

April 14, 1942.

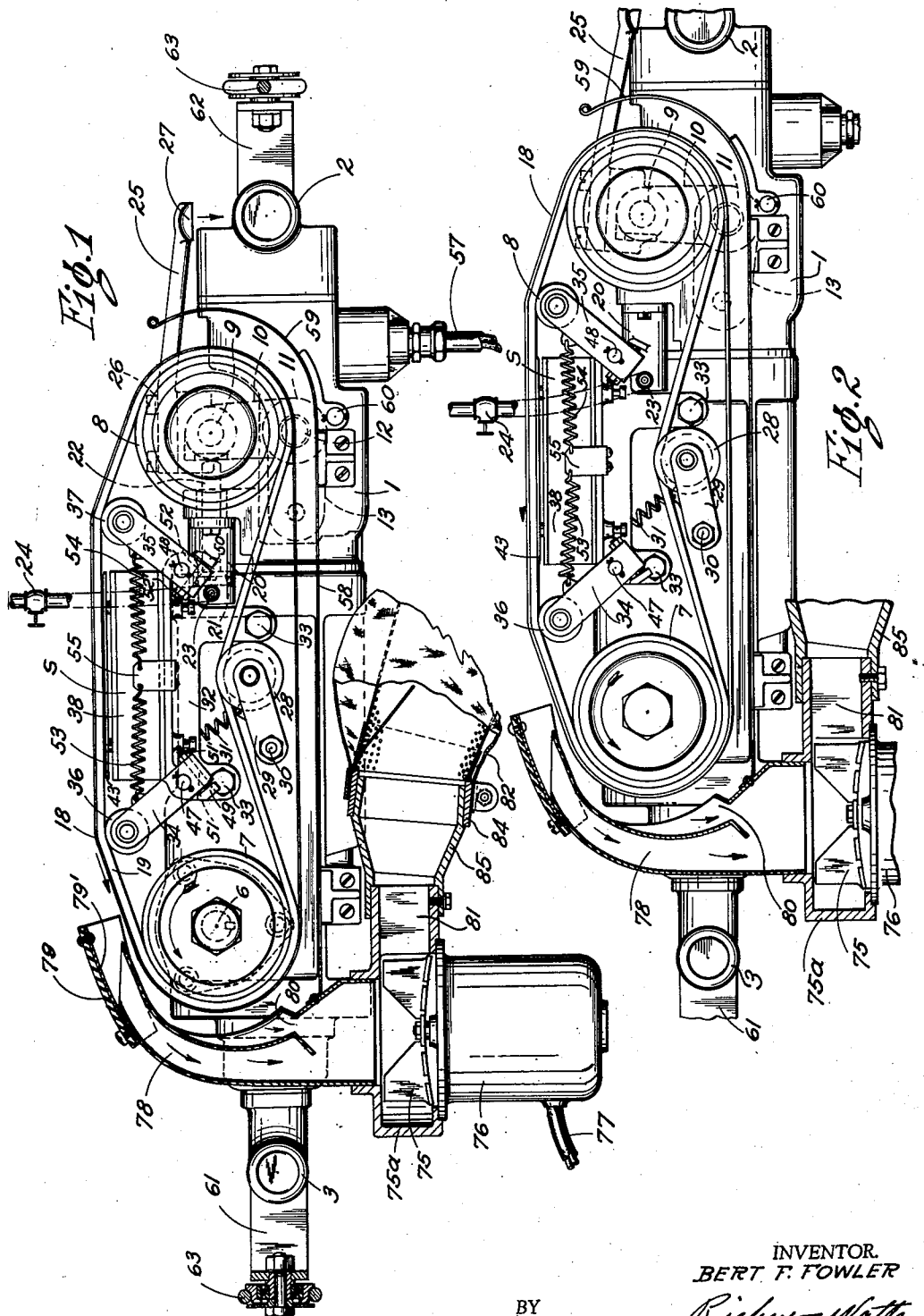
B. F. FOWLER

2,279,782

SURFACE FINISHING APPARATUS

Filed Feb. 12, 1938.

5 Sheets-Sheet 1



INVENTOR.
BERT F. FOWLER

Richey & Watts.
ATTORNEYS

BY

April 14, 1942.

