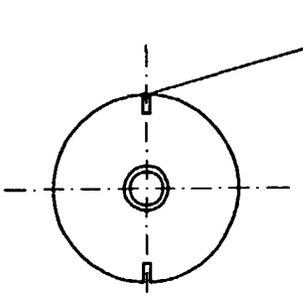

FIG.6

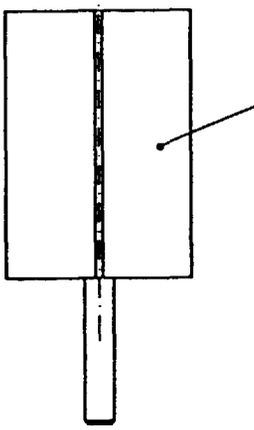

FIG.7