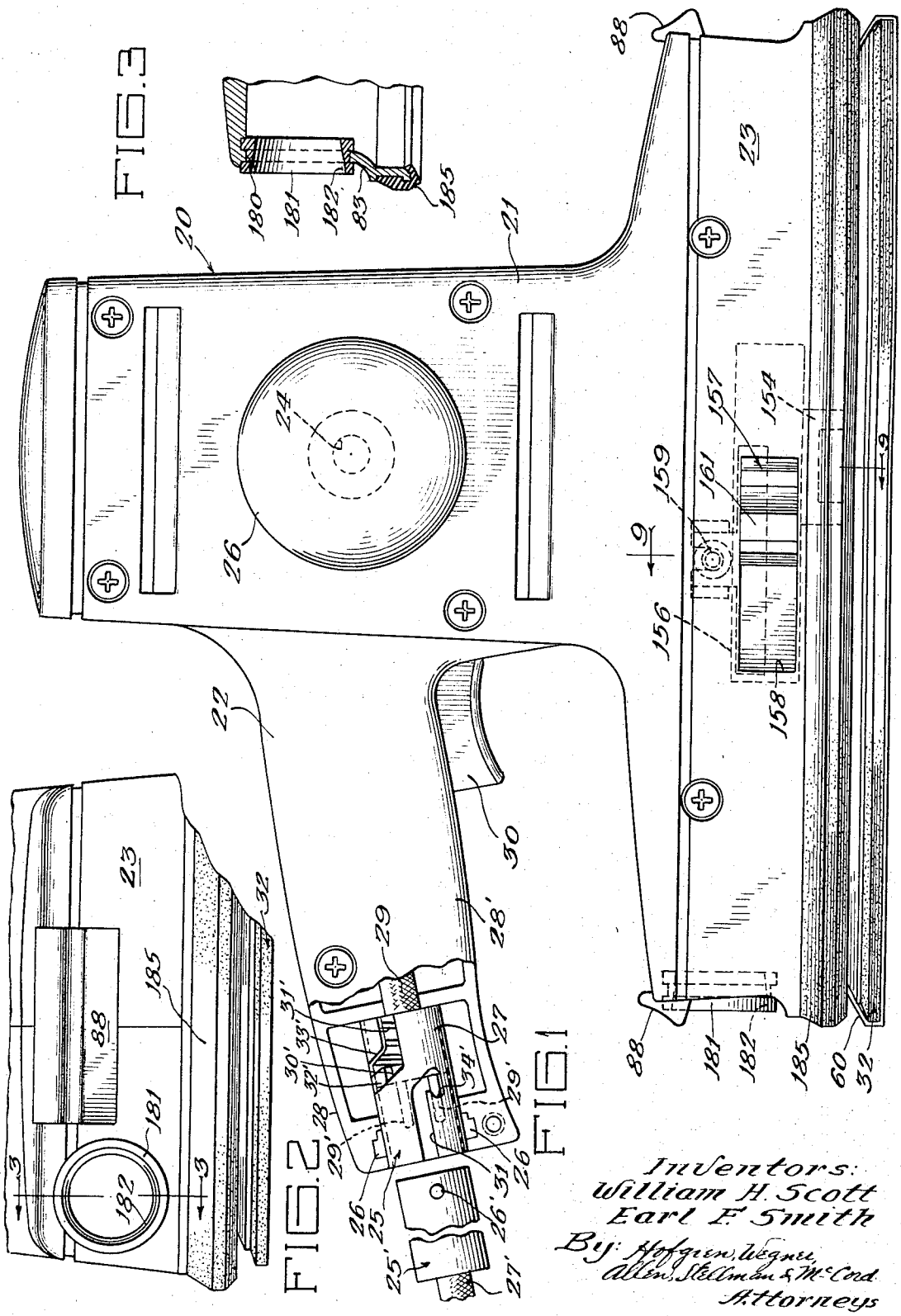
April 2, 1968 W. H. SCOTT ETAL 3,375,616

DUAL MOTION SURFACE-DRESSING MACHINE

Filed Jan. 11, 1965 3 Sheets-Sheet 1



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DUAL MOTION SURFACE-DRESSING MACHINE

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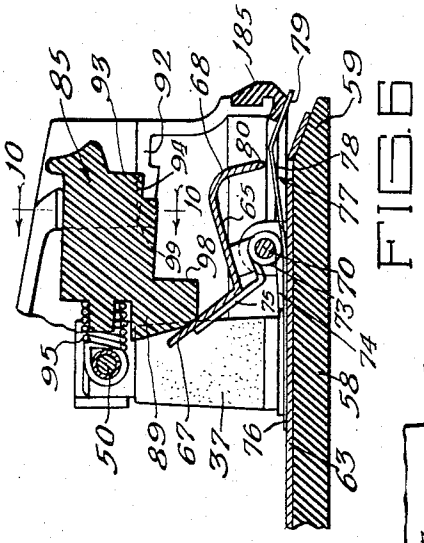