B. F. FOWLER

2,279,782

SURFACE FINISHING APPARATUS

Filed Feb. 12, 1938

5 Sheets-Sheet 2

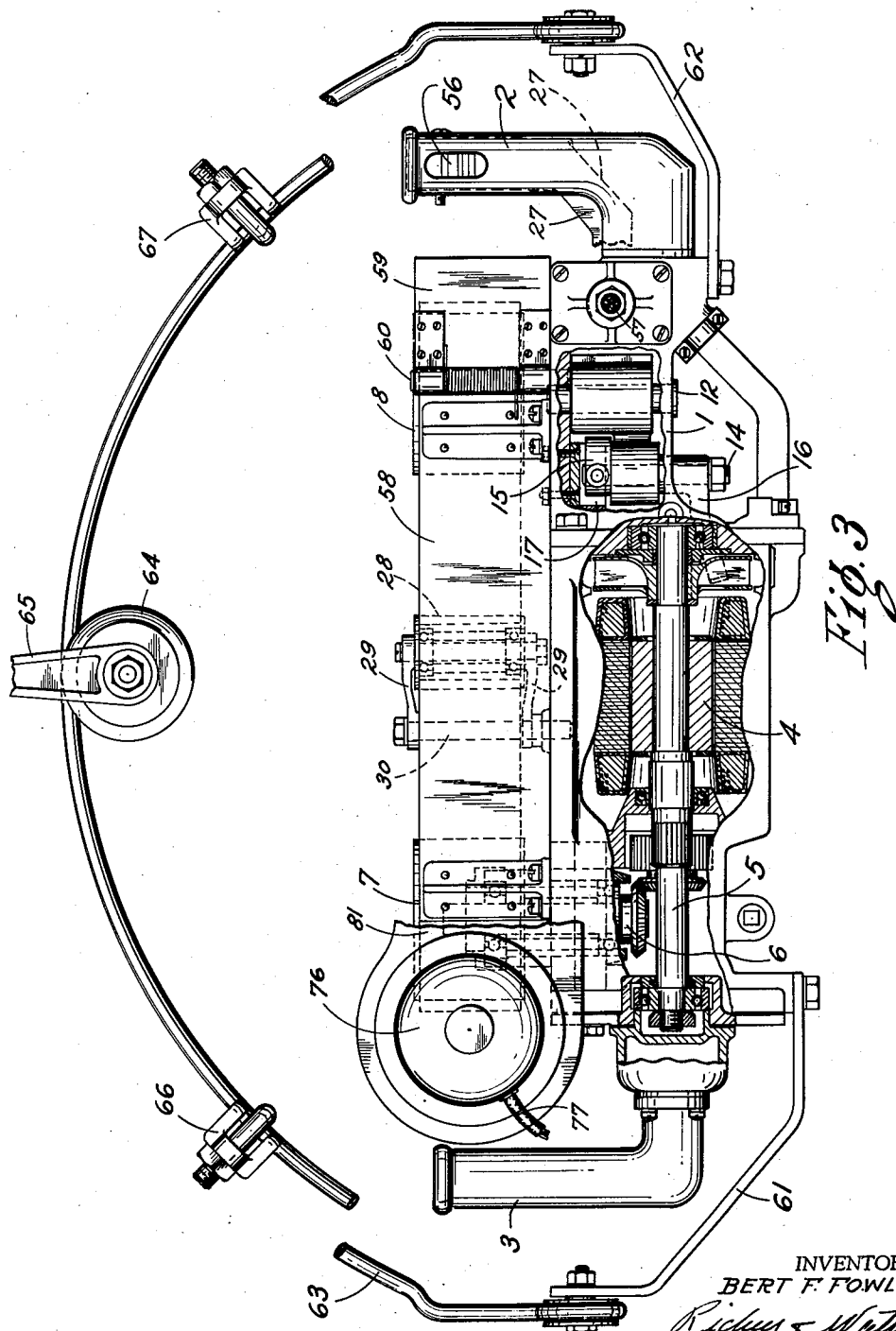


Fig. 3

INVENTOR.
BERT F. FOWLER
Rickey & Watts.
ATTORNEYS

April 14, 1942.

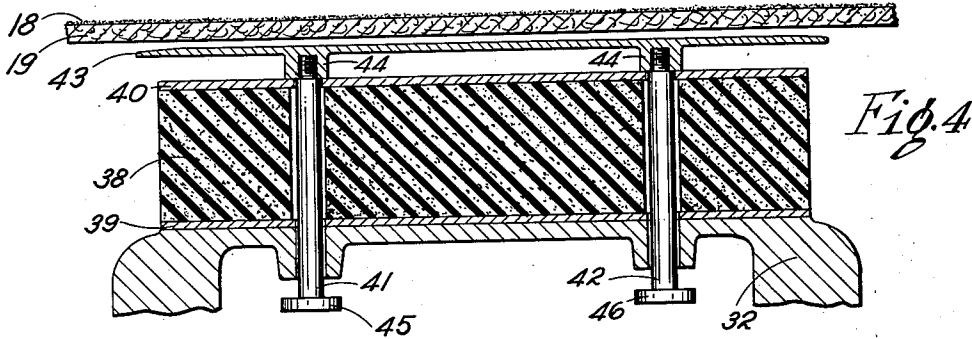
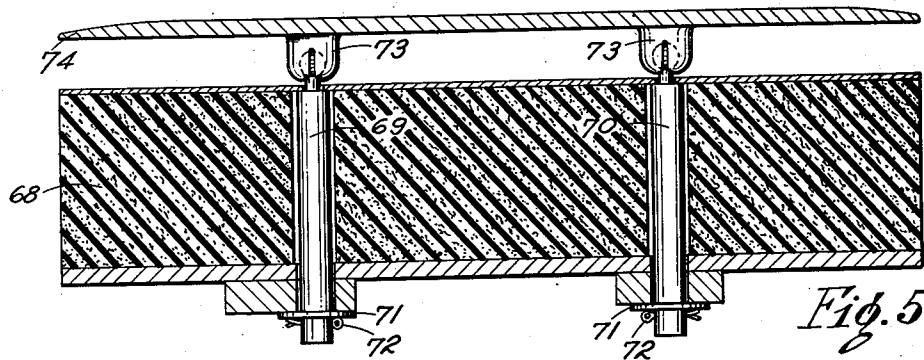
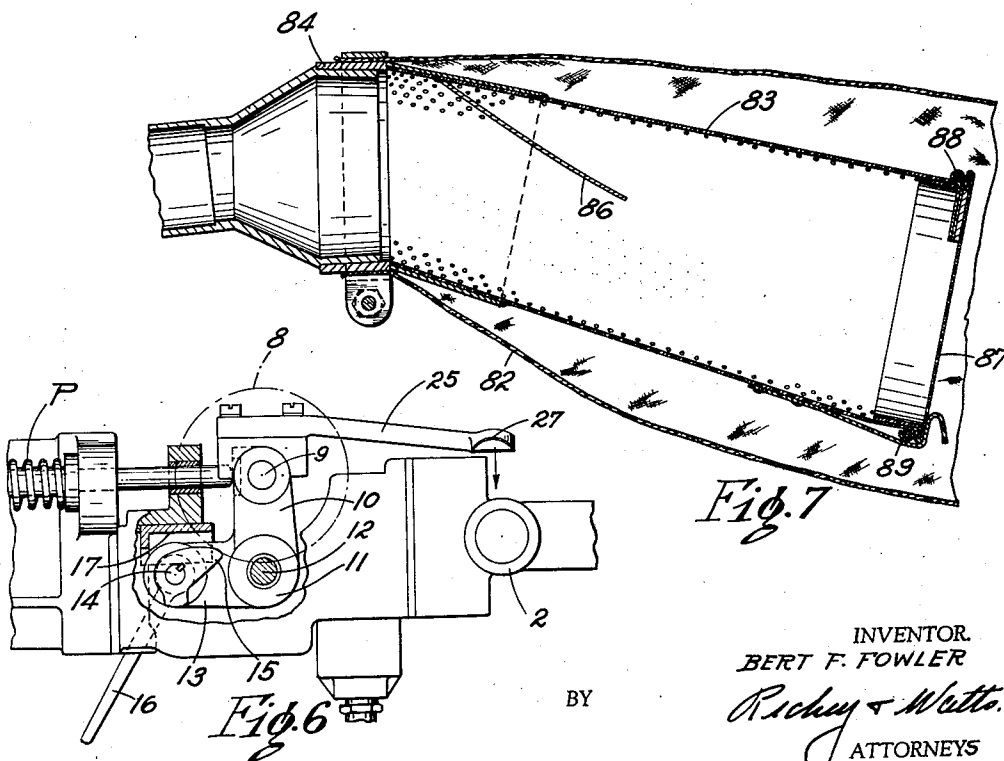
B. F. FOWLER

2,279,782

SURFACE FINISHING APPARATUS

Filed Feb. 12, 1938

5 Sheets-Sheet 3



INVENTOR
BERT F. FOWLER
Rochey & Watts.
ATTORNEYS

BY

April 14, 1942.

