

Oct. 21, 1947.

L. MAYER

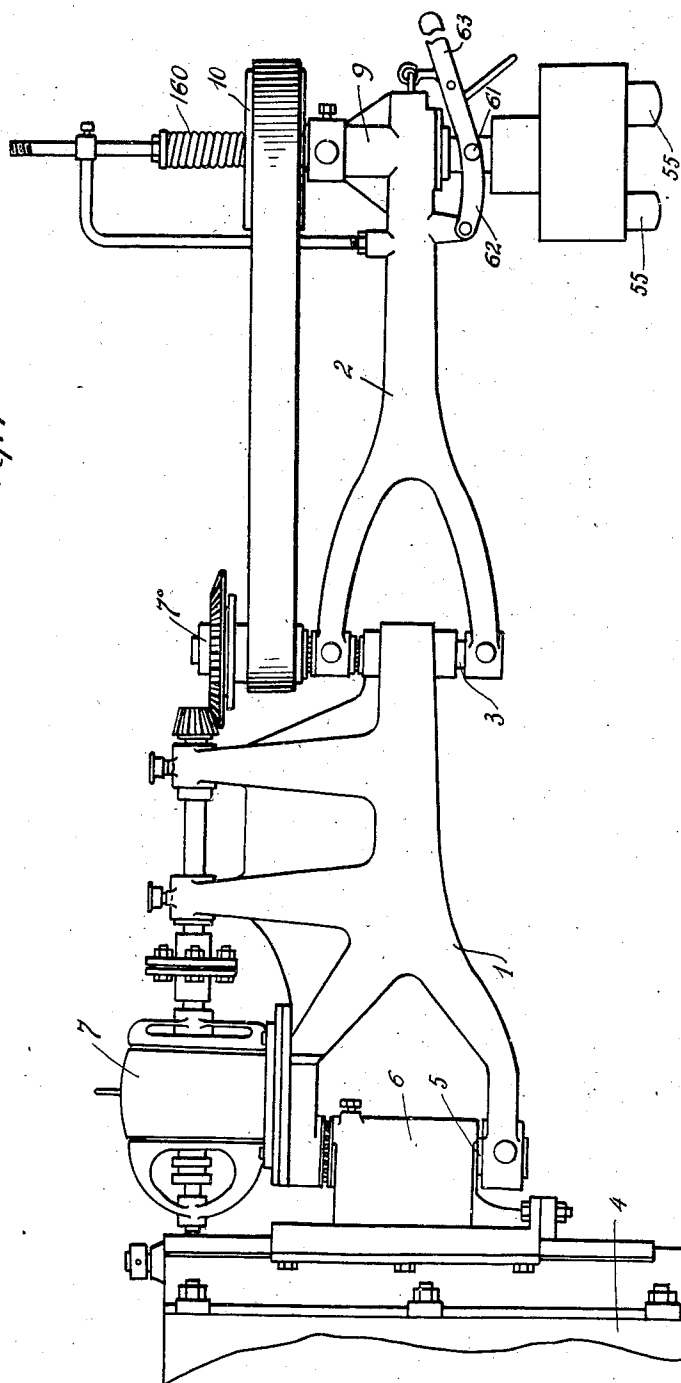
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APPARATUS FOR SURFACING AND POLISHING HARD MATERIALS

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3 Sheets-Sheet 1

Fig. 1



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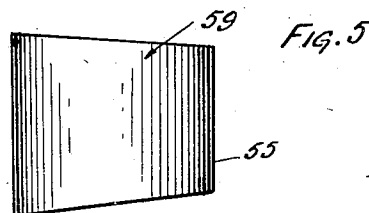
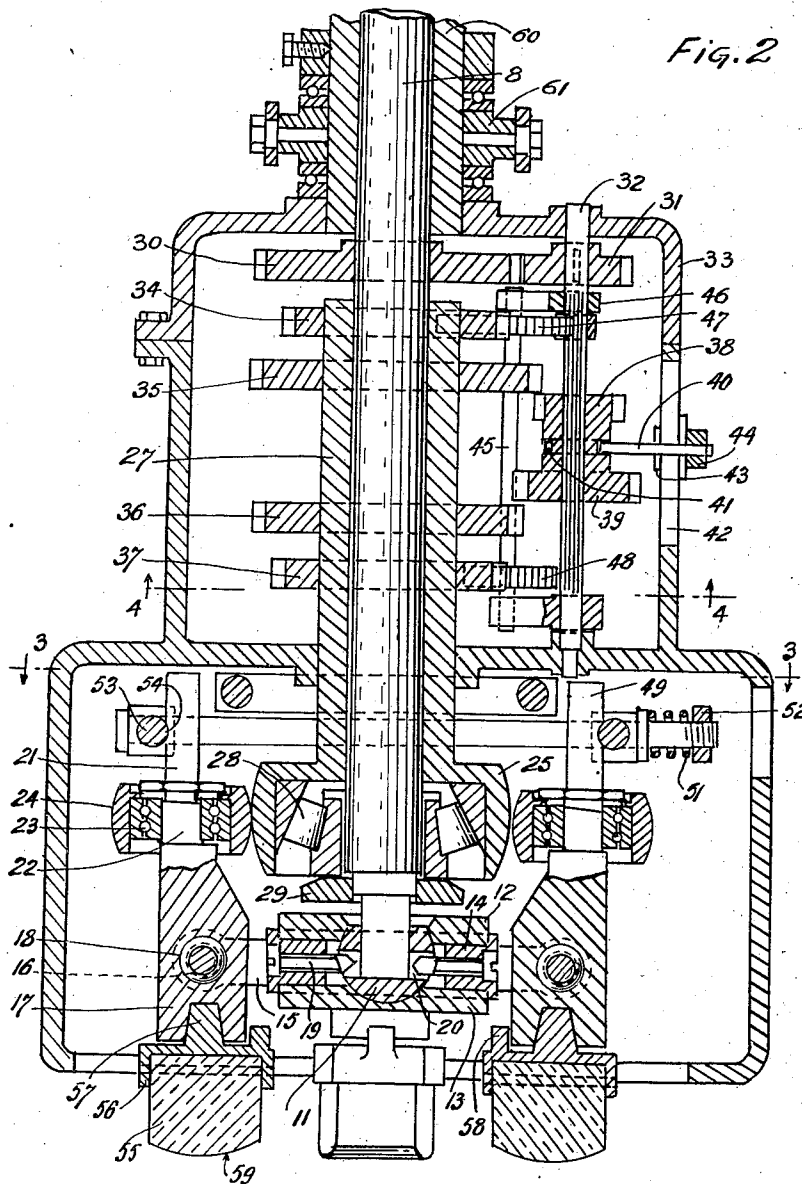
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Fig. 3