FIG. 6

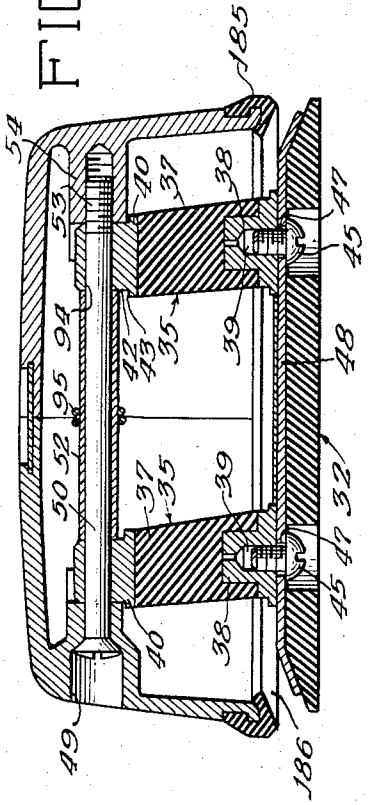


FIG. 5

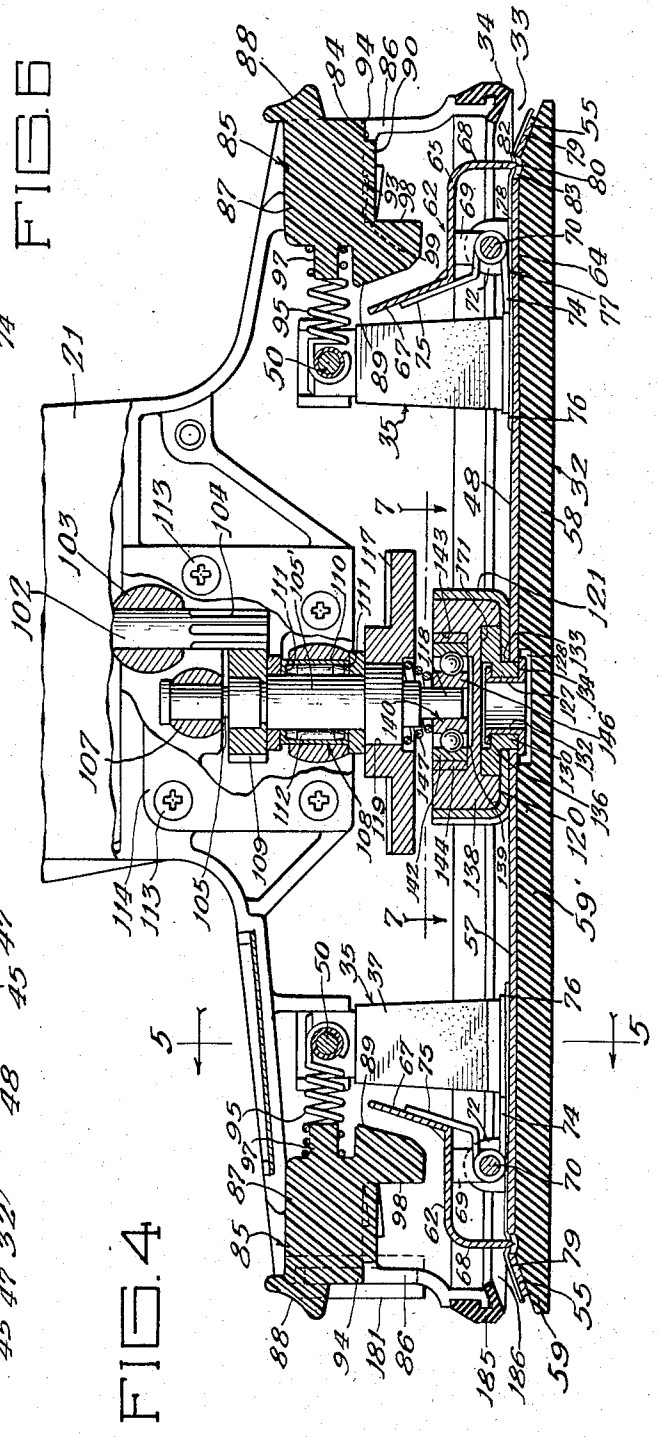


FIG. 4

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DUAL MOTION SURFACE-DRESSING MACHINE

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FIG. 7

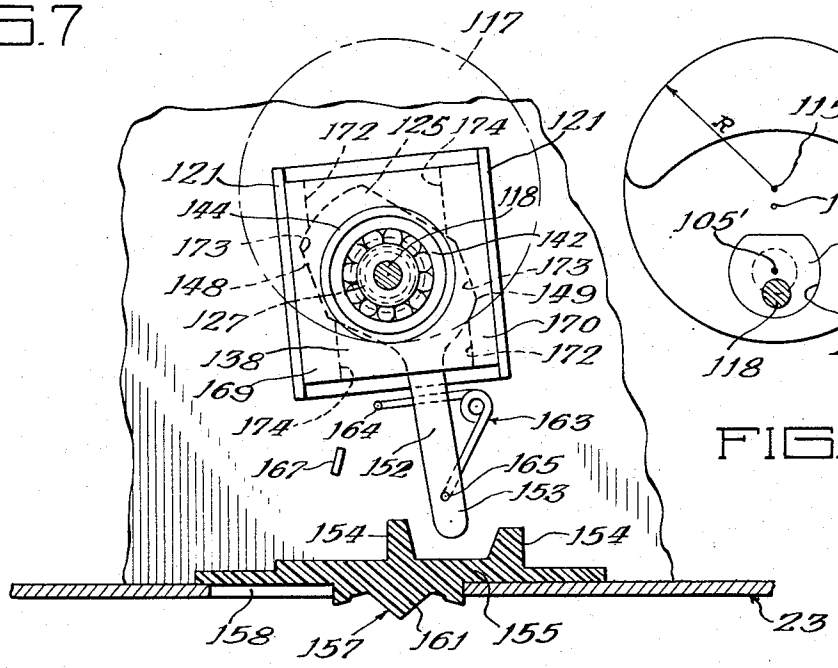


FIG. 11

FIG. 8

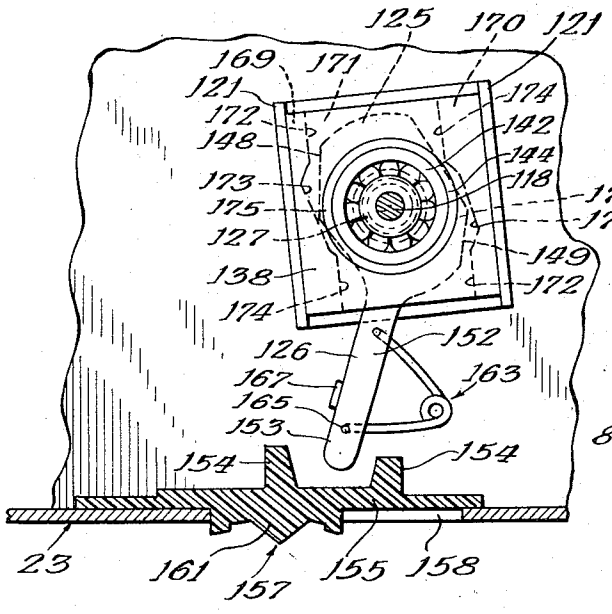


FIG. 9

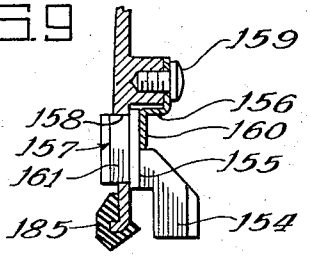
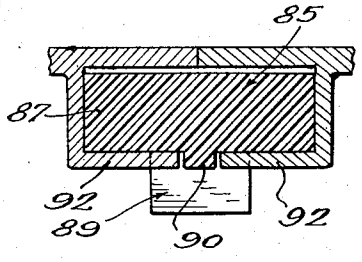


FIG. 10



United States Patent Office 3,375,616 Patented Apr. 2, 1968

3,375,616

DUAL MOTION SURFACE-DRESSING MACHINE

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Filed Jan. 11, 1965, Ser. No. 424,715
7 Claims. (Cl. 51—170)

ABSTRACT OF THE DISCLOSURE

A surface-dressing machine is provided which has an externally actuated member for converting the motion of the surface-dressing member from reciprocating motion to orbital motion. The machine also has externally actuated members for locking or unlocking the sand paper or the like to the machine. The housing is designed in relation to the surface dressing platen that suction inside the housing will draw dust into and through the housing. A means is provided between the driving means and the surface-dressing platen for reducing the ill-effects of misalignment of the drive pin therebeween. A novel mechanism is provided for converting the rotary motion of the driving means to either reciprocating motion or orbital motion of the surface-dressing member.

This invention relates to power operated surface-dressing machines and more specifically to an improved dual motion surface-dressing machine.

Currently surface dressing machines are generally capable of performing either only reciprocating motion of the surfacing plate or only orbital motion of said plate. One such machine is capable of performing both motions, but the change from one motion to another necessitates stopping the machine and inserting a special tool to effect a changed mechanical relation, such for instance that reciprocating motion can be changed to orbital motion or the reverse. This system of conversion from one motion to another is inefficient, is time consuming and is somewhat expensive, i.e., requiring special tools.