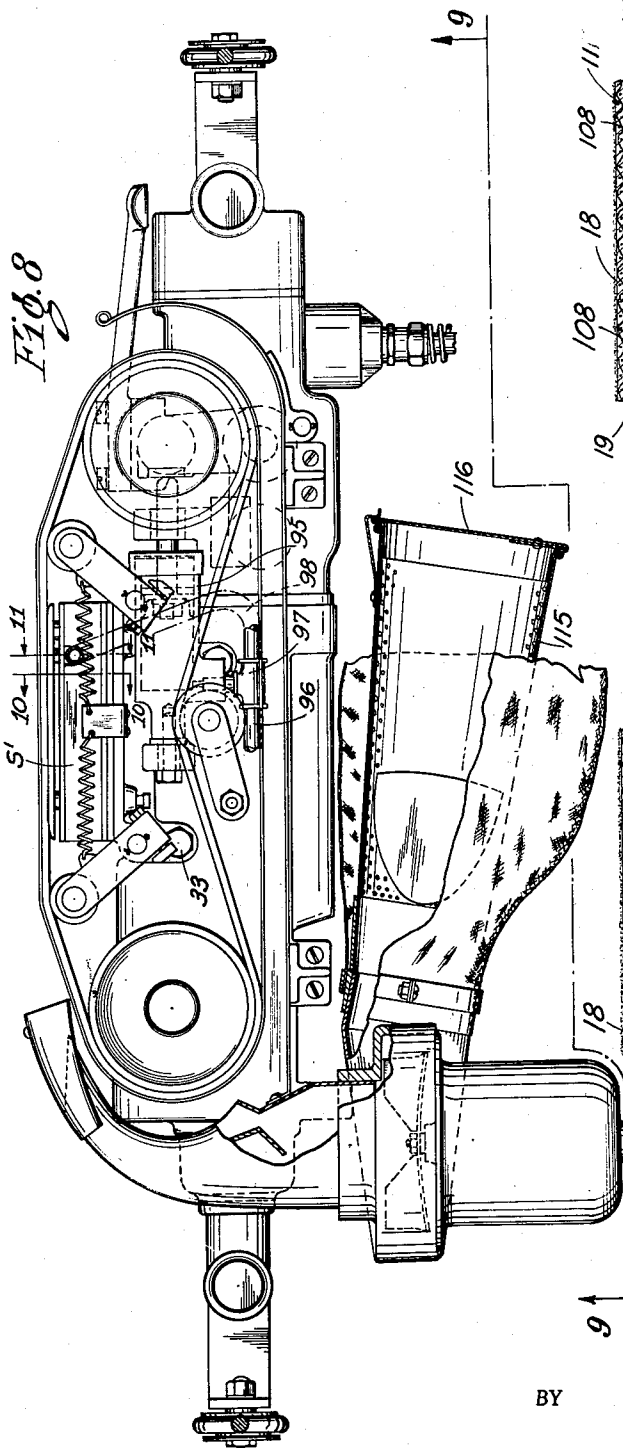
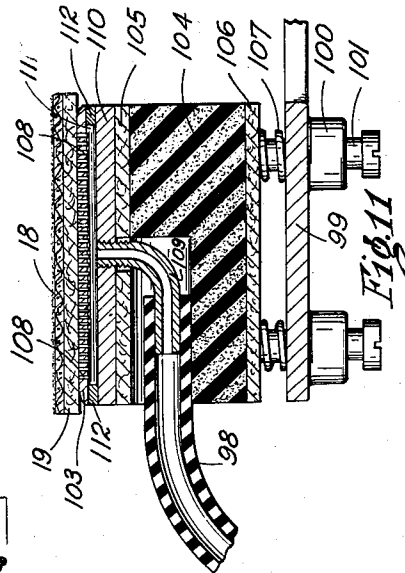
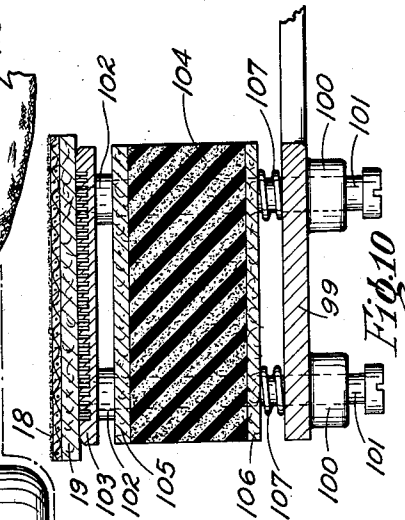
B. F. FOWLER

2,279,782

SURFACE FINISHING APPARATUS

Filed Feb. 12, 1938

5 Sheets-Sheet 4



BY

INVENTOR.
BERT F. FOWLER
Richey & Watto
ATTORNEYS

April 14, 1942.

B. F. FOWLER

2,279,782

SURFACE FINISHING APPARATUS

Filed Feb. 12, 1938

5 Sheets-Sheet 5

Fig. 9

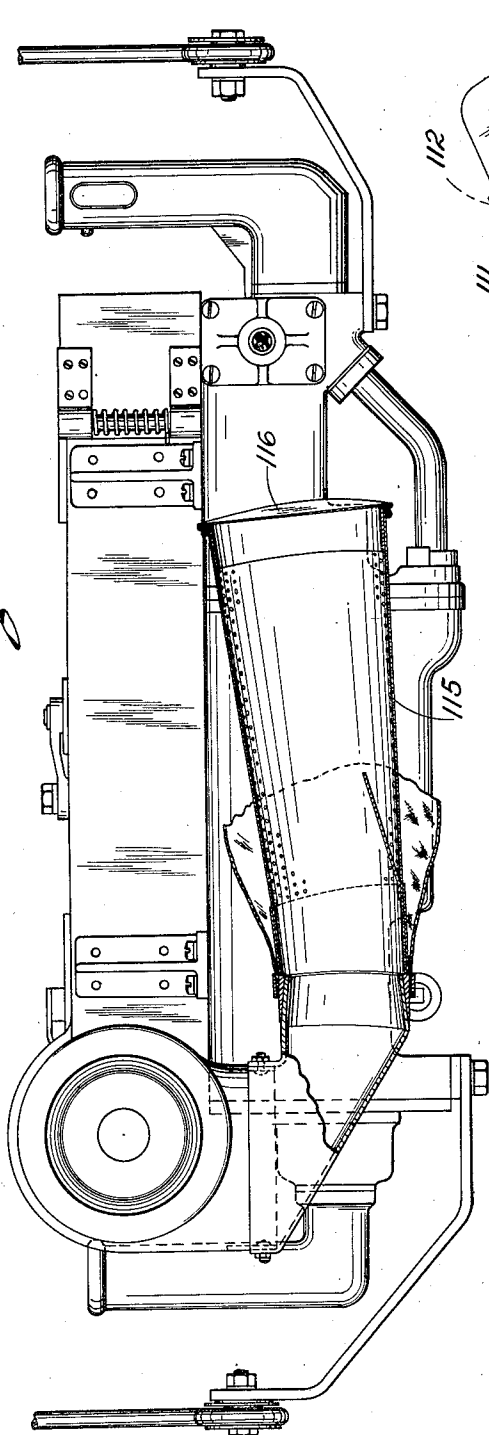
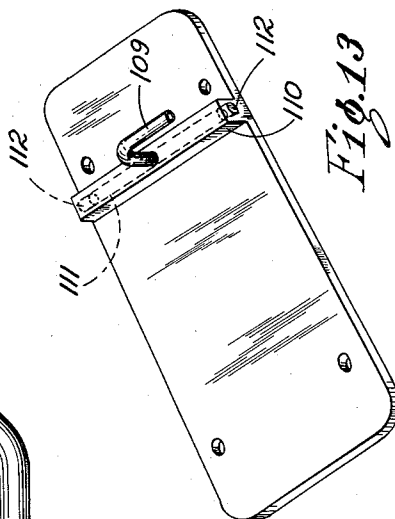


Fig. 13

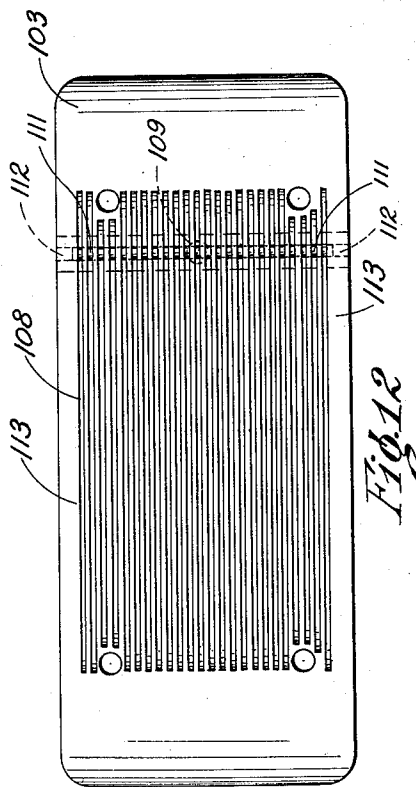


Fig. 12

BY

INVENTOR.
BERT F. FOWLER
Rickey & Watts
ATTORNEYS

UNITED STATES PATENT OFFICE

2,279,782

SURFACE FINISHING APPARATUS

Bert F. Fowler, South Bend, Ind.

Application February 12, 1938, Serial No. 190,254

14 Claims. (Cl. 51—170)

This invention relates to metal surface finishing and more particularly to improvements in portable sanding machines of the endless belt type.

In my co-pending United States patent application, Serial No. 139,406, filed April 28, 1937, which matured as Patent No. 2,199,069, April 30, 1940, I have described and claimed a portable belt sanding machine embodying certain improved features and the present application may be considered a continuation in part of my said co-pending patent application, containing some common subject matter and some new subject matter.

In the surface finishing of metal structures such as automobile bodies, preparatory to applying paint or other protective or decorative coating, prior to my invention, a large amount of hand filing, scraping, etc. has been required. Attempts have been made to provide power driven devices to accomplish the hand finishing operations but without substantial success. It is among the objects of my invention to provide a portable power driven machine which can effectively and economically prepare metal surfaces for painting, which is adapted to surface finish flat, concave or convex surfaces of complex form and which is always under the complete and accurate control of the operator.

Other objects of my invention are the provision of a sanding machine of the type described in which heating and belt friction is reduced to a minimum; the provision of a sanding machine which will not endanger the health of the operator and which includes effective dust and waste material collecting means which will operate on the hot particles of metal which are removed by high speed belt sanding operations; the provision of a belt sanding device in which sanding belts can be removed and replaced quickly with a minimum of effort; the provision of a belt sanding machine for high production operation in which the danger of burning of dust collecting bags is eliminated; the provision of an improved backing shoe for belt sanders or the like whereby a finer surface finish can be obtained; the provision of a high speed, high production metal finishing tool which is completely under the control of the operator at all times and which is adapted to operate economically and hold up under modern high speed continuous production conditions.

My improved sanding machines, as described and claimed herein, have been in use on the regular production line in the body plant of one of the

large automobile manufacturers of this country. They have reduced the cost of metal finishing in this plant by very substantial amounts and have operated successfully for long periods of time in continuous production use. Practically all of the laborious hand filing operations on the bodies have been eliminated by the use of my machines, thus relieving the workmen of the arduous work previously required to give the desired surface finish on the body. It will, of course, be understood that although I have referred particularly herein to the adaptation of my improved sanding machine to the finishing of automobile bodies and the like, it may be used for numerous other purposes where a portable, efficient and extremely sensitive surface finishing machine is required. Its effectiveness is not limited to metal articles but it may be used on any material which is adapted to sanding. A major problem in industry where abrasive action is depended upon for the removal of material is that of occupational diseases of the worker caused by inhaling the dust and particles removed by the abrasive devices. In my invention substantially complete prevention of the dispersion of dust and metal particles into the air is prevented, accurate tests having shown that approximately 95.5% of the material removed, and of the abrasive particles of the belt which are thrown off, may be collected by my improved apparatus.

The above and other advantages and objects of my invention will be seen from the following description of several embodiments thereof, reference being had to the accompanying drawings, in which—

Figure 1 is a plan view, partly in section, of one embodiment of my improved sanding machine shown in position to sand a vertical surface, the driving and sanding belts being illustrated in their free running or idle positions.

Figure 2 is a view generally similar to Figure 1 but illustrating the driving and sanding belts in working position, the inner surface of the driving belt being in engagement with the shoe surface.

Figure 3 is an elevational view, partly in section, taken from the operator's position and illustrating the machine shown in Figures 1, 2 and 6 and its adjustable supporting bail.

Figure 4 is an enlarged fragmentary view of one embodiment of my improved resilient, hard surfaced abrasive belt backing shoe.

Figure 5 is a vertical cross-sectional view, similar to Figure 4, but illustrating a modified form of shoe having a hard surfaced friction or con-

tact plate adapted for substantially universal movement relative to its supporting pins.

Figure 6 is a fragmentary sectional view of the operator's handle for controlling the engagement of the belt with the rigid surface of the backing shoe and illustrating a spring belt tensioner and cam and lever arrangement for releasing the belt tension to permit abrasive belts to be changed.

Figure 7 is an enlarged cross-sectional view of one form of my spark arresting and dust collecting device showing the baffle means for preventing matted waste material from dropping back into the dust collecting fan.

Figure 8 is a plan view generally similar to Figure 1 but illustrating my sanding machine equipped with my improved resilient air cushion shoe.

Figure 9 is a view taken on line 9—9 of Figure 8.

Figure 10 is an enlarged cross-sectional view of my air cushion shoe assembly taken on line 10—10 of Figure 8.

Figure 11 is a view generally similar to Figure 10 taken on line 11—11 of Figure 8.

Figure 12 is a top elevation of the slotted shoe.

Figure 13 is a perspective view of the bottom of my improved air cushion shoe.

Referring now to Figure 1, the illustrated embodiment of my invention includes a main frame and motor housing 1 having handle members 2 and 3 secured thereto at its opposite ends. The driving motor (which is seen in section in Fig. 3) includes a rotor 4 and shaft 5 which is connected by suitable gearing to drive the pulley shaft 6 on which is mounted the belt driving pulley 7. The motor 3 may be of any suitable type. I preferably employ an alternating current motor of the "high-cycle" type in order to obtain the desired power and high belt speed and still retain portability of the apparatus.

The pivotally supported belt pulley 8 is mounted on a shaft 9 which is carried by one arm 10 of a bell crank lever, which may be generally referred to as 11 and which is pivotally supported on the shaft or pin 12 which in turn is carried by the main frame 1 of the machine, as is seen in Figures 3 and 6. The other end 13 of the bell crank lever extends generally parallel to the length of the frame, and when a spring belt tension device is used, as shown in Figure 6, rather than the air cylinder 20 of the apparatus of Figures 1, 2 and 3, carries at its outer end a shaft 14 to which is secured a cam member 15. On the other end of the shaft 14 a handle 16 is mounted. An abutment plate member 17 is secured to the frame 1, as is seen in Figure 6, and is adapted to co-act with the cam 15 to swing the bell crank lever 11 about its pivot shaft 12 to move the pulley 8 toward the pulley 7 when it is desired to compress the spring P to remove a worn abrasive belt and replace it with a new one.

In the machine of Figures 1, 2 and 3, in order to maintain the desired tension on the abrasive belt 18 and the supporting belt 19 I provide a fluid pressure actuated device comprising a cylinder 20 mounted on the frame 1 of the machine. This cylinder, as is shown in Figure 1, contains a piston 21 having a piston rod 22 extending out of the end of the cylinder 20 and adapted to engage the arm 10 of the bell crank lever 11. The cylinder 20 is connected, on the left hand side of the piston 21, to a source of suitable fluid under pressure, such as compressed air, through a pipe

or conduit 23 and a pressure regulating valve 24 (Fig. 2) may be provided accurately to adjust the pressure effective against the piston 21. By adjusting the fluid pressure the force exerted by the piston rod 22 against the crank arm 10 may be controlled and thus the tension on the belts 18 and 19 may be regulated. It will be understood that when the air cylinder 20 is employed the lever 16 and associated parts shown in Figure 6 may be omitted because it is only necessary to release the pressure in cylinder 20 to permit sanding belts to be changed.

A lever arm 25 is secured to the end of the arm 10 of the bell crank 11 as by means of screws 26. This arm 25 extends lengthwise of the body of the machine and has a transversely extending handle portion 27 at its end. This handle 27 extends parallel and adjacent to the fixed handle 2 and is so positioned that the operator can grasp both the handle 2 and the handle 27 simultaneously. Movement of the handle 27 toward the handle 2 will cause the bell crank arm 10 to swing toward the handle 2 and will move the pulley 8 away from the pulley 7, thus increasing the tension applied to the belts 18 and 19. The function and operation of this handle member 27 will be later described.

A driving belt idler pulley 28 is rotatably mounted at the end of a supporting arm 29 which may be pivotally secured to the frame 1 of the machine by the bolt 30. A spring 31 is secured at one end to the arm 29 and at its other end to the frame 1 of the machine. This spring is normally maintained in tension and exerts a force tending to move the pulley 28 and the driving belt 19 inwardly toward the common center line of the pulleys 7 and 8. As is fully described in my above noted co-pending patent application, the provision of the idler pulley 28 permits the separation of the driving belt 19 from the abrasive belt 18 during the entire length of one run between the supporting pulleys, thus greatly increasing the cooling of the belts and giving greater pulley contact between the driving belt 19 and the driving pulley 7.

A bracket 32 is secured to the main frame 1 by bolts 33. This bracket carries one form of my improved resilient shoe member (generally indicated at S) which forms the backing for the abrasive belt, and also supports the arms 34 and 35 which carry the auxiliary supporting rollers 36 and 37 respectively.

The shoe S includes a resilient body portion 38, preferably of sponge rubber or other material having generally similar resilient properties. This sponge rubber is preferably mounted between the metal plate members 39 and 40. Guide pins 41 and 42 extend through suitable apertures in the bracket 32, the plates 39 and 40, and the resilient body 38 and are adapted to have free movement therein. These pins 41 and 42 have threaded connections at their upper ends with the hard surfaced shoe or plate member 43, said shoe member preferably having spacer boss portions 44 which maintain it in spaced relation to the top plate 40 which covers the resilient body 38. The lower ends of the pins 41 and 42 are provided with enlarged heads 45 and 46 to limit the upward movement thereof and thus restrict the upward movement of the hard surfaced shoe or plate 43. From the above description it will be seen that the belts 18 and 19 may have what may be termed substantially universal movement due to variations in pressure of the belt 18 against the work while the pins 41 and

42 prevent lateral displacement of the plate 43 and the entire shoe assembly S; due to the frictional engagement of the belt 18 on the plate 43. By providing an air space between the plate 43 and the body 38 of resilient material the transfer of heat to the resilient body 38 is greatly reduced and its life correspondingly increased. It will be seen that pressure against the belt 18 adjacent one end of the shoe plate 43 may cause the same to be depressed, compressing the resilient body 38, without substantial downward movement of the other end of the plate 43. A substantially universal tilting action may also be given the plate 43 and this is one of the features of my invention which permits it to be successfully used in fine metal surface finishing, particularly on thin sheet metal where excessive pressure at any one point such as might be caused by relatively rigidly mounted shoes might result in wearing completely through the metal.

As is clearly seen in Figures 1 and 2 the plate 43 and the resilient member 38 are adapted to hold the belts 18 and 19 out of their normal straight line path between the pulleys 7 and 8 so that the working surface of the sanding belt 18 projects out away from the rest of the machine thus greatly facilitating the application of the belt to concave and convex surfaces and making possible the desired sensitive resiliency which is imparted to the working surface of the abrasive belt by my improved belt backing shoe and support arrangement.

Auxiliary belt supporting rollers 36 and 37 are disposed at the opposite ends of the shoe S. The arms 34 and 35 which carry these rollers are pivotally mounted on pins 47 and 48 which are carried by the bracket 32. Lugs 49 and 50 on the bracket 32 form abutments for the screws 51 and 52 which co-act with the lugs to form adjustable stops for the arms 34 and 35 limiting the movement thereof in a direction towards the shoe S. Springs 53 and 54 are secured respectively to the arms 34 and 35 and to a flange 55 on the bracket 32. These springs normally hold the arms 34 and 35 and the rollers 36 and 37 in the position shown in Figure 1. As is seen, the screws 51 and 52 are preferably adjusted so that the inner surface of the belt 19 clears the surface of the friction shoe 43 and is completely out of contact therewith. Lock nuts 51' and 52' are adapted to hold these screws in adjusted position. The air pressure on the cylinder 20 is adjusted so that it does not overcome the springs 53 and 54 or the spring 31 to move the belts out of the position shown in Figure 1.

It will be seen that when the parts are as shown in Figure 1 the belts 18 and 19 will run freely with a minimum of friction or rubbing contact with other parts of the apparatus. The driving belt 19 contacts only the main pulleys 7 and 8 and the idlers 28, 36 and 37 and thus very little heat is generated although the motor may be driving the belt at its full speed.

When the operator desires to apply the working surface of the belt 18, i. e., that part which lies between the pulleys 36 and 37, to the surface to be finished he squeezes together the handles 2 and 27. This causes the pulley 8 to move away from the pulley 7, the bell crank arm 11 swinging about its pivot 12. The arms 34 and 35 will move about their pivots, lowering the rollers 36 and 37 relative to the surface of the plate 43 and permitting the belt 19 to bear against the plate 43 (see Fig. 2). When in this position the re-

silient backing action of the shoe S will be effective and the desired control of the contact of the sanding belt with the surface can be obtained. When the operator removes the belt from the work to change its position, or for any other reason, and he does not desire to shut off the driving motor by manipulation of the hand operated motor switch control 56, he simply releases his grip on the handles 27 and 2, permitting the springs 53 and 54 to return the idler pulleys 36 and 37 to the positions shown in Figure 1 and again moving the inner surface of the driving belt 19 away from and entirely clear of the surface of the plate 43. Furthermore, by varying the degree of pressure exerted on the handle 27 the belt 19 may be caused to contact with the shoe surface with more or less pressure thus giving the operator a very sensitive means for controlling the abrasive action of the sanding belt which is carried by the driving belt. As will be understood the belt 19 is relatively heavy while the sanding belts are relatively light and are discarded after their abrasive surface is worn out.

Electrical connections to the driving motor may be provided through the conduit 57 and a guard plate 58 is adapted to cover the length of the sanding belt on the side opposite its working surface. A hinged curved end guard 59 is also provided and is preferably adapted to swing back out of the way about a pivot 60 to facilitate replacement of the sanding belts.

As shown in Figure 3, bracket members 61 and 62 are secured to the main frame 1 and have pivotal connections at their ends to the bail member 63. A supporting pulley 64 is carried by a bracket 65 which may be supported from the ceiling and counterweighted to balance the weight of the sanding machine in well known manner. Adjustable stops 66 and 67 can be clamped on to the bail at any desired points to limit the possible degree of tilting of the sander. The pivotal supports at the ends of the bail and the bracket 61 and 62 permit rotation of the sander to accommodate and follow any surface contour. By properly counterbalancing the machine the operator's only effort is that involved in guiding the belt over the surface to be finished and controlling the belt tension by the handle 27.

In Figure 5 I have illustrated a modified form of backing shoe in which a resilient body 68 corresponds to the body 38 of Figure 4. Pins 69 and 70 extend through the body 68 and are adapted for free movement therethrough. At the bottom of each of these pins there is a washer 71 and cotter pin 72 which limit the movement thereof. The upper ends of the pins are ball shaped and fit into corresponding sockets in the members 73 on the friction plate 74. The ball and socket joints thus provided permit the plate 74 to tilt either longitudinally or laterally relative to the resilient body 68. This arrangement permits the surface of the sanding belt to follow the surface being finished with a minimum of tendency to gouge or dig into the surface due to unequal pressure thereon at different points of contact with the sanding belt 18. It will be understood that the form of shoe shown in Figure 5 may be used in some instances while in others the form shown in Figure 4 may be more satisfactory. Each of these embody my improved resilient body and hard surfaced contact plate combination which I have found results in a most effective shoe for fine metal finishing work.

In Figures 9 and 10 a sanding machine is illustrated which is substantially the same as that shown in Figures 1 and 2 except that my improved air cushion belt backing shoe has been employed and a slightly different arrangement of the spark arrester is utilized. Similar parts are indicated by the same reference characters as used in describing Figures 1 and 2 and reference will be made here primarily to the different features of the apparatus.

An air cylinder 95 performs the same function as the air cylinder 20 in Figures 1 and 2. Air is supplied to the cylinder 95 through a pipe 96 and a T 97 which directs a part of the air to the cylinder 95 and a part to the conduit 98, preferably a flexible rubber hose or the like. This hose 98 extends to the shoe S' which is shown in detail in Figures 10, 11, 12 and 13.

Figure 10 is a cross-sectional view taken substantially on line 10-10 of Figure 8. The shoe supporting bracket 99 is secured to the main frame of the machine by screws 33 and has bosses 100 formed thereon through which the guiding and supporting pins 101 extend. These pins 101 are free to move in the holes in the bracket 99 and extend through spacing washers 102 at their upper ends and have threaded engagement with the grooved shoe member 103. The resilient sponge rubber shoe backing 104 has top and bottom plates 105 and 106 which are preferably of fiber or other substance which tends to resist the transfer of heat. The pins 101 are allowed to move freely through the block 104 and plates 105 and 106 and coil springs 107 are disposed around each pin 101 between the supporting bracket 99 and the bottom plate 106. These springs coact with the sponge rubber block 104 to provide a very effective resilient and substantially universal support for the driving belt 19 and the sanding belt 18.

The shoe 103 has a plurality of elongated narrow grooves 108 cut in its outer surface, as is clearly seen in Figures 10, 11 and 12. The air pipe or tube 98 connects to a short connecting tube 109 which is threaded into a transversely extending rib 110 on the bottom of the shoe 103. This rib 110 is preferably of the same thickness as the spacing washers 102 so that the shoe 103 is held in spaced heat insulating relation to the top plate 105 of the sponge rubber block assembly. A hole 111, which may be formed by drilling transversely through the rib 110 and then plugging the ends as indicated at 112, forms an air passage which connects with the tubes 109 and 98 and each of the grooves 108 is cut sufficiently deep into the surface of the shoe 103 that it intersects the transverse hole 111.

When the machine is operating the belts travel in the direction shown by the arrow in Figure 8 and, as air under pressure is supplied to the pipe 96 to operate the belt tensioning cylinder 95, air under pressure also will pass through the pipes 98 and 109 to the transverse passage 111 which will distribute the air into each of the narrow longitudinally extending grooves 108. A valve (not shown) may be inserted in the hose or pipe 98 to regulate the quantity of air discharged into the grooves 108. As is seen in Figure 12 the grooves 108 stop short of the ends of the shoe 103 and the belt 19, as it runs up on the shoe 103, forms a resistance to the escape of the air from the right hand end of the grooves in the shoe 103 (as seen in Fig. 8). The grooves 108 also stop short of the sides of the shoe 103 leaving a smooth belt engaging portion 113 on each side. In operation, the

tendency is for the air to be maintained under pressure in the elongated grooves 108 and to form a cushion support for the belts 18 and 19. This action has proved to be very effective in obtaining the finest quality of metal finishing. It has been found that by using my improved air cushion shoe construction with a sanding belt of approximately No. 30 grit a finish can be obtained which has the appearance of one made by a No. 35 grit belt used on a shoe without the air cushion feature. This permits coarser belts to be used while still obtaining the desired fineness of surface finish. The air which passes into the grooves 108 and escapes out all around the edges of the shoe 103 also greatly assists in cooling of the shoe and belts and, when combined with my improved manual means for causing the belt to engage the shoe only during actual sanding operations, results in a device which has a sensitivity of touch or feel whereby an extremely high quality of work can be done. Although longitudinal grooves 108 have been illustrated it will be understood that the shoe surface may be provided with other forms of elevated and depressed portions without departing from the spirit of my invention.

In order to protect the operator from the harmful effects of the metal dust and particles of abrasive thrown off when my sanding machine is in operation, I have incorporated in the illustrated embodiment thereof a suction fan 75 adapted to be driven by a separate motor 76 which if desired may be connected to a separate source of current through conductors 77. The suction inlet to the fan 75 includes two passages, one of which, 78, has an opening which is generally parallel to the working face of the sanding belt and which is provided with a flexible mouthpiece or scoop 79, of rubber or the like, which extends out beyond the line of travel of the working surface of the belt 18. A metal wear plate 79' protects the scoop 79 from abrasive wear and, being resilient, permits the scoop to be deflected if it should strike against the work. When the machine is operating the belt rotates in the direction indicated by the arrow in Figure 1 and a large part of the sparks and particles of hot metal and abrasive material are thrown off of the belt at about the point where it passes over the pulley 36. These sparks are immediately picked up by the scoop-shaped mouthpiece 79 and are sucked down through the passage 78 by the action of the suction fan 75.

Some of the particles of removed metal and abrasive, however, may adhere to the belt and travel around the pulley 7. In order to catch these a second preferably Venturi-shaped suction passage 80 is provided in the housing of the dust catching apparatus. This collects the remaining particles which were not caught and conducted through the passage 78. Both the passages 78 and 80 open into the fan housing 75 which is provided with a discharge outlet 81. It will be understood that any type of fan or blower may be employed so long as the suction inlet is connected to the passages 78 and 80 and a suitable outlet is provided.

In order to prevent distribution of the collected particles of material back into the atmosphere it is necessary to provide a bag or the like which will collect the solid materials but which will permit the air draft to pass therethrough so that the desired suction may be maintained at the openings of the passages 78 and 80. As the high speed operation of this machine results in particles of red or white hot metal being drawn through the suction fan and blown out through the opening 81,

a serious problem is encountered to prevent setting the fabric bags 82 on fire. These bags 82 are necessarily made of a material which will prevent the passage of solid material but will not unduly restrict the passage of air therethrough. I have completely overcome the fire hazard by providing a tubular, perforated, generally cylindrical member 83 which is secured to a sleeve 84 which in turn fits over the enlarged outlet member 85. Preferably the member 83 is made of sheet metal containing closely spaced holes, for example, sheet brass having holes approximately $\frac{1}{4}$ " in diameter spaced on about $\frac{1}{8}$ " centers although the specific arrangement and construction may be varied as shown in Figures 8 and 9. Walls of this kind effectively stop and cool the white hot particles of metal, etc. before they can come into contact with the bag 82. As the operation of my sanding machine results in the formation of very fine elongated shavings of the metal which is being surfaced these shavings tend to mat together in the tubular member 83 and form a ball. In order to prevent this ball from rolling back into the fan plate 75 when the machine is tilted in such a direction as to cause the ball to move towards the fan plates, I have provided a baffle 86 which extends across the tubular perforated shell 83 and which will permit the particles of material to pass into the spark arrester and shaving collector 83 but which will prevent the ball of matted material from rolling back into the fan. The end of the tubular perforated member 83 is preferably closed by a door 87, of perforated metal as illustrated in Figure 7, if desired, or solid as shown in Figure 8, which may be hinged at 88 and is provided with a spring latch 89. This facilitates the emptying of the spark arrester after a period of operation of the machine sufficient to collect a substantial mass of material therein. My dust collecting means is very compact and does not interfere with the complete portability of the sanding machine. The spark arrester 115 which is shown in Figures 8 and 9 is slightly modified from the one illustrated in Figures 1 and 2 in that it is mounted on the fan outlet at a slightly different angle and is provided with a solid end piece 116 which may be desirable in some classes of work.

When it is desired to change sanding belts the air pressure applied through the pipe 23 (Figs. 1 and 2) may be shut off from the cylinder 20 thus permitting the bell crank arm 10 and pulley 8 to move toward pulley 7 loosening the belt 18 so that it can be easily removed and replaced. When the spring belt tension device of Figure 6 is used the lever handle 16 is thrown to the right causing the cam 15 to engage the surface 17 thus swinging the bell crank 11 about its pivot and causing the arm 10 thereof to move to the left carrying with it the pulley 8. The cam 15 is so shaped that it will maintain the bell crank 11 in the released position until the operator throws the handle 16 back to the position shown in Figure 6 and thus greatly facilitates the removal of a worn sanding belt and its replacement with a new one.

As will be seen from the above description of the illustrated embodiments of my invention I have provided a portable metal finishing unit in which a high speed abrasive belt is employed and means are provided for effectively preventing the distribution into the air of the particles removed by its action. In my machine friction and heating are very largely eliminated except during the actual period of time when the device is operating against the surface of the metal being

finished, and an extremely resilient and substantially universal flexible support or backing for the abrasive belt is provided whereby surfaces can readily be followed without danger of gouging, cutting or undesired removal of material by the sanding belt. Heating of the backing shoe and of the driving and abrasive belts is greatly reduced. In using my improved type of abrasive shoe in which a resilient body such as sponge rubber is employed the elimination of heat is of considerable importance because heat causes the sponge rubber body to deteriorate and lose its flexibility. By providing my improved control handle and lever arrangement whereby the belt engages the shoe only during actual work the heating of the shoe is greatly reduced and thus the life and effectiveness correspondingly increased. A very fine surface finish can be obtained with my machine and the use of coarser sanding belts will produce a surface equal to that produced by much finer belts used with other types of equipment. The air cushion shoe assists in cooling the belts and gives a floating backing for the belt which has been found to be very effective in obtaining the finest possible surface finish.

Although I have described the illustrated embodiments of my invention in considerable detail it will be understood by those skilled in the art that modifications and variations may be made in the specific forms which I have shown and described without departing from the spirit of my invention, and I do not, therefore, wish to be limited to the particular apparatus illustrated and described herein but claim as my invention all embodiments thereof coming within the scope of the appended claims.

I claim:

1. In apparatus of the type described, a frame, a handle on said frame, spaced pulleys supported by said frame for relative movement toward and away from each other, a belt carried on said pulleys, means for exerting a predetermined force tending to move said pulleys apart and independent manually operable means for increasing the force tending to move said pulleys apart from said predetermined value and increasing the spacing between said pulleys, said manually operable means including an operating lever having a handle portion disposed adjacent said handle on said frame.

2. In apparatus of the type described, a frame, spaced pulleys supported by said frame, one of said pulleys being movable toward and away from the other, an endless belt encompassing said pulleys, fluid pressure actuated means for moving said movable pulley away from the other pulley to apply tension to said belt, and independent manually operable means for increasing the tension applied to said belt by said fluid pressure actuated means and for releasing such increased tension.

3. In apparatus of the type described, a frame, spaced pulleys supported by said frame, one of said pulleys being movable toward and away from the other, an endless belt encompassing said pulleys, a shoe member adapted to engage the inner surface of said belt between said pulleys, resilient means for applying tension to said belt, resilient means for normally holding said belt out of frictional engagement with said shoe, and manually operable means for increasing the tension applied to said belt to move said belt into engagement with said shoe.

4. In apparatus of the type described, an end-

less belt, spaced pulleys for supporting said belt, means for driving one of said pulleys to operate said belt, a shoe member adapted to engage and support the inner side of said belt, means for normally maintaining said belt out of contact with said shoe while operating, and means operable while said belt is operating to move said belt into and out of contact with said shoe.

5. In apparatus of the type described, a frame, a pulley rotatably supported in said frame, means for driving said pulley, a pulley supporting arm pivotally mounted on said frame, a second pulley rotatably supported on said arm, an endless belt encircling said pulleys and adapted to be driven thereby, resilient means for exerting a force on said pulley supporting arm tending to move said pulleys apart and exert a tension on said belt, and a lever secured to said arm and manually operable to move said pulleys farther apart than the positions they assume under the influence of said resilient means.

6. In apparatus of the type described, a frame, spaced pulleys supported by said frame, one of said pulleys being movable toward and away from the other, a belt encircling said pulleys, a shoe member adapted to engage the inner surface of said belt, resilient means exerting a force tending to move said movable pulley away from the other pulley, resilient auxiliary belt supports adjacent the ends of said shoe for normally holding said belt out of contact with said shoe, and manually operable means for exerting an additional force to move said movable pulley and cause said belt to move said resilient supports and come into contact with said shoe, said resilient supports being adapted, upon release of said manually operable means, to return said belt to out of contact relation with said shoe.

7. In a sanding machine of the type described, a frame, spaced pulleys supported by said frame, one of said pulleys being movable toward and away from the other, a belt encircling said pulleys, means for exerting a force tending to move said pulleys apart, means for driving one of said pulleys, a guiding and supporting handle on said frame, means, including an operating handle disposed adjacent said guiding handle and adapted to be grasped therewith, for moving said movable pulley away from the other of said pulleys, and spring means whereby said movable pulley will be moved toward said other pulley upon release of said operating handle.

8. In a sanding machine of the type described, a frame, spaced pulleys supported by said frame, one of said pulleys being movable toward and away from the other, a belt encircling said pulleys, means for driving one of said pulleys, a backing shoe for said belt, a guiding and supporting handle on said frame, means, including an operating handle disposed adjacent said guiding handle and adapted to be grasped therewith, for moving said movable pulley away from the other of said pulleys, and spring means whereby said movable pulley will be moved toward said other pulley upon release of said operating handle, said last named means including an arm carrying a roller engaging said belt and being pivotally mounted on said frame, and a spring urging said roller against said belt and tending to move said belt away from said shoe.

9. In a portable sanding machine or the like, a frame, an endless belt, spaced pulleys carried by

said frame and supporting said belt, means for driving one of said pulleys, a shoe having a grooved face disposed adjacent and substantially covered by the inner surface of said belt, the grooves in said face extending in the direction of belt travel from a point adjacent one end of said shoe to a point adjacent the other end of said shoe and means for discharging fluid under pressure into the grooves of said shoe face at a point adjacent the end of the shoe first engaged by the belt.

10. In a sanding machine or the like, a frame, an endless belt, spaced pulleys carried by said frame and supporting said belt, means for driving one of said pulleys, a shoe having ungrooved edge portions and a longitudinally grooved central portion, the grooves extending from a point adjacent one end of said shoe to a point adjacent the other end of said shoe, means for supporting said shoe in belt supporting position adjacent and substantially covered by the inner surface of said belt, and means for discharging air into said grooves while said belt is being driven.

11. In apparatus of the type described, a belt, means for driving said belt, a shoe having a belt engaging surface provided with raised and depressed portions, said depressed portions stopping short of the edges of said belt engaging surface and extending for substantially the full length of said shoe, means for supporting said shoe in belt backing-up position and means for discharging fluid under pressure into said depressed portions of said shoe surface whereby the fluid under pressure flows through said depressed portions in the direction of belt travel for substantially the full length of said shoe.

12. In apparatus of the type described, a frame, spaced pulleys carried by said frame, a belt encircling said pulleys, means for driving one of said pulleys and a shoe carried by said frame and adapted to back up and support said belt between said pulleys, said shoe including a resilient supporting portion and a rigid belt engaging plate carried by said supporting portion, said plate having a grooved belt engaging surface, and means for discharging air between said belt and plate surface.

13. In apparatus of the type described, a frame, an endless belt, means carried by said frame for supporting and driving said belt and a belