March 18, 1941. M. H. BIRGER ET AL 2,235,446

SURFACING MEANS

Filed July 10, 1939 4 Sheets-Sheet 1

FIG. 1.

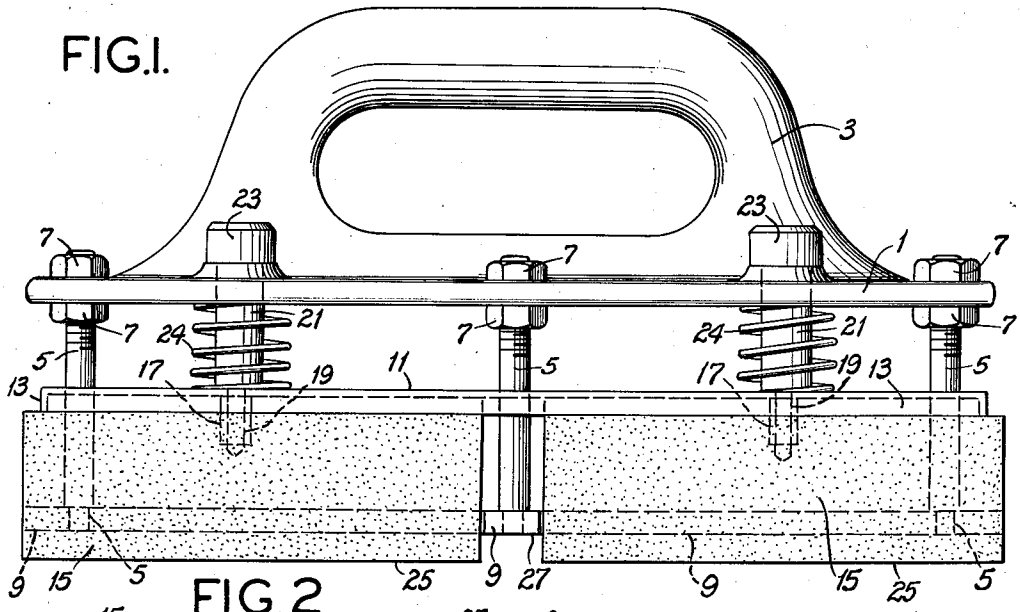


FIG. 2.

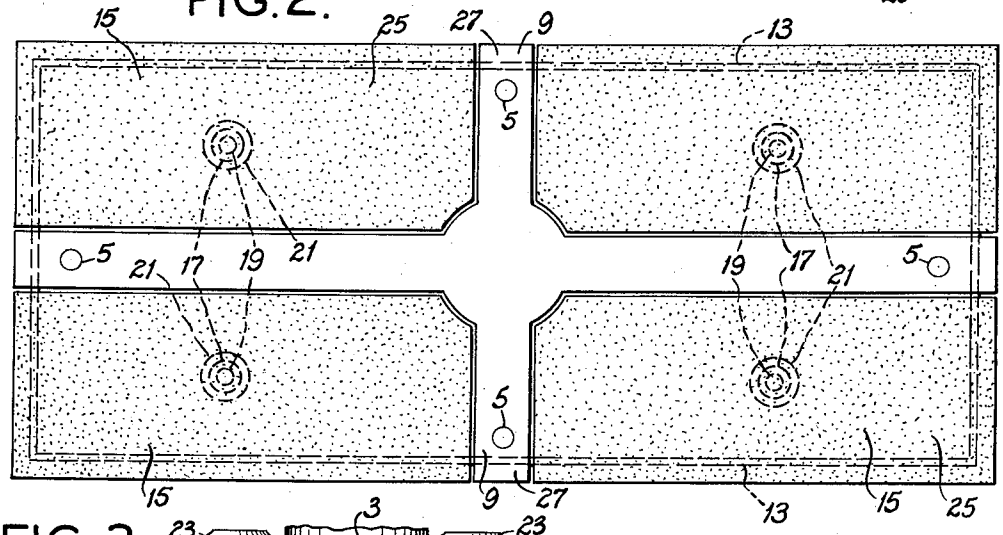
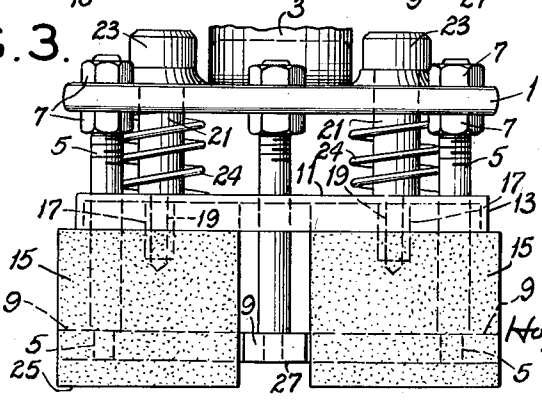


FIG. 3.