In addition, to make current surface dressing tools operate substantially dust free requires the positioning of a special vacuum shroud over the machine, which shroud stands away from the machine making it impossible to effectively work flush with corners, walls or other obstructions. The shrouds, being esentially of a stiff material, vibrate in such a way that dust and other foreign matter on the work surfaces are agitated and stirred up ahead of the tool, making the attempt to reduce the dust ineffective.

Presently available surface dressing machines also have complex means for effecting the insertion of the strips of abrasive material into the housing for locking in position on the plate. These relatively complex means do not provide any method for guiding the strip of material into a position to be clamped and as a result the ends of the strip of material often curl, bend and crack, becoming almost impossible to line up in position to be clamped to the plate.

It is, therefore, a principal object of this invention to overcome the above noted disadvantages of the prior art and to provide a surface-dressing machine having improved features throughout.

It is also a principal object of this invention to provide an improved surface-dressing machine having selectively available different motion patterns for the surface-dressing member.

It is another principal object of this invention to provide an improved surface-dressing machine having a self contained dust removing feature.

It is still another principal object of this invention to provide a surface-dressing machine having an improved sheet material inserting and retaining mechanism.

And it is still another important object of this invention to provide a sheet material backing member that will not deteriorate or disintegrate with moisture.

Still another object of this invention is to provide an improved mounting principle for the surface-dressing member which will permit flush sanding into corners and other close surface discontinuities.

A further object of this invention is to provide an improved surface-dressing mechanism wherein surface-dressing motion patterns can be changed while the surface-dressing mechanism is in operation.

A still further object of this invention is to provide an improved bearing mounting wherein discrepancies from the normal angular relationship between the plane of the surface-dressing member and the axis of the driving shaft lying perpendicular to the plane of said member can be tolerated.

Another object of this invention is to provide an improved balancing of the forces between the driving portion of the mechanism and the surface-dressing member for better operation of the machine.

And another object of this invention is to provide an improved means for guiding the end of a strip of material into position to be clamped to the base plate assembly.

And still another object of the invention is to provide an improved housing mounted device for locking the sheet material clamping member in the open position for more efficient reception and removal of the sheet material.

These and other objects, features and advantages of the invention will be apparent from the following detailed description taken in connection with the acompanying drawings, in which:

FIGURE 1 is a side elevational view of the improved surface-dressing machine;

FIGURE 2 is a partial rear elevational view of the surface-dressing machine of FIGURE 1;

FIGURE 3 is a sectional view taken along lines 3—3 of FIGURE 2;

FIGURE 4 is a sectional view taken on a plane along the longitudinal centerline of the surface-dressing machine and showing some parts in full;

FIGURE 5 is a sectional view taken along lines 5—5 of FIGURE 4;

FIGURE 6 is a partial view in section similar to the right hand portion of FIGURE 4 but with parts in another operative position;

FIGURE 7 is a sectional view taken along the lines 7—7 of FIGURE 4;

FIGURE 8 is a sectional view similar to FIGURE 7 but with the parts in a different operative position;

FIGURE 9 is a sectional view taken along the line 9—9 of FIGURE 1;

FIGURE 10 is a sectional view taken along the lines 10—10 of FIGURE 6; and

FIGURE 11 is a sectional view taken along the line 7—7 of FIGURE 4 but looking upwardly.

As shown in the drawings for purposes of disclosure, the invention is illustrated and embodied in a dual motion surface-dressing machine having a housing with a motor for driving a surface-dressing member. A means is provided for giving the surface-dressing member either a reciprocating motion or an orbital motion. A motion selecting means is mounted on the outside of the housing which can be operated between two positions, in one position the surface-dressing member is driven with an orbital motion and in another position the surface-dressing member is driven with a reciprocating motion.

A sheet of abrasive material can be attached to the

surface-dressing member by a novel guiding means and clamping means. The clamping means is mounted on the top surface of the surface-dressing member and the strip of material to the surface-dressing member. The guiding means is carried by the top surface of the surface-dressing member in coacting relationship with the clamping means such that releasing the clamp means permits the guiding means to move into a position to guide the end of a strip of material into position to be clamped to the surface-dressing member. The surface-dressing member has a novel resilient pad which is adapted to be molded or shaped for use with a backing member of the surface-dressing machine and is of such a nature that moisture will not deteriorate the pad. The pad presents a surface with a high coefficient of friction to the back of the sheet of abrasive material which holds the sheet against creeping relative to the pad.

Mounting on the housing for actuation from outside the housing is a clamp release means which is adapted to engage with and release the clamping means upon inward movement of said clamp release means. The clamp release means includes means for holding the clamping means in a released position.

To keep the work surface free of dust and other airborne foreign matter, a self contained system is provided which includes a novel relationship between the edge portions of the surface-dressing member and the edge portions of the housing such that when a pressure differential is provided between the inside of the housing and the surface surrounding the edges of the surface-dressing member, air will be drawn into the housing close to the work surface in such a way as to bring dust and other airborne foreign particles into the housing for disposal.

Referring now to the drawings wherein similar reference numerals will refer to similar parts throughout the several views, a dual motion surface-dressing machine or sander **20** is shown having a housing or body **21** to which is integrally formed a handle **22** outwardly extending from one side thereof and a hollow inverted rectangularly shaped bottom portion **23** formed on the lower part of said body. A knob **26** may be screwed into any one of three treaded openings **24** provided in the three walls of the housing that do not support the handle **22**. For certain types of sanding jobs its becomes necessary or important to use both hands, one on the handle **22** and the other on the knob **26**. In this way the sander can be turned or pressure applied in any desired direction. The ability to position the knob **26** in any one of three locations adds to the flexibility of the tool.

The handle **22** has a plug **25** secured therein by means of protruding lugs **26** on the casing **27** being gripped between the two mating side halves **28, 28'** of the handle. A wire **29** extends from the plug **25** to a switch actuated by an on-off trigger **30** mounted on the handle **22**, the wire then continues from the switch to the motor, not shown, mounted in the housing or body **21**. The plug **25** has a bayonet slot **31** formed in the wall of the casing **27** for receiving a coacting lug **26'** on the side of a mating plug **25'** carried by an extension cord **27'**. A plurality of prongs **29'** are electrically connected with the wire **29** through an insulated base **30'** within the casing **27**. A spring **31'** acts against the one end of the casing **27** and against the insulated base **30'** for urging the outwardly extending lugs **32'** on the sides of the base **30'** against the forward ends of slots **33'** formed in the rearward portions of the wall of the casing **27**. The mating plug **25'** has recesses for receiving the prongs **29'** on the plug **25** when the lug **26'** on said plug **25'** is aligned with and moved in the bayonet slot **31** in the casing **27** against the urging of the spring **31'**. The spring **31'** is depressed as the mating plug **25'** is inserted until the lug **26'** can be turned and seated in the locking portion **34'** of the bayonet slot **31** whereupon an electrical connection is established to the switch on the tool.

With this construction of the plug **25** it is possible to provide one extension cord **27'** for many different hand tools, such as drills, saws, different types of sanders and the like. Instead of the inconvenience of several cords that must be wrapped around the tools for storage and often create problems of shorting at the junction of the cord with the tool due to continuous flexing in use and storage, the new connection makes it possible to more easily store the tools; shorts created by the flexing at the junction of the tools are eliminated and the number of cords required for two or more tools is reduced to a minimum.