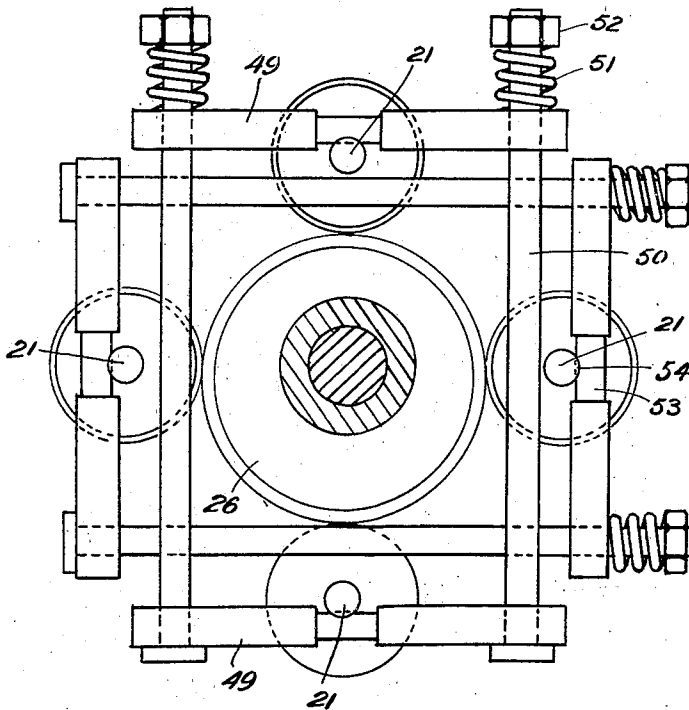
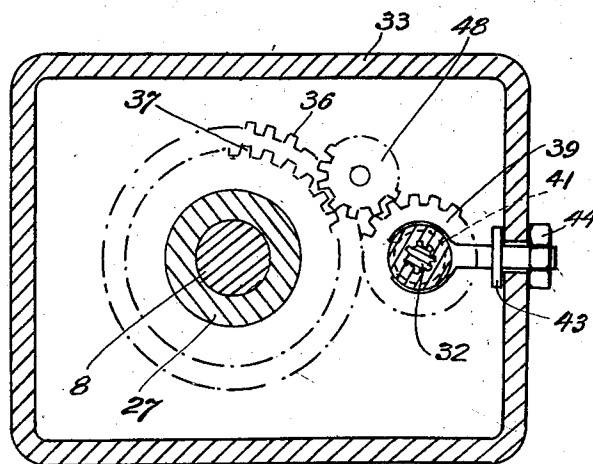


Fig. 4



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APPARATUS FOR SURFACING AND POLISH-
ING HARD MATERIALS

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19 Claims. (Cl. 51—126)

1

The invention relates to the surfacing and polishing of stones, marbles and generally any hard materials, in blocks, plates or sheets, and is particularly concerned with the apparatus used in such operations and including rubbing tools effecting several movements on the surface of the work.

It has already been proposed to make use as rubbing members, of bodies such as blocks made of a substance appropriate to the operation to be effected and acting on the work while having therewith a tangential contact only, the said members having amongst other oscillating movements the purpose of which is to renew, in principle continuously, the contact with the work of these members.

In known devices, the rubbing and oscillating members are mounted on an appropriate frame caused to rotate about an axis, in turn moved with the supporting frame within the area of the surface of the work.

In these devices however, for each turn of the supporting frame the rubbing members pass periodically through the same positions resulting in certain drawbacks: particularly difficulties are experienced for conducting the supporting frame on the surface of the work within the marginal portions of this surface so as to operate all these portions, particularly evenly. On the other hand irregularities in the mechanisms causing the movements of the rubbing members result in irregularities in the wear of the working surfaces of the rubbing members and consequently in defects in the surfaces operated upon.

Also, in these devices the quantity of work done by a rubbing member is not the same either at all points of its line of contact with the work or for the various lines of contact with the work corresponding to its various oscillating positions, with the result that except within a limited zone, there is a lack of harmony between the action to be exerted and the quality or the nature of the tool resulting in either a premature wear of certain zones of the tool or too strong an action, which may be moreover irregular, of the tool on the work.

Furthermore, in the particular instance where several rubbing tools, distributed around an axis of the traversing movements of their supporting frame upon the surface of the work, are caused to oscillate in a radial direction relatively to this axis, the connections of the said members with their frame and of the latter with the axis of the traversing movements generate irregularities in the engagement of the members with the sur-

2

face of the work and consequently not only damage said members but also cause defects in the surface of the work.

The main purpose of the invention is to remedy these drawbacks.

To this end the invention consists in providing the apparatus of the kind specified with means adapted to ensure that for each turn of the supporting frame about its axis, the oscillating positions resumed by the rubbing members shall be different, at least for a comparatively large number of successive turns of said supporting frame.