Milton H. Birger,
Calvin D. Johnson,
Inventors.
Haynes, Koenig and Wolf,
Attorneys.

March 18, 1941. M. H. BIRGER ET AL 2,235,446

SURFACING MEANS

Filed July 10, 1939 4 Sheets-Sheet 2

FIG. 5.

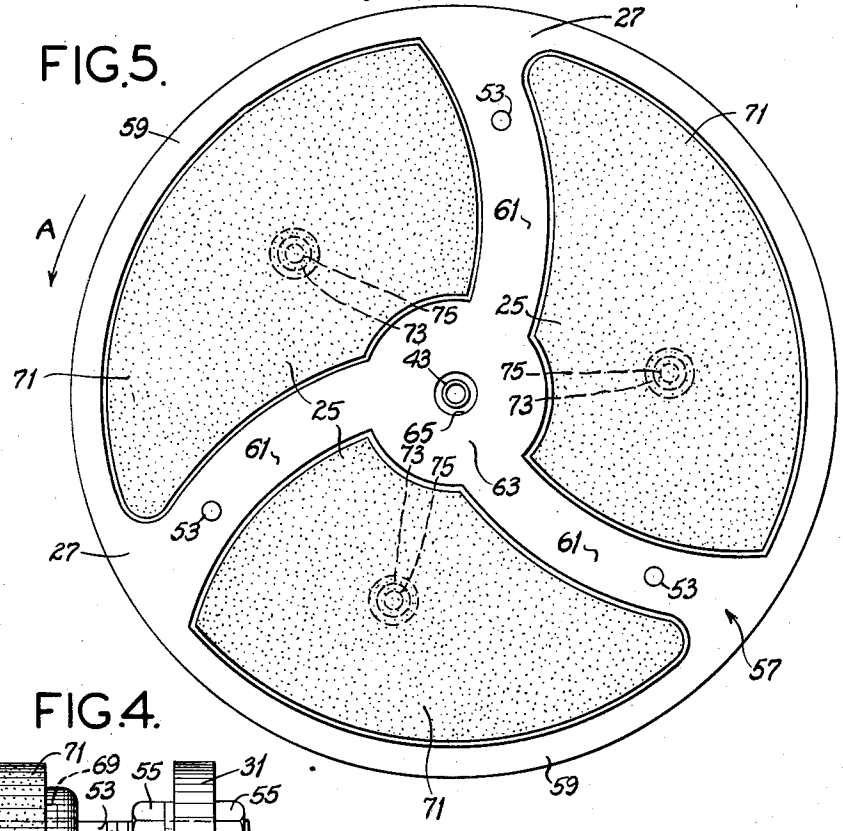
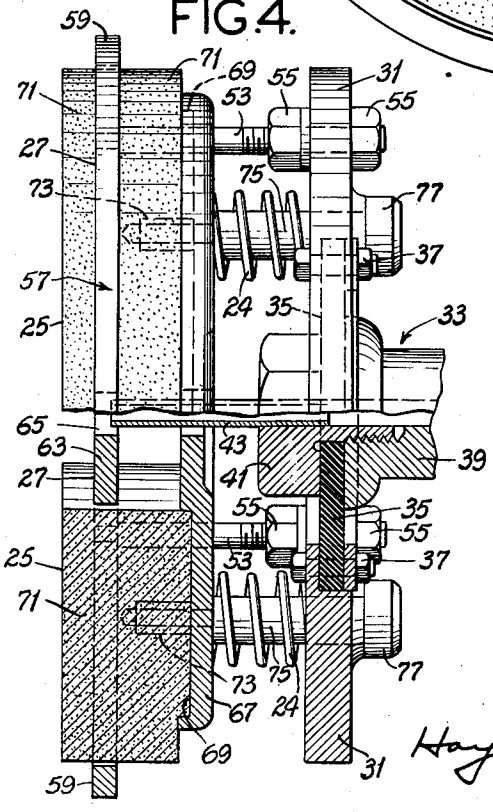


FIG. 4.



Milton H. Birger,
Calvin D. Johnson,
Inventors.
Haynes, Koenig and Wolf,
Attorneys.

March 18, 1941. M. H. BIRGER ET AL 2,235,446

SURFACING MEANS

Filed July 10, 1939 4 Sheets-Sheet 3

FIG. 6.

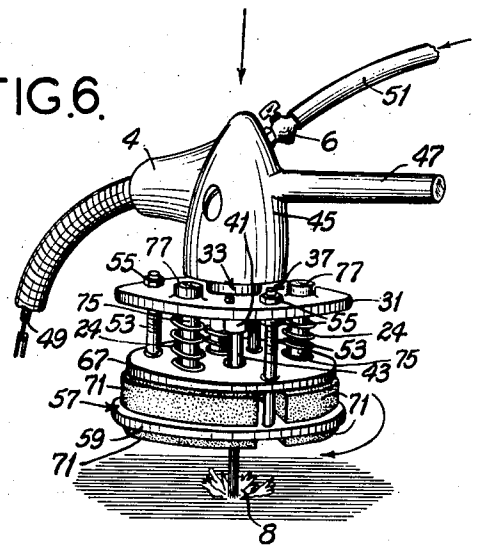
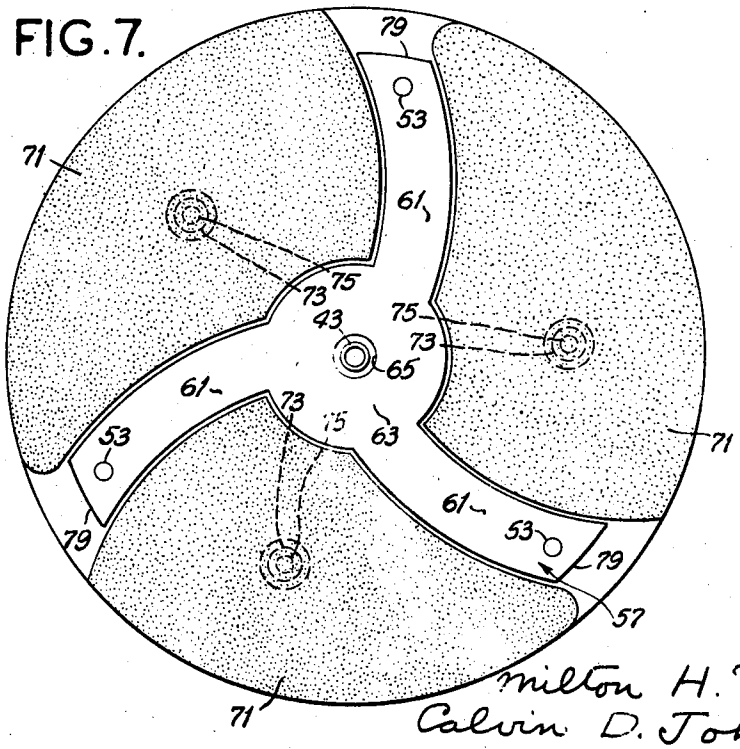


FIG. 7.



Milton H. Birger,
Calvin D. Johnson,
Inventors.
Haynes, Koenig and Wolf,
Attorneys.

March 18, 1941. M. H. BIRGER ET AL 2,235,446

SURFACING MEANS

Filed July 10, 1939 4 Sheets-Sheet 4

FIG. 9

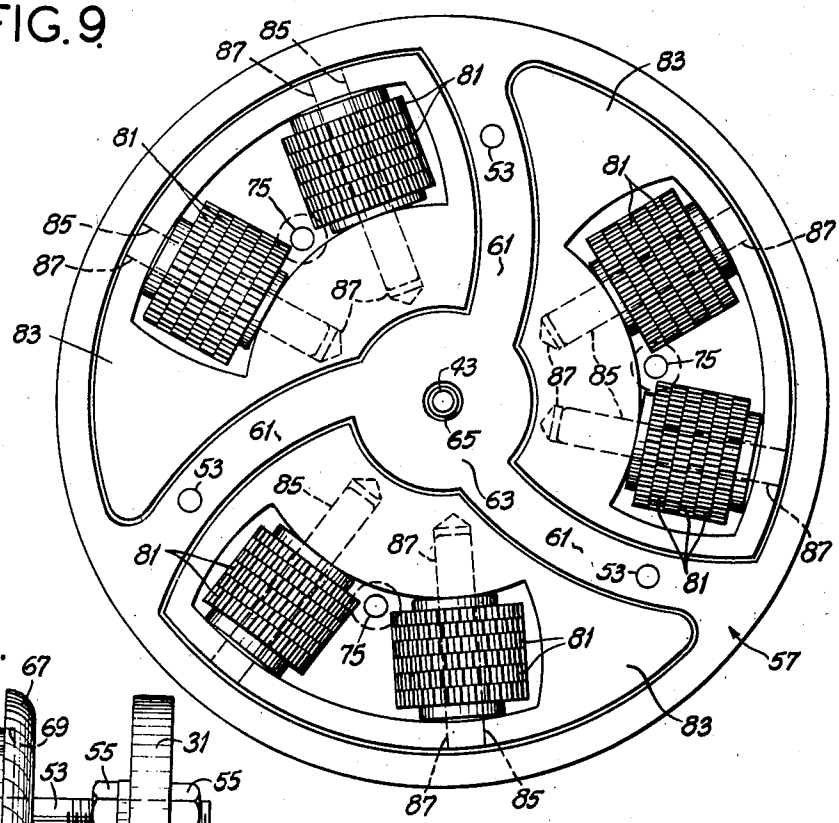
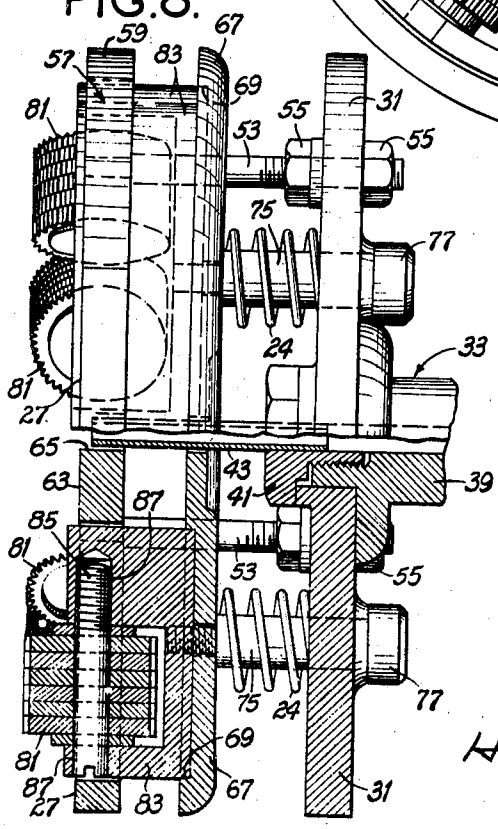


FIG. 8.



Milton H. Birger,
Calvin D. Johnson,
Inventors.
Haynes, Koenig and Wolff
Attorneys.

Patented Mar. 18, 1941 2,235,446

UNITED STATES PATENT OFFICE

2,235,446

SURFACING MEANS

Milton H. Birger, Glen Carbon, and Calvin D. Johnson, Belleville, Ill.

Application July 10, 1939, Serial No. 283,560

10 Claims. (Cl. 72—136)

This invention relates to surfacing means, and with regard to certain more specific features, to surfacing means for concrete or the like.

Among the several objects of the invention may be noted the provision of a method of surfacing, and apparatus therefor, in which comminuted material obtained by a grinding or abrasive action on a surface is conserved in situ, and which is promptly trowelled into position within voids which are broken open by the grinding or abrasive action or which may have been left by water or air bubbles in placing of the concrete; the provision of surfacing means of the class described, whereby at a single operation a smoothing and dressing is accomplished; the provision of means of the class described which may be made in either manually-operated or power-operated forms; the provision of means of the class described which is easier to operate than the means heretofore used for analogous purposes, yet which provides a smoother and better finish, all at much reduced cost; and the provision of means of the class described in which partially used abrasive blocks and the like may be more completely consumed. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which are illustrated several of various possible embodiments of the invention,

Fig. 1 is a side elevation of a manually operable form of apparatus for carrying out the invention;

Fig. 2 is a bottom plan view of Fig. 1;

Fig. 3 is a fragmentary end elevation of Fig. 1;

Fig. 4 is a side view of a power-driven form of the invention, parts being in section;

Fig. 5 is a bottom plan view of Fig. 4;

Fig. 6 is a perspective view of the apparatus of Figs. 4 and 5, shown attached to a driving head and raised from the surface to be finished;

Fig. 7 is a view similar to Fig. 5 showing a modified form;

Fig. 8 is a view similar to Fig. 4 showing another form of the invention; and,

Fig. 9 is a bottom plan view of Fig. 8.

Similar reference characters indicate corresponding parts throughout the several views of the drawings.

When a concrete structure or the like has been poured and has set, and the forms have been removed, there is presented a surface which does not have a smooth, dressed appearance. It is therefore desirable to remove from the surface the marks left by the forms, consisting of offset marks, voids, fins, grain pattern and other irregularities.

Heretofore dressing has been done by the use of an abrasive stone or the like to break the seal or the like which formed on the outside of a structure. Such grinding works the sand and cement into a mortar which is used to seal the voids that are formed on the surface of the structure. The voids are filled by means of a separate trowelling operation, and with additional surfacing material where necessary. The additional surfacing material and additional trowelling operation have been made necessary by reason of the fact that during the abrading operation to break the voids, the comminuted material which has been loosened has been lost, either by blowing away if dry, or by being flung away if wet. During the abrading operation it is often the practice to apply water to the surface so that the abraded material functions as much as possible as a mortar.

By means of the present invention, the sludge or mortar of comminuted material and water is conserved in situ during the abrading operation and is intermittently trowelled into position during that operation, so that not only is the number of operations reduced, but a greater amount of mortar-like material is available for finishing.

The invention may be used upon various types of structures, but it will be described in connection with concrete structures by way of example. It is applicable to concrete structures of all ages. However, if the invention is used in connection with structures which have just been set, it is more advantageous, because then the comminuted concrete is in a condition to re-form into a more durable surface for filling the voids which have been left or broken open by abrasion.

Referring now more particularly to Figs. 1–3, which show a manually operable form of apparatus, numeral 1 indicates a supporting plate upon which is formed a handle 3. Passing through openings in the supporting plate 1 are spacing pillars 5. These pillars are not threaded into the plate 1, but are slidable through their openings and are held rigidly in position by means of oppositely located lock nuts 7. By means of the lock nuts 7, the pillars 5 may be adjusted vertically in the supporting plate 1.

At their lower ends 1, the spacing pillars 5 are fastened into what will hereinafter be referred to as a trowel head or trowel 9 having a non-abrasive, smooth bottom surface 27. This head is smooth and flat upon its bottom and is of cruciform shape, as shown in Fig. 3. Thus, the supporting plate 1 and the trowel 9 are fixedly but adjustably related.

At numeral 11 is shown a carrier or face plate which is flanged at its edges as at 13 for receiving at its corners a plurality of spaced abrasive stones 15. Each stone is provided on its back with an anchored, interiorly threaded thimble 17. Threaded into these thimbles 17 are the ends 19 of guide studs 21. The guide studs 21 are therefore rigidly supported on the plate 11 and are rigid with respect to the stones 15. The studs pass slidably through openings in the supporting plate 1 and are thereabove provided with heads 23. Springs 24 reacting between the supporting plate 1 and the face plate 15 tend to push the latter downward, and consequently also the stones 15. The limit of motion is determined by the heads 23 and is such that the lower surfaces 25 of the stones 15 are normally a substantial distance below the surface of the trowel 9 (see Figs 1 and 3, for example).

It will therefore be seen that the lower surfaces 25 of the stones 15 are resiliently spaced below the lower surface 27 of the cruciform trowel 9. The pillars 5 pass through the spaces between pairs of stones 15 and freely through openings in the face plate 11, so that with some added pressure from the handle 3, the springs 24 may be compressed. Hence, if the stones 15 rest upon a concrete surface or the like, the surface 27 of the trowel 9 may be pushed against the concrete at will. Normally, without said added pressure, the stone 15 may be rubbed laterally over a concrete surface without pushing the surface 27 flush with the surface 25.

The operation of the device of Figs. 1–3 is as follows:

Assume that a concrete has been poured and set and has had the forms removed. The operator flushes water upon this surface and then applies the abrasive stones with a lateral rubbing action which may be reciprocating or more or less spiral or rotary. In carrying out this action he may press somewhat upon the handle 3 without substantially compressing the springs 24. Thus the lower surface 27 of the trowel 9 remains clear of the surface, while the bottom surfaces 25 of the abrasive stones 15 rub upon the surface and break open the voids just beneath. At the same time the abraded and comminuted material mixes with the applied water and forms a mortar-like sludge which, as the rotary action continues is substantially conserved in the cruciform channel formed between blocks 15 and beneath the trowel 9. In other words, this sludge-like material does not run away as easily as heretofore.

After the operator has worked up a substantial amount of sludge by having effected an abrasion and comminution of a substantial part of the surface, he continues his lateral motions and at the same time presses normally with more force upon the handle 3 to force the trowel surface point 27 into a plane with the surface 25, that is, against the abraded (and now more smooth) concrete surface. This forces the conserved sludge into the voids which have been broken open by the abrasion, and at the same time smooths out this sludge into a desirable surface. After an area has been completed in this way, the operator removes his operations to an adjacent area and continues them.

Ordinarily, if the operations are carried out directly after the forms have been removed from the structure, there is enough remaining setting power in the cement of the concrete to cause the sludge which has been forced into the voids to take a final or residual set which resists later leaching. After ten days or so, the operation over the entire surface is ordinarily repeated. Finally, after drying, the surface appears smoother and whiter, due to the different reflective character of the implaced comminuted material.

If the operations are delayed until the structure becomes older, for example, a year or so, then the power of the cement in the sludge to take a final or residual set is gone, and in such event it may be desirable to add some fresh material to the sludge as it is formed, as by throwing on powdered cement to become absorbed with the sludge and worked in by the trowel 9.

From the above it will be seen that the invention provides for breaking open surface voids by means of an abrasive, conserving the comminuted material which is abraded away, and in the same operation forcing a sludge of the comminuted material into the voids thus broken open.

After a time, the abrasive stones 13 will wear, thus decreasing the depth of the channel under the trowel 9 and between stones 15. To compensate for this, the nuts 7 may be adjusted so that the trowel 9 is drawn back toward the supporting plate 1 the necessary distance to maintain the channel.

Additional advantages of the invention are that the weight of the device is not greatly more than the weight of the so-called rubbing bricks heretofore used. There is a conservation of stone material because the adjustment mentioned obviates throwing away large pieces of abrasive block. Furthermore, the basic mechanism of the device is conserved for when the stones are completely worn out they may be removed and new stones applied to the plate 11.

In Figs. 4 to 6 is shown another form of the invention in which a rotary movement is obtained from a power source. In this case there is provided a rotary supporting plate 31 which is annular in form and coupled to a hub 33 through a flexible coupler 35 made of flexible material such as rubberized layers of fabric. Means for fastening the coupler to the supporting plate 31 are shown at 37. The hub 33 consists of a flanged and hollow rotary shaft 39 to which is threaded a hollow flange 41. These clamp the inner periphery of the flexible coupling 35. The head 41 carries an outlet water nozzle 43 which receives water from the hollow shaft 39.

The hollow shaft 39 is driven to rotate from a known type of driving head 45 shown in Fig. 6 having a handle 47 and a flexible rotary chain drive 49 leading from a suitable source of rotary motive power, such as from a gasoline power unit. The inlet 4 for the drive 49 also serves as a handle. The heads such as 45 are ordinarily also provided with a water connection 51 which supplies water through a suitable interior packing gland to the hollow shaft 39. The details of the drive 49, head 45 and water connection 51 to the hollow shaft 39 need not be further described here, because apparatus of this type is known and available for driving other devices requiring a

water feed. Inserted in the water line 51 at the head 45 is a water valve control 6.

The supporting plate 31 will be seen to be provided with adjustable but normally stationary supports 53 held by lock nuts 55 and carrying at their outer ends a rotary trowel 57, the trowel being thus spaced and carried by the supporting plate 31. A circular protective edge 59 is employed in connection with spiral arms 61. The arms 61 terminate in a central hub 63 in which is a hole 65. The nozzle 43 extends into the hole 65 but short of the outer surface of the trowel 57. Substantial space exists between the end of the nozzle 43 and the hole 65, to accommodate the relative movement permitted by the flexibility introduced by the flexible disc 35.

Numeral 67 indicates a rotary supporting or face plate having suitable recesses 69 into which are set abrasive stones 71, the latter also including holding thimbles 73 for threadably receiving studs 75. The studs hold the stones 71 to the plate 67. The studs 75 pass slidably through the rotary supporting plate 31 and on the other side are provided with movement-limiting heads 77. The shapes of the stones are shown in Fig. 5 and their thicknesses in Fig. 4. They are thick enough so that their lower surfaces 25 are below the surface 27 of the rotary trowel 57.

Operation of this form of the invention is as follows:

The desired rotation is in the direction shown by the arrow A in Fig. 5, that is, with the curved forms of the trowel arms 61 presenting their concavities or pocket shapes in the direction of motion so that comminuted sludge material tends to have its centrifugal motion counteracted by a centripetal action. Thus the region formed between the stones 71 and below the trowel surface 27 forms recesses in which sludge (made by the grinding of the stones) is conserved. After turning on the engine, the operator presses the rotating head so that the stones 71 abrade the desired surface, water having been turned on at valve 6 in the desired amount to exude from the nozzle 43 as shown at 8 (Fig. 6). After a substantial amount of abraded sludge is worked up, more pressure is applied to the handles 4, 47 and head 45 so that the surface 27 is pressed flush with the surface 25, thus causing the trowel 57 to smooth out the sludge and press it into the voids opened by the stones 71. After a given region has been finished, the operator moves to an adjacent one and continues the operations.

The flexible connector 35 is a refinement for the purpose of making easier the alignment of the device; that is, the operator needs not level it accurately against the surface with this flexible connector because it seeks its own level. However, the device may be made without such a flexible connector, the driving connections between the plate 31 and the hub 33 being rigid as hereinafter indicated.

It is to be understood that, if desired, the device may be driven from a rotary head which does not supply water, in which event the water is applied to the surface by the operator by means of a separate nozzle or brush. This method of feeding water is sometimes even desirable where a water-head is incorporated, if the device is so high that providing the pressure head necessary for water delivery becomes impracticable.

As stated, the purpose of the edge portion 59 of the trowel 57 is to surround the stones 71 with a metallic guard to prevent the stones from breaking off upon impact at corners or the like. This guard has the effect of limiting the closeness with which corners of a structure may be entered, and for the purpose of finishing such corners the device of Figs. 1–3 may be used; or the alternative construction shown in Fig. 7 may be used. In the latter case the trowel 57 is made with the hub 63 and with arms 61. However, the arms are terminated at 79 and no guard portion 59 is used. With such a rimless rotary dresser, corners may be entered, but it needs to be operated with more care so that the stones are not broken or chipped by impact.

In Figs. 8 and 9 is shown another form of the device in which like numerals designate like parts. In this case, there is, for example, a rigid connection between the rotary supporting plate 31 and the hub 33. This form of the invention also shows its application to the use of abrasive star wheels 81. The face plate 67, in this case, carries metal (aluminum, for example) blocks 83, instead of the stones 71. These blocks in turn carry supporting pins 85 located across sockets 87 in the blocks 83. Each pin carries a plurality of freely rotary, renewable, hardened star wheels 81. These star wheels roll on the concrete surface under medium pressure and function to provide a faster but coarser dressing than the stones 71. The operation is the same as the device shown in Figs. 4–7, extra pressure being used to force down the trowel 57 when a smoothing action is desired. Such pressure places surface 27 flush with the rolling tangent of the star wheels. In this form of the invention, the rim 59 may also be left off.

It is intended that the metal blocks 83 with their star wheels shall be interchangeable with the stones 71 of Figs. 4 and 5 or of Fig. 7.

As to the flexible coupling 35 (Figs. 4–6), there may be substituted a flexible joint in the drive shaft 39.

After operations are finished upon a concrete surface with any of the forms of the invention, the sludge which has been trowelled into place in the voids dries and forms a much whiter (crystalline) surface upon the structure than is obtained by simply permitting the structure to stand or by covering it with cement (without opening the voids).

The character of the stones 71 and 15 is that of any good block type abrasive, such as silicon carbide or the like. The angular velocity of the head is variable and may be made to suit circumstances of engine speed, available drives, etc. For example, from 200 to 1000 or so revolutions per minute has been found satisfactory.

It is to be understood that the rotary form of the device may also be driven from hydraulic, pneumatic or electric apparatus, such as is often available to contractors in their ordinary building operations.

Another feature of the invention is the use of segmental stones. Heretofore, rubbing stones have been made up in one large stone. In the present case, the stones are made more economically in smaller pieces, the conserving channels being obtained by separation.

It will be understood that the invention is applicable to smoothing other walls, for example masonry, brick, plaster and the like, although its primary use is for monolithic concrete.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in the above

constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

We claim:

1. Finishing apparatus comprising a movable support, spaced abrasive elements resiliently connected thereto, a non-abrasive trowel element rigidly connected to said support intermediate said spaced abrasive elements, whereby pressure applied to said support will force the trowel element into engagement with the surface upon which the abrasive elements move.

2. Finishing apparatus comprising a rotary support, spaced abrasive elements resiliently connected thereto for relative axial movement, a non-abrasive trowel element rigidly connected to said support intermediate said abrasive elements, whereby pressure applied to said rotary support will, while rotating, force the trowel element into rotary engagement with the surface upon which the abrasive elements move.

3. Finishing apparatus comprising a movable support, spaced abrasive elements resiliently connected thereto, a non-abrasive trowel element rigidly connected to said support intermediate said spaced abrasive elements, whereby pressure applied to said support will force the trowel element into engagement with the surface upon which the abrasive elements move, and means attached to the support for directing water upon said surface where the abrasive elements act.

4. Finishing apparatus comprising a movable support, at least one abrasive element resiliently connected thereto, a non-abrasive trowel element rigidly connected to said support adjacent to said abrasive element, whereby pressure applied to said support will force the trowel element into engagement with the surface upon which the abrasive element moves, and means attached to the support for directing water upon said surface where the abrasive element moves.

5. Finishing apparatus comprising a rotary support, spaced abrasive elements resiliently connected thereto for axial movement, a non-abrasive trowel element rigidly connected to said support intermediate said abrasive elements, whereby pressure applied to said rotary support will, while rotating, force the trowel element into engagement with the surface upon which the abrasive elements move, and means attached to the support for directing water upon said surface where the abrasive elements act.

6. Finishing apparatus comprising a movable support, spaced abrasive elements resiliently connected thereto, a non-abrasive trowel element rigidly connected to said support, said trowel having a portion intermediate and a protective portion around said spaced abrasive elements, whereby pressure applied to said support will force the trowel element into engagement with the surface upon which the abrasive elements move.

7. Finishing apparatus comprising a rotary support, spaced abrasive star-wheel elements resiliently connected thereto for axial movement, a non-abrasive trowel element rigidly connected to said support intermediate said star-wheel elements, whereby pressure applied to said rotary support will, while rotating, force the trowel element into engagement with the surface upon which the star-wheel elements move.

8. Finishing apparatus comprising a movable support, at least one abrasive element having a resilient connection therewith, a non-abrasive trowel element rigidly connected to said support and located adjacent said abrasive element, whereby pressure applied to said support will force the trowel element into engagement with the surface upon which the abrasive element moves, said resilient connection normally withholding the trowel away from said surface.

9. Finishing apparatus comprising a rotary support, spaced abrasive elements resiliently connected thereto for relative axial movement, a non-abrasive trowel element rigidly connected to said support intermediate said abrasive elements, whereby pressure applied to said rotary support will, while rotating, force the trowel element into rotary engagement with the surface upon which the abrasive elements move, said trowel element having a pocket shape concave in the direction of motion to exert a centripetal gathering action on abraded material.

10. Finishing apparatus comprising a rotary support, spaced abrasive elements resiliently connected thereto, a non-abrasive trowel element rigidly connected to said support intermediate said abrasive elements whereby pressure applied to said rotary support will, while rotating, force the trowel element into engagement with the surface upon which the abrasive elements move, attached means for directing water upon said surface as the abrasive elements act to detach abraded materials, said trowel element having a spiral face concave in the direction of rotation to exert a centripetal action upon the mortar formed by the water and abraded materials.

MILTON H. BIRGER.
CALVIN D. JOHNSON.