Inasmuch as it is one of the objects of this invention to provide a surface-dressing machine with an output means mounted relative to the housing of the machine in a manner that permits surface dressing or sanding flush into corners and other surface discontinuities, a novel relationship is provided between overlapping edges of the housing and of the surface-dressing member making it possible to reduce to a minimum the spacing between said edges so that the movement of the surface-dressing member will not interfere with the housing and yet said surface-dressing member will sand flush into corners. The minimum spacing of the edges also contributes to another important feature of the invention which will be referred to hereinafter. The surface-dressing member or rectangularly shaped base plate assembly **32** is resiliently supported within and in slightly overlapping relationship to the opening **33** defined by the edges **34** of the hollow inverted bottom portion **23** of the housing by means of four elongate resilient legs or supports **35**. Each leg or support **35** has a tapered round body **37** made of rubber or similar resilient material which at one end is molded around or secured to a stepped ferrule **38** internally threaded at **39** and at the other end is secured to a ferrule **40** having a stepped down body **42** forming a shoulder **43** with a transverse aperture **44** passing through said body **42**. A screw **45** passes through an aperture **47** in a back plate **48** of said surface-dressing member or base plate assembly **32** and into the threaded aperture **39** of the leg or support **35** for securing the base plate assembly **32** to the supports **35**.

As shown in FIGURE 5, one side wall of the bottom portion **23** of the body or housing **21** has a recess **49** into which is inserted an elongated screw **50** passing through the apertures **44** in the supports **35** which supports are held spaced apart by a sleeve **52** encircling the screw **50**. The screw **50** has threads **53** thereon threaded into a lug **54** in the opposite side wall of the bottom portion **23**. A pair of screws **50**, as shown in FIGURE 4, are used to secure the four legs or supports **35** to the housing **21**. Therefore, the surface-dressing member or base plate assembly **32** is resiliently connected to the housing through the four legs or supports **35**.

The base plate assembly **32** has the back plate **48** formed of sheet material of substantially rigid construction with a peripheral edge portion **55** extending completely around the back plate and being angularly disposed downwardly and outwardly with respect to the main body portion **57** thereof. A pad **58** formed of hard rubber or polyisoprene is bonded or attached as by gluing to the back plate **48** and has a peripheral portion **59** with a downwardly and outwardly tapered top surface angularly disposed with respect to the main body portion **59'** of said pad **58**. The angled surface of the peripheral edge portion **59** of the pad lies at substantially the same angle as the edge portion **55** of the back plate **48** so that a substantially uniform angularly disposed edge portion is formed about the outer periphery of the surface-dressing member or base plate assembly **32**. The pad **58** is made of a material such as hard rubber that can be molded to shape with the tapered top surface on the edge portion **59**. The material from which the pad is made has a high coefficient of friction which coacts with the back surface of a sheet of abrasive material **60** to resist creeping the the material relative to the pad. In this way the

sheet of material does not become loose on the pad and every motion of the pad will be motion of the abrasive sheet relative to the surface being treated.

In order to affix the strip of material or a sheet of sandpaper **60** to the base plate, novel means is provided which not only serves to guide the end of the strip or paper into a proper position, but also cooperates with a clamping means to grip and secure the strip or paper in a locked position for use. The clamping means comprises a pair of identical spaced apart clamp members **62** mounted on the back plate **48** at oppositely disposed end portions **63**, **64** of said base plate assembly **32**. Each clamp member **62** has a body portion **65** with an upwardly disposed actuator arm **67** and a downwardly disposed gripping portion **68**. A pair of mounting tabs **69** extend downwardly from said body portion **65** and are pivotally engaged by a pin **70** extending parallel to the back plate **48** through upwardly disposed mounting lugs **72** attached to said back plate **48**. A spring **73** is wrapped around said pin **70** with one end **74** engaging with the back plate **48** and with the other end **75** engaging with the back of said actuator arm **67** for urging the gripping portion **68** of said clamp member into engagement with said back plate.

Attached at one end **76** to the back plate **48** substantially midway between each pair of laterally spaced legs or supports **35** is a guide member **77** having an elongate body portion **78** and an integrally formed angularly disposed end portion **79** lying, in one position, against the back of said back plate **48** and substantially conforming to the contour of said back plate. The guide member **77** is made of resilient material such as sheet spring steel and is formed in such a way as to urge the free end portion **79** into a position away from said back plate **48** as is shown in FIGURE 6. The force of the spring **73** on the clamp member **62** is stronger than the resilience of the said guide member **77** such that the force of spring **73** urges the clamp means against the body portion **78** of the guide member **77** for flattening said guide member **77** against the back of said back plate. The gripping portion **68** of the clamp means **62** has a pair of spaced apart prongs or points **80** projecting downwardly therefrom and being adapted to align with and extend through the apertures **82** in the body portion **78** of the guide member **77** and the apertures **83** in the back plate **48**.

In order to actuate the clamp means and guide means without removing the base plate from the housing or without the use of some other special tools, a release means is provided on the housing **21** which is actuated from outside the housing and which is positioned relative to the clamp means in such a way that the clamp means will be moved out of clamping position and the guide means will move into guiding position relative to the housing. The release means has a locking feature which acts to hold the release means and the clamp means in released position so that the strip of abrasive material or sheet of sandpaper can be inserted or removed from the base plate with ease. A separate release means is provided for each clamp means and each release means comprises a release member **85** having a body portion **87** slidably disposed in an aperture **84** in the end wall **86** of the bottom portion **23** of the housing. The release member **85** also has an externally extending actuator portion **88** and a contact portion **89** disposed in the housing in close proximity to the actuating arm **67** of the clamp **62**. Sufficient clearance must be provided between the contact portion **89** and the actuating arm **67** to permit the base plate assembly to which the clamp member **62** is attached to move freely and without interference through the orbital or reciprocatory motions required of the machine. A rib **90** is formed on said body portion **87** and is adapted to slide between the spaced ledges **92** carried by the walls of the housing for guiding the movement of the release member **85**. An offset or stop **93**, spaced inwardly from the wall **86**, is formed in the ledges **92** in said housing in a position to be engaged by the front corner or edge **94** of the body portion **87** of said release member **85**. A compression spring **95** has one end encircling a lug **97** on the back portion of the release member **85** and has the other end connected to the sleeve **52** around the elongated pin or screw **50**.

The spring **95** urges the release member **85** into the inactive position of FIGURE 4 with the surface **98** of the contact portion **89** engaging with the edge **99** of the ledges **92**. An operator pressing inwardly against the releasing member **85** compresses the spring **95** and engages the contact portion **87** with the actuating arm **67** of the clamp **62** to pivot the clamp about the pin **70** so as to release the gripping portion **68** from the guide member **77** and from the plate **48**. The front corner **94** on the release member **85** will engage with the stop **93** on the housing to hold the clamp in the released position.