The invention also consists in arranging the rubbing members, or the drive thereof, or both, in such a way that for any position the quantity of work done by each tool shall be the same for every point of its contact line with the work or for the various contact lines corresponding to the different oscillating positions of the tool.

The invention further consists in arranging the connections of each of the rubbing members distributed around a common axis, so as to enable them to oscillate in radial direction relatively to this axis, and in arranging the connections of the supporting frame with the said axis so as to enable the rubbing members to engage simultaneously in a constant manner with the surface of the work.

And in order that, in any case, the above characteristic arrangements as well as certain other features of the invention may be well understood, they will now be described with more detail, together with certain of their preferred embodiments given by way of example and illustrated in a more or less diagrammatical manner, in the annexed drawings, in which:

Fig. 1 shows, in side elevation, a surfacing and polishing apparatus having the invention applied thereon;

Fig. 2 shows at a large scale and in longitudinal section, with certain parts omitted, a portion of this apparatus;

Figs. 3 and 4 are sectional plane views, obtained approximately along the lines 3—3 and 4—4 of Fig. 2;

Fig. 5 shows the projected working face of a rubbing tool, on the horizontal plane.

Referring first to Fig. 1, in the surfacing and polishing apparatus, of knee construction, taken as an example (such apparatus could as well be of another type) there is provided an arm or support made by means of the sections 1 and 2, pivoted to each other at 3, and on the other hand pivoted together, at 5, to a comparatively fixed support 6, forming a component part of a frame

4, which could be a wall, a partition or the like.

A rotating drive is arranged at 7, near the support 6, and is associated with a counter shaft 7^o mounted above the pivotal connection 3, in order to cause the rotation about its axis of a vertical shaft 8 arranged at the end of the section 2, the drive of the rotatory movement being ensured for example by means of a pulley 10.

In Fig. 2, the vertical shaft is numbered 8, and is provided at its lower end with rubbing members mounted as indicated hereafter or in a similar manner.

With the end of the shaft 8 there is associated a spherical member 11 or any other device providing for universal movement, as for example a Cardan mechanism, and on the spherical member are mounted two disc plates 12 and 13 retaining between them an angular member 14 supporting two or more pairs of brackets 15, for example four pairs of brackets as in the illustrated embodiment. In corresponding holes of these brackets there are mounted axles 16 on which supports 17 for rubbing members are arranged to oscillate. The axles 16 and supports 17 are arranged to enable not only oscillating movements in radial direction but also a more or less important tilting movement about a radius passing approximately through the central point of their axes and, to this end spherical bearing surfaces, such as the spherical members 18, are provided on the axles 16.

To ensure the rotation about the axis or shaft 8, connecting members, such as the pins 19, are inserted, as by screwing, in the annular member 14, and freely extend in hollows 20 of the spherical member 11, thus ensuring the universal movements of the supports 17 for the rubbing members.

On the other hand the said supports 17 are provided with extensions 21, on a cylindrical portion 22 of which bearings 23 are supported, preferably of the ball or roller type, supporting in turn rollers 24 having a curved, and preferably a spherical or similar rolling surface.

These rollers 24 engage a cam 25 which may have one or several bosses but which is preferably formed by means of a member including at least one section of circular cross-section which is eccentric relative to the shaft 8.

This cam 25 is made integral with or secured on a sleeve 27 surrounding the shaft 8, and able to rotate about its axis relatively to this shaft 8. For this purpose a mounting is provided, which preferably comprises rolling members, at least in the section where the cam 25 is located, and for example a roller bearing 28 forming also a thrust bearing and to this effect resting through its inner race on a ring 29 secured in any convenient manner on the shaft 8.

The peripheral surface of the cam 25 is also curved and for example spherical. With the sleeve 27 is associated a device adapted to ensure the rotation thereof, conveniently from the shaft 8, but with speeds different from that of the shaft 8, and even in a direction opposite to that of said shaft 8.

To this effect any suitable device may be provided, such as gearings including toothed wheels as illustrated, which may be made as follows. On the shaft 8 is secured a pinion 30 imparting its movement to a pinion 31 secured on a counter shaft 32 journaled in a box 33 surrounding the mechanism.

The sleeve 27 is provided on the other hand with a series of toothed pinions 34, 35, 36 and

37 having different diameters, appropriate to the speeds it is desired to obtain, and the countershaft is provided with a sliding change speed member comprising two associated pinions 38 and 39 the movements of which on the serrated countershaft 32 are obtained by means of a fork 40, engaging an annular groove 41 on the sliding change speed member, and movable within a slot 42 of the box 33. Any suitable means such as the stop 43 and the nut 44 are provided enabling the fork to be secured in any desired position of adjustment.

There is further provided a second countershaft 45 supported in brackets 46 from the countershaft 32, and provided with reversing pinions 47 and 48, in permanent engagement with the pinions 34 and 37 on the sleeve 27, respectively.

Owing to this arrangement, when the pinion 38 is moved in engagement with the pinion 35, by an upward movement of the fork 40, the sleeve 27 is caused to rotate in the same direction as the shaft 8, with the slowest speed of rotation in said direction which may be imparted to it. Past this position, when continuing the upward movement of the fork 40, the pinion 38 is caused to engage the reversing pinion 47, thus moving the sleeve 27 in a direction opposite to that of the shaft 8, with the slowest speed of rotation which may be imparted to it in said direction.

To the contrary, by lowering the fork 40, an engagement is obtained, first between the pinions 39 and 36, resulting in moving the sleeve 27 with the fastest speed of rotation in the same direction as the shaft 8, and subsequently between the pinions 39 and 48 thus moving the sleeve 27 in a direction opposite that of the shaft 8 with the fastest speed which can be imparted to it in this direction.

Finally, by moving the sliding change speed member 38—39 in an intermediate position between the pinions 35 and 36, as illustrated, the sleeve 27 is not positively moved in rotation.

To retain the rollers 24 in contact with the cam 25, means are provided, which may be resilient means, such as springs, or members actuated by gravity, such as counterweights, but preferably use is made of an arrangement including resilient members, and in which these members are subjected to small deformations only, even of a minimum value.

In the illustrated embodiment, each of the extensions 21 is resiliently connected to the extension 21 which is situated on the opposite side of the cam 25, the connection being formed by a pair of cross members 49 united at their corresponding ends by means of tie members 50, between one end of which and the corresponding cross member 49 are mounted springs 51 the force of which may be adjusted as desired by means of the nuts 52. The section 53 of the cross member 49 abutting against the extensions 21 is preferably slightly engaged in the corresponding extension, for example within a notch 54 formed therein, and this section 53 is made to allow for the lateral oscillations of the rubbing members on the herebefore mentioned spherical members 18.

As best seen in Fig. 2, the rubbing members 55, which are made of a material appropriate to the work to be done, are arranged in the form of blocks and inserted in suitable attachments 56, which are engaged in the tool holders 17, preferably by means of conical extensions or the like, 57. Means are provided to avoid rotatory movements of the rubbing members about the axes of the said extensions 57, which means may be of any suit-

5

able construction and for example made in the form of projections 58 resting against one of the sides of the tool holders 17.

When the rubbing members 55 are caused to oscillate radially relatively to the shaft 8, the distance between the contact line with the work of each of these members, and the axis of said shaft 8 increases and decreases and, owing to the circular motion around the shaft 8, the speeds of movement vary with the position of the contact line.

Should the length of this line be a constant, the reciprocal actions between the rubbing member 55 and the work would be variable, and the nature of the tool, presumed to be homogeneous, would not be appropriate, except for a small zone of the engagement.

To ensure the desirable constancy of the reciprocal actions, the rubbing tools 55, and at least the working surface 59 thereof, are shaped so that the length of their contact line with the work varies with the radius of the circular motion of the member around the shaft 8, that is they receive the shape of a trapezoid as illustrated in the projected view on a horizontal plane in Fig. 5, the smallest base of the trapezoid being nearer the centre of rotation.

In the described apparatus, the pressure on the work is ensured by the weight of the movable parts, i. e., the shaft 8 and associated members and the sleeve 27 and associated members, which weight may or may not be assisted with an additional pressure, as a resilient pressure, applied at the end of the shaft 8 as by means of a spring such as 160, and to complete the arrangement there is provided, on a sleeve 60 secured on the shaft 8, a collar 61 provided with laterally extending pins upon which are engaged the branches of a forked lever 62 (Fig. 1) pivoted on a fixed point of the support 1—2, and provided with an extension 63 serving on the one hand to move the rubbing members assembly upon the work and on the other hand to raise this assembly away from the surface of the work.

It follows from the above that the shaft 8 being rotated, the rubbing members 55 will be moved circularly on the work while effecting simultaneously radial oscillating movements relatively to said shaft 8.

By imparting to the cam 25 a suitable rotating movement, the position of the contact line with the surface of the work of any rubbing member is modified every turn so that not only any portion, particularly the marginal portions of the surface of the work may be operated upon, but the wear of the working faces of the rubbing members will be uniform, resulting in an improved action on the work.

It will be further appreciated that the change, every turn, of the position of the contact line of a rubbing member with the surface of the work may be obtained while the cam 25 is not positively driven, owing to the sleeve 27 being free to rotate when the sliding change speed member occupies the position illustrated in Fig. 2, the cam 25 then being slowly moved in rotation under the action of the rollers 24.

Although the invention has been described with reference to certain preferred embodiments, it is to be understood that it is not limited thereto but that it includes the modifications, the alternatives and the equivalent arrangements.

I claim:

1. An apparatus for surfacing and polishing stones, marbles and other hard materials com-

6

prising a supporting frame, rubbing tools arranged in said supporting frame, and having a tangential contact with the surface of the work, a shaft for said frame, means for rotating said frame about said shaft, means for oscillating the rubbing tools radially towards and away from said shaft in an arc about a center so as to renew the contact of the said tools with said surface, the plane of the arc being substantially perpendicular to the work surface and means to cause the said rubbing tools to take oscillating positions which are different for each turn of the supporting frame, at least for a comparatively important number of successive turns of said frame.

2. An apparatus for surfacing and polishing stones, marbles and other hard materials comprising a supporting frame, rubbing tools arranged on said supporting frame and having a tangential contact with the surface of the work, a shaft for said frame, means for rotating said frame about said shaft, means for oscillating continuously the said tools radially away and towards the axis of said shaft, in an arc about a center to renew permanently the contact of said tools with said surface, the plane of the arc being substantially perpendicular to the work surface, and means to cause the rubbing tools to take positions which are radially different for each turn of the supporting frame, at least for a comparatively large number of successive turns of said frame.

3. An apparatus for surfacing and polishing stones, marbles and other hard materials, comprising a supporting frame, rubbing tools arranged on said supporting frame and having a tangential contact with the surface of the work, a shaft for said frame, means for rotating said frame about said shaft, means for oscillating continuously the rubbing tools radially away and towards the shaft in an arc about a center to renew permanently the contact of said tools with said surface, the plane of the arc being substantially perpendicular to the work surface, said oscillating means being rotatable around the shaft in both the direction of rotation of the shaft and the opposite direction.

4. An apparatus according to claim 3, in which the means for oscillating continuously the rubbing tools radially away and towards the shaft includes horizontally disposed supporting shafts and a cam shaped member operating at a level different from the levels of the supporting shafts.

5. An apparatus according to claim 3, in which the means for oscillating continuously the rubbing tools radially away and towards the shaft are positively actuated in circular motion.

6. An apparatus according to claim 3, in which the means for oscillating continuously the rubbing tools radially away and towards the shaft is freely rotatable around the shaft whereby the circular motion of said means about said shaft, in the direction of rotation of the shaft, is obtained by the reactions of the actuated members associated to the rubbing tools.

7. An apparatus according to claim 3, in which the supporting frame for the rubbing tools is connected to its driving shaft through the intermediary of a device providing for universal movement, as a spherical member.

8. An apparatus according to claim 3, in which each rubbing tool is connected to the supporting frame by means of a connection including a device providing for universal movement, as a spherical member.

9. An apparatus according to claim 3, in which the means for oscillating continuously the rubbing tools radially away and towards the shaft include a cam shaped member the longitudinal cross section of which has a curved outline.

10. An apparatus according to claim 3, in which the means for oscillating continuously the rubbing tools radially away and towards the shaft include a cam shaped member the longitudinal section of which has a curved outline, and associated rollers the longitudinal cross section of which has a curved outline.

11. An apparatus for surfacing and polishing stones, marbles and other hard materials comprising a supporting frame, rubbing tools arranged on said supporting frame and having a tangential contact with the surface of the work, a shaft for said frame, means for rotating said frame about said shaft, means for oscillating continuously the rubbing tools radially away and towards the shaft in an arc about a center, the plane of the arc being substantially perpendicular to the work surface, said means including a cam shaped member associated with the shaft and cooperating members, cooperating members associated with the rubbing tools, and connections between the cooperating members associated with the rubbing tools and the other cooperating members actuated by the cam shaped member and to which movements are imparted which are substantially equal and approximately opposed.

12. An apparatus according to claim 11, in which the connections are provided between cooperating members each of which is associated with a rubbing tool.

13. An apparatus according to claim 11, in which the connections between the members cooperating with the cam shaped member include extensions of the rubbing tools, cross members bearing against said extensions, tie members connecting together cross members located at opposite sides of the cam shaped member and resilient members associated with said tie members.

14. An apparatus according to claim 11, in which the connections between the members cooperating with the cam shaped member include extensions on the rubbing tools, cross members bearing against said extensions and united together by devices including spring means, the contact between said extensions and said cross members including tiltable elements as cylindrical elements.

15. An apparatus for surfacing and polishing stones, marbles and other hard materials, comprising a supporting frame, rubbing tools arranged on said supporting frame and having a tangential contact with the surface of the work, a shaft for said frame, means for rotating said frame about said shaft, means for oscillating continuously the rubbing tools radially away and to-

wards the shaft in an arc about a center, the plane of the arc being substantially perpendicular to the work surface, whereby the contact of said members with said surface is permanently renewed, and the rubbing tools are caused to move circularly about paths of variable radius, and the rubbing tools having working surfaces shaped so that the extent of the contact of each rubbing tool with the surface of the work is at any time related to the speed of circular motion of said tool about the centre of said motion.

16. An apparatus according to claim 15, in which the working surface of the rubbing tools is of trapezoid formation with the small base of the trapezoid nearer the centre of the circular motion of said tools.

17. An apparatus for surfacing and polishing stones, marbles and other hard materials, comprising a supporting frame, rubbing tools arranged on the supporting frame and having a tangential contact with the surface of the work, a shaft for said frame, means for rotating said frame about said shaft, means for oscillating continuously the rubbing tools radially away and towards the shaft in an arc about a center, the plane of the arc being substantially perpendicular to the work surface, said means being rotatable around the shaft and the rotating means comprising a change speed gear including a sliding change speed member.

18. An apparatus according to claim 17, comprising a counter shaft, a transmission gear between the shaft and the counter shaft, and means for actuating the change speed gear from the counter shaft.

19. An apparatus for surfacing and polishing stones, marbles and other hard materials comprising a supporting frame, rubbing tools arranged in the supporting frame, and having a tangential contact with the surface of the work, a shaft for said frame, means for rotating said frame about said shaft and means for oscillating the rubbing tools radially towards and away from said shaft in an arc about a center, so as to permanently renew the contact of the said tools with said surface the plane of the arc being substantially perpendicular to the work surface.

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