As the clamp member **62** is pivoted, the gripping portion **68** will move upwardly whereupon the free end portion **79** of the guide **77** will also move upwardly away from the back plate **48** and from its edge portion **55** until said free end portion **79** comes into contact with the edge **34** of the housing **23**. In this position the guide **77** forms an open ended slot into which the end of a strip of material **60** can be easily inserted. The guide **77** and the back plate **48** being relatively smooth permits ready ingress of the strip of material **60** without interference into a position between the guide **77** and back plate **48** such that movement of the clamp member into engagement with the guide **77** will clamp the strip of material **60** to the base plate assembly.

With the releasing member **85** locked in the clamp member released position of FIGURE 6, an upward movement of the actuating portion **88** of the releasing member **85** into an inactive position with the surface **98** of **92** permitting the spring **95** to drive the releasing member **85** into an inactive position with the surface **98** of the contacting portion **89** in engagement with the ledges **92**. The spring **73** on the clamp **62** will force the prongs **80** on the gripping portion **68** through the apertures **82** in the guide member **77** and will depress the guide member against the end portion of a strip of material and against the back plate **48** for clamping the material in position on the base plate assembly. The prongs **80** will bite into the strip of material as they pass through the aligned apertures **82** and **83** in the guide and back plate, respectively, providing a further positive locking action for the strip of material to the base plate assembly.

The surface-dressing machine has a motor which is connected with the surface-dressing member or base plate assembly in such a way as to provide the surface-dressing member or base plate assembly with either reciprocating motion or orbital motion deepnding upon the selection made by the operator. The change from one motion to the other can be accomplished with means provided on the outside of the housing. The motion changing means can be activated while the surface-dressing member or base plate assembly is in motion and is interconnected with parts of the connection between the motor and the base plate assembly by a novel means for effecting the change. An improved system for balancing the forces in the driving means for the surface-dressing member or base plate assembly is provided which produces a better operating surface-dressing machine.

Within the housing **21** is mounted a conventional motor (not shown) having a vertically disposed shaft **102** mounted in a bearing **103** and having a set of gear teeth **104** formed in the lower end portion thereof. A stub shaft **105** is mounted by means of bearings **107**, **108** in said housing and has fixed thereon a pinion gear **109** meshing with said gear teeth **104** on the shaft **102**. The bearing **108** has a sleeve **110** with inturned ends **111** for retaining a multiplicity of elongate cylindrical bearing pins **112** which are adapted to roll about a longitudinal axis which is parallel to the longitudinal axis of the shaft **105**. This type of bearing **108** has particularly good char-

acteristics for maintaining a predetermined alignment of a rotating shaft supported by said bearing.

The bearings **103**, **107** and **108** are nested in appropriate cavities in the housing **21** which together with the motor shaft end **104**, pinion **109** and shaft **105**, are enclosed by cover plate **114** screwed into place by screws **113**. Fixed on the lower part of the shaft **105** to rotate therewith is a weighted disc member **117** which is rotatable in a plane perpendicular to the axis **105'** of the shaft **105**. The disc member **117** is circular in shape and has an insert **116** keyed in an aperture **119** offset from the true center **115** of the disc member **117** and located on a radius between the true center of the disc member **117** and one peripheral edge portion thereof. The shaft **105** is connected to the insert **116** of the disc member with the axis of the insert coinciding with the axis of the shaft **105** so that rotation of the shaft **105** rotates the disc member **117** about the common axis **105'** of both the shaft **105** and the insert **116**. The disc member **117** will be rotating as an eccentric and will create a counterweight effect with the center of the counterweight mass acting at a point called the center of gravity **117'** located on the diameter of the disc member passing through the true center **115** of the disc member and the axis of rotation of the insert **116**.

A driving pin **118** is fixed to the insert **116** of the disc member **117** and extends downwardly therefrom with the longitudinal axis of the pin **118** offset from the longitudinal axis of rotation of the insert **116**. The longitudinal axis of the pin **118** lies on the common diameter of the disc member which diameter passes through the true center **115** of the disc member, the axis **105'** of the insert **116** (or axis of rotation of the disc) and the center of gravity or the point **117'** at which the counterweight mass effectively acts. The just enumerated location of the pin **118** creates an inbalance in the disc member which is balanced by the location of the center of the mass of the counterweight on the opposite side of the axis of rotation of the disc member. The counterweight mass provides an excess of counterbalancing forces over what is needed for counterbalancing the weight of the pin which will be described more fully hereinafter. In addition, the excess of weight of the disc member **117** produces to some extent a flywheel effect for the drive pin **118** and as such produces extra forces for keeping the mechanism operating once it has been started in motion.

Rotation of the shaft **105** by the motor will rotate the disc member **117** about the axis **105'** of the insert **116** of the disc member with the pin **118** subscribing a circle about the axis of the shaft, which motion of the pin **118** is described as orbital motion.

Substantially centrally disposed longitudinally and laterally of the base plate assembly and connected to the back plate **48** is a channel shaped track member **120** opening upwardly away from said plate assembly and having an axis parallel to the sides **121** of the channel, which axis is disposed a few degrees off the axis lying transverse to the longitudinal axis of the base plate assembly. The few degrees deviation from the true transverse axis has been arrived at by experience wherein it has been found that the reciprocatory motion of the base plate assembly **32** will be along the longitudinal axis of the housing if the connecting means is skewed slightly from the transverse axis.

The channel or track **120** has an enlarged part **125** of a lever **126** pivotally mounted centrally of said track by means of a hollow rivet **127** passing through the part **125** of the lever, the track **120** and the back plate **48** of the base plate assembly. A slight cavity **128** is formed in the pad **58** so that a turned over end **129** of the rivet **127** will not bulge the pad downwardly. The part **125** of the lever **126** has a struck down portion **130** around the aperture **132** which struck down portion **130** serves as a bearing and as a support for the rivet **127** as it extends through the openings **133**, **134**, respectively, in the channel or track **120** and the back plate **48**. A collar **136** is formed on the upper part of the rivet **127** for holding the lever and channel assembled on the back plate **48**. The channel or track **120** is rigidly attached to the back plate against movement relative thereto by means of welding or any other appropriate attaching means.

A block **138** is shaped to fit into and slide relative to the channel or track **120** and has a recess **139** in the top surface into which is seated an antifriction ball-type bearing **140**. The outer race **142** of the bearing **140** is cushioned from the wall **143** of recess **139** by a sleeve formed of a thin layer of rubber or other resilient material **144** which can be press fit between said race **142** and said wall **143** or bonded to said race **142** and to said wall **143** in any well known fashion. The pin **118** on the disc member **117** extends into the inner race **146** of the bearing **140** whereby the orbital movement of the drive pin **118** is transmitted to the block **138**. A compression spring **147** surrounds the pin **118** between the disc member **117** and the inner race **146** of the bearing **140** to urge the block into nesting relation within the channel or track **120**.

The sleeve **144** being positioned between the surface dressing member or base plate assembly and the pin **118** of the driving means permits slight skewing or misalignment between the plane of the surface dressing member or base plate assembly and the axis of the pin **118** lying perpendicular to said plane which helps reduce the side load on the bearings of the shaft **105**, adding to the life of the whole machine. The sleeve **144** also absorbs a small amount of the shock effect caused by the surface dressing member or base plate assembly encountering an unexpected obstruction that might under certain conditions have stalled or sparked the motor. The sleeve **144**, therefore, is an important feature contributing to the improved operation of the sander.

Earlier in this description, reference was made to an excess of balancing forces created by the counterweight mass of the disc member **117** over the weight necessary to balance the weight of the drive pin **118**. Since the block **138** travels with the pin **118** when the lever **126** is in either of the two positions which creates one or the other of the two motions of the surface dressing member, it is considered to be part of the pin **118** so that the weight of the block **138** and the weight of pin **118** added together are considered to be acting at a radius equal to the radius of the circle generated by the pin **118** rotating around the axis of the shaft **105'**. The weight of the disc **117** acting at the center of gravity **117'** of the disc is considered to be acting at a radius extending between the axis **105'** of rotation of the disc **117** and the center of gravity **117'**. The centrifugal forces created by the weight of the disc **117** acting through the center of gravity of the disc is used to substantially balance the centrifugal forces created by the sum of the weights of the pin **118** and block **138** acting at the radius of rotation of the pin **118** about the axis **105'** on the side of the axis **105'** opposite to the side bearing the center of gravity of the disc. The illustration of the center of gravity of the disc **117** as being at point **117'** is exemplary only. The center of gravity can be varied along the diameter of the disc passing through the center of rotation **105'** and the true center of the disc **115** to any point desired depending on the results of the computations of forces needed to balance a particular force carried on the pin **118**.

During the orbital motion of the surface dressing member, the block **138** is locked to the channel and to the surface dressing member such that the weights of those elements are added to the weights of the block and pin to create the forces on the one side of the center of rotation **105'** of the disc. During reciprocating motion of the surface dressing member the forces are considered to be both rotating and reciprocating and as such cannot

be completely balanced. Since it is not possible to completely balance the forces of the system for both reciprocating motion and for orbital motion, it has been concluded to compromise such that the weight of the disc acting through the center of gravity of the disc balances in large measure the extremes of forces of the surface dressing member, channel, block and pin during both orbital and reciprocating motions. Actually there is an excess of weight on the surface dressing member side of the balance, which weight acts as a form of flywheel which contributes added forces to the abrasive surface being moved over a work surface. This flywheel effect improves the effective power given to the abrasive surface which results in more sanding, abrading or polishing by the machine.

The motion selection means comprises the lever **126** with the enlarged part **125** having a pair of substantially parallel surfaces **148, 149** diagonally offset on opposite sides of the pivot axis of the rivet **127**. The surfaces **148, 149** are substantially planar throughout the length thereof and at each end curve slightly about the corners **175** forming obtuse angles with other non-functional edge surfaces of the lever. The parallel planes of the surfaces **148, 149** are intersected by the longitudinal axis of the lever arm **152** at acute included angles. The lever arm **152** has an end portion **153** extending outwardly into position to be contacted by one or the other of two abutments **154** projecting from the body **155** of a slide member **157** carried in an elongated slot **158** in the wall of the hollow portion **23** of the housing **21**. The two abutments **154** on the slide member **157** are spaced apart from each other and from the end portion **153** of the lever arm **152** a distance at least great enough to permit the movement of the lever **126** created by the orbiting or reciprocating of the surface-dressing member or base plate assembly attached to said lever **126** without movement of the slide member **157**. The connection between the slide **157** and the lever **126** is sometimes referred to as a lost motion connection. The slide **157** is held in sliding position on the housing by means of a clip **156** fastened by means of a screw **159** to the housing and having an overlapping arm **160** engaging the body of the slide to permit the slide **157** to traverse the slot **158** from one extreme to the other. A raised outwardly extending grip portion **161** on the body **155** is adapted to be engaged for urging the slide one way or the other within the slot **158**. A scissors type spring **163** having one end seated in an opening **164** in the black plate **48** and having another end seated in an opening **165** in the outer end portion **153** of the lever urges the lever **126** into one position against a stop **167** on the back plate **48** for reciprocating or straight line sanding or into another position remote therefrom for orbital sanding.

The block **138** is formed of relatively heavy material as for example iron-nickel powdered metal, oil impregnated for lubricating purposes. The iron-nickel powdered metal forms a block of high density material creating a concentrated mass which can be used to supplement or balance the forces for the various motions contemplated by the machine. The lower portion of the block **138** has a hollowed out portion consisting of a pair of walls **169, 170** contiguous with the sides of the block and extending downwardly from a planar center surface **171** within the hollowed out portion of the block. The inner surface of the wall **169** within the hollowed out portion has a planar portion **172** parallel to the outer surface of the wall **169** of the block, an angled recessed portion **173** and another planar portion **174** parallel to the outer surface of the wall **169** but spaced therefrom a distance greater than the spacing between the first planar portion **172** and the outer surface of the wall **169**. The wall **170** has the same inner surface configuration but reversed end for end; that is, for instance, the surface **174** on wall **169** is opposite to surface **172** on the wall **170**. The angled recessed portions **173** lie in planes substantially parallel to each other and intersect the longitudinal axis of the block at acute included angles. The acute included angles between the planes of the surfaces of the recesses **173** and the axis of the block substantially equal the acute included angles between the planes of the surfaces **148, 149** of the lever **126** and the axis of the lever arm **152**. The length of the surfaces **148, 149** on the lever **126** is substantially equal to the length of the surfaces of the recesses **173** such that in one position of the lever **126** the surfaces **148, 149** are seated in the recesses **173** so as to lock the block **138** to the channel or track **120** and to the surface dressing member or base plate assembly **32** as is best shown in FIGURE 7.

With the surfaces **148, 149** of the lever arm **126** seated in the recesses **173** of the hollowed out portion of the block **138**, the orbital motion of the drive pin **118** is transmitted directly to the block **138**, channel **120** and base plate assembly **32** so that orbital movement of the surface dressing member relative to the housing results.

Movement of the slide **157** engages abutment **154** with the end **153** of lever **126** to pivot the lever **126** to remove the surfaces **148, 149** from the recesses **173** in the hollowed out portion of the block, as shown in FIGURE 8, whereupon the block can now reciprocate relative to the channel or track 120. The corners **175** on the diametrically opposite surfaces **148, 149** protrude into the recesses **173** and provide limits for the movement of the block relative to the channel by said corners contacting intermediate portions of the surfaces **173** of the recesses. However, these limits are never reached in practice because the extent of movement transmitted to the block by the pin **118** is less than the distance between the extremes of movement of the block.

With the block **120** able to reciprocate relative to the channel or track **138**, the orbital motion of the pin **118** will impart only a longitudinal component of motion to the channel **120** and to the surface-dressing member or base plate assembly **32** to produce in effect straight line longitudinal motion in the surface-dressing member. The block sliding in the channel or track **120** along the axis of the channel will give no component of movement to the surface-dressing member or base plate assembly **32** in the direction transverse to the longitudinal axis of the housing.

It can be readily seen, therefore, that movement of the slide **157** from one position to another will change the motion of the surface-dressing member or base plate assembly **32** from reciprocating motion to orbital motion or back again without stopping the motor and without the need for special tools or fixtures.

With the motion selection means positioned with the arm **152** of the lever **126** bearing against the stop **167** as shown in FIGURE 8, the surfaces **148, 149** will be out of engagement with the recesses **173** and the block **138** will transmit reciprocating motion to the surface dressing member along the longitudinal axis of the housing. To now change the type of motion of the surface-dressing member to orbital motion, the actuator **157** is moved to the right to pivot the lever **126** in a counterclockwise direction. The corners **175** on the opposite ends of the planar surfaces **148, 149** on the enlarged portion **125** of the lever **126** engage with the surface of the recesses **173** in the hollowed out portion of the block and slides the block a short distance relative to the channel or track **120** toward the actuator **157** until the surfaces **148, 149** align with and nest in the recesses **173** in the block **138** as the lever **126** is resiliently urged into that position by the spring **163**. The spring **163** urges the enlarged portion **125** of the lever into the nested position of FIGURE 7 and due to the way the spring **163** is anchored to the back plate of the surface-dressing member, the urging action of the spring is attempting to rotate the coacting block **138** in the channel or track **120** about the axis of the rivet **127** which further acts to lock the block to the channel and accordingly to the surface-dressing member. The orbital motion of the pin **118** is now transmitted directly to

the block, channel and surface-dressing member to provide orbital motion to said surface-dressing member relative to the housing.

From the above, it can be readily seen that movement of the actuator in either direction will be possible even with the surface-dressing mechanism in operation. The surfaces **148**, **149** on the lever **126** being locked to the surfaces of the recesses **173** for orbital movement of the surface-dressing member and being free of the surfaces of the recesses **173** for reciprocating movement of the surface dressing member with the corners **175** of the ends of the surfaces **148**, **149** of the lever acting as camming surfaces to make contact with portions of the recesses **173** to move the block **138** relative thereto until proper nesting between the portion **125** on the lever **126** can take place with the hollowed out portion of the block.

As stated hereinbefore the surface-dressing member or base plate assembly **32** is positioned partially within the open side of the bottom portion **23** of the housing **21** so as to permit flush sanding with the machine; it was also indicated that the positioning of the base plate at a minimal distance from the edge of the housing had another purpose, namely, to provide a restricted passage through which air could be drawn into the housing, bringing dust and other loose foreign particles along with it. A vacuum source is connected through an opening directly into the hollow base of the housing such that drawing air from the housing through said opening will draw the air and dust into the housing through the minimal opening around the edge of the plate. Drawing the air into the housing around the edge of the base plate, being close to the work surface, and being angled upwardly therefrom will provide a maximum of surface and air cleaning at the point of maximum air and surface contamination, thereby producing the best cleaning results. Accordingly, the hollow bottom portion **23** of the sander or surface dressing mechanism has an aperture **180** through one end wall **86** into which aperture is fitted a collar **181** having an outwardly tapered wall portion **182** therein. A source of vacuum can be connected to the housing through a hose, not shown, having a tapered nozzle on one end which is adapted to be wedged into the tapered portion **182** of the collar **181** in the housing **23**. Around the bottom edge **34** of the hollow portion **23** of the housing **21** is attached a resilient bumper **185** which has a tapered edge portion **186** facing inwardly of the housing. The tapered edge of the bumper completely encircles the periphery of the housing and conforms to some extent to the taper on the outer peripheral edge portions **55**, **79** of the base plate assembly and guide member **77**, respectively. The base plate assembly **32** is positioned in the opening **33** in the housing in an overlapping relationship with respect to said tapered bumper **185**. The spacing between contiguous peripheral edge portions **55** of the base plate **32** and the tapered portion **186** of the bumper **185** is as small as it can be made without interference between the surface dressing member or base plate assembly **32** and herein this is accomplished by the bevel on the surface dressing member and the corresponding bevel on the housing with the centerline of the opening therebetween forming an angle of approximately 45° so as to permit movement of the surface-dressing member a distance greater than the transverse distance between the two overlapping surfaces when the surface dressing member is at normal or rest position. With the angle of the centerline between the two overlapping surfaces of the housing and surface-dressing member varying from a few degrees up to a few degrees from the 90° position, the horizontal distance between the surfaces will be greater than the horizontal travel of the surface dressing member relative to the housing. The opening between the beveled surfaces can be smaller than would be required if the surfaces were at right angles to each other such that an opening, being the result of the angled relationship between the beveled surfaces, does not limit the relative movement of the overlapping surfaces. With the angularly disposed, overlapping beveled surfaces, it is possible to have a smaller opening therebetween for the same horizontal movement of the surface-dressing member. The angled overlapping surfaces between the housing and dressing member also results in a minimum opening variation during operation of the mechanism. The minimum opening variation is important in producing a surface-dressing mechanism which has an efficient and effective amplitude of motion for the surface-dressing member while at the same time keeping the opening between said member and the overlapping housing to a minimum so that a more efficient air flow into the housing will be created when a differential in pressure between the inside and the outside of the housing is produced.

When a pressure differential is created between the hollow bottom portion **23** of the housing by a suction outwardly through the aperture **180**, the relatively small spacing between the tapered portion **186** of the bumper and the tapered portion **55** of the surface dressing member or assembly **32** will make it possible for a relatively large volume of air to be drawn therethrough at high velocity, bringing with it loose dust and other stray particles of contamination lying or floating in and around the vicinity of the surface being treated by the surface dressing member.

The tapering of the edge portions **55** of the base plate assembly **32** permits the edges of the pad to extend outwardly of the opening in the housing to an extent that makes it possible for the edges of the surface dressing member or base plate assembly, when reciprocating or orbiting, to reach out substantially flush with the outer reaches of the bumper, permitting surface treatment to be performed right up to the base of walls or other corner-type obstructions. The tapering of the edge portions **55** also permits the mouth of the opening between the housing and the surface dressing member to be positioned close to the work surface which, together with the fact that the passageway between said housing and dressing member is angled upwardly from said work surface, permits the flow of air to sweep close to the work surface as it passes up the passageway into the housing. The sweep will bring with it a greater volume of dust and starting practically at the moment the dust is released from the work surface by the surface dressing member. A cleaner, more effective work cleaning device results from this angled passageway commencing close to the work surface structure.

From the above description it will be apparent that a surface dressing machine or sander is provided which is capable of providing an improved, externally operated means for converting reciprocating motion of the base plate to orbital motion or the reverse while the machine is in operation. The machine also has novel means for balancing the forces of the driving system for the surface dressing member and includes improved self contained work surface decontamination means. An improved clamping means and guiding means are described for the strip of material or sandpaper including externally actuated release means and locking means whereby the clamp means may be released and held in released position. The base plate of the surface dressing machine is made in a particular way and of a particular material to permit flush sanding with the machine under wet or dry conditions and said base plate is driven with a novel means that allows misalignment of the surface dressing member relative to the driving system without damaging effects on the connection between said surface dressing member and said driving system.

It is to be understood that the present invention is not limited to any specific construction, arrangement or form of the cooperating parts, since it is capable of numerous modifications and changes without departing from the spirit of the claims.

We claim:

1. A surface-dressing machine having a housing, a sur-

face-dressing member, driving means carried by said housing, pin means carried by said housing and being orbitally driven by said driving means, a channel member mounted on said surface dressing member and being disposed generally transverse to the longitudinal axis of said surface-dressing member, lever means pivotally mounted in said channel member, an actuator movably mounted on the housing in position to be engaged by one end portion of the lever means for moving said lever means between two predetermined positions, surface means formed on the other end portion of said lever means, block means movably positioned in said channel member and being engaged by said pin means, and coacting means formed in the lower surface portion of said block means in engagement with said surface means whereby in one position of said lever means the surface means and the coacting means are locked together such that the block means and surface-dressing member will move together with the same orbital movement as the pin means, and in the other position of said lever means said surface means permits the coacting means and the block means to slide relative to the channel member whereby orbital movement of the pin means will impart reciprocating movement to the surface-dressing member.

2. A surface-dressing machine having a housing, a surface-dressing member resiliently carried by the housing, driving means carried by said housing, pin means carried by said housing and being orbitally driven by said driving means, track means carried by said surface-dressing member and having an axis lying generally transverse to the longitudinal axis of the surface-dressing member, lever means mounted on said track means for movement to selected positions relative to said track means, the pivoted end portion of the lever means having a pair of surfaces lying substantially parallel to each other on opposite sides of said pivot, said surfaces lying in planes disposed at an acute angle with respect to the longitudinal axis of the lever means, block means slidably positioned in said track means and being engaged by said pin means, said block means having a coacting means formed therein, said coacting means having a pair of spaced apart wall portions, said wall portions of the coacting means having recesses formed therein with a surface angularly disposed with respect to the wall portions and substantially conforming in size and spacing to the size and spacing of the surfaces on the lever means, one setting of said lever means positioning said surfaces at an angle to the surfaces of said recesses to permit the block means to move relative to said track means whereby orbital movement of the pin means will slide the block means relative to the track means to produce reciprocating movement of the surface-dressing member, and in another setting of the lever means the surfaces will seat in the recesses in the coacting means to lock the block means to the track means so that orbital movement of the pin means will produce orbital movement of the surface-dressing member.

3. A surface-dressing machine having a housing, a surface-dressing member resiliently supporting said housing, driving means carried by said housing, drive pin means carried by said housing and being orbitally driven by said driving means, channel means carried by the top portion of said surface dressing member and extending generally transverse to the longitudinal axis of the surface-dressing member, lever means pivotally mounted on said channel means for movement in a plane substantially parallel to the plane of said surface-dressing member, means movably mounted on the housing and having a lost motion connection with a remote end portion of the lever means for moving said lever means between two predetermined positions, a pair of spaced apart substantially parallel surfaces formed on the pivoted end portion of said lever means, block means movably positioned on said channel means and being operatively engaged by said drive pin means, and coacting means on the block means in overlapping relationship with said parallel surfaces on the pivoted end portion of the lever means, said coacting means comprising spaced apart wall portions on said block means and having longitudinal recesses formed in said wall portions, the base of each recess being angled with respect to said wall portion and being substantially equal in length to the length of surfaces on the pivoted end portion of the lever means, said lever means being set in one position to seat the pair of surfaces on the lever means in the recesses in the block means to prevent movement of the block means relative to the surface-dressing member whereby orbital movement of the drive pin means will impart orbital movement to the surface-dressing member, and said lever means being set in another position with the surfaces on the lever means being out of engagement with said recesses in the coacting means to permit the block means to slide relative to the track means whereby orbital movement of the drive pin means will impart reciprocating movement to the surface-dressing member.

4. A surface-dressing machine having a housing, a surface-dressing member carried by said housing, driving means carried by said housing, pin means carried by said housing and being orbitally driven by said driving means, channel means carried by said surface-dressing member and disposed generally transverse to the longitudinal axis thereof, block means movably positioned on said channel means and having a recess formed in the top surface thereof, bearing means in said recess, a resilient sleeve means bonded between said bearing means and the walls of said recess in said block means, said pin means engaging in said bearing means for transmitting movement of the pin means to the block means, whereby the resilient sleeve will absorb shocks and misalignment from the surface-dressing member, means for selectively locking and unlocking the block means to the channel means for selectively providing reciprocating and orbital motion to the surface dressing member, and means movably mounted on the housing in operative connection with said selectively locking and unlocking means whereby in one position of said movably mounted means said surface-dressing member is driven with a reciprocating motion and in another position thereof said surface dressing member is driven with an orbital motion.

5. In a surface-dressing machine having a housing with a motor mounted therein, a surface-dressing member resiliently carried by the housing, and means between the motor and said surface dressing-member for transmitting motion from said motor to said surface-dressing member, said means comprising pin means operatively connected to said motor, block means carried by said surface-dressing member, a bearing engaged by said pin means, resilient means bonded between a portion of said bearing means and said block means whereby misalignment of the plane of the block means from the axis of the pin means lying perpendicular to said plane will be accommodated by said resilient means, and means movably mounted on the housing operatively connected with said block means whereby selected positions of said movably mounted means will produce either reciprocating motion or orbital motion of said surface-dressing member.

6. A surface-dressing machine having a housing, a surface-dressing member carried by said housing, and a driving system carried by the housing and operatively connected with said surface-dressing member for providing motion for said surface-dressing member relative to said housing, said driving system comprising a motor driven shaft carried by said housing, a disc secured to said shaft for rotation with said shaft about an axis offset from the center of said disc, the weight of said disc acting through a center of gravity removed from said axis of rotation, a driving pin carried by said disc and offset from said axis of rotation of said disc, the axis of said pin lying on the opposite side of the axis of rotation of said disc from the center of gravity of said disc, and a block formed of a high density material movably mounted

on said pin and being slidably disposed in a channel means carried by said surface-dressing member whereby the weight of the pin and block acting at the radius of gyration of the pin about the axis of rotation of the disc is balanced in some measure by the weight of the disc acting through the center of gravity of the disc on the side opposite to the side bearing the pin to produce a compromised balance of forces for the surface-dressing member.

7. A surface-dressing machine having a housing, a surface-dressing member carried by said housing, and a driving system carried by the housing and operatively connected with said surface-dressing member for providing motion for said surface-dressing member relative to said housing, said driving system comprising a motor, a shaft driven by said motor, a disc secured to said shaft for rotation about an axis offset from the true center of said disc, the weight of said disc acting through a center of gravity removed from said axis of rotation, a driving pin carried by said disc and offset from said axis of rotation of said disc, the axis of said pin lying on the opposite side of the axis of rotation of said disc from the center of gravity of said disc, a weighted block movably mounted on said pin, a channel member mounted on said surface-dressing member for movement with said surface-dressing member, said block being slidably mounted in said channel member, and means for selectively locking said block

to said channel member, whereby in said locked position the surface-dressing member, the channel, the block and the pin acting at the radius of gyration of the pin about the axis of rotation of the disc is partially balanced by the weight of the disc acting through the center of gravity of the disc on the side opposite to the side bearing the pin and in the unlocked position the block and pin together with the sliding and reciprocating forces created by the surface-dressing member and the channel are partially balanced by said weight of the disc to produce a compromised balance of forces for the surface-dressing member.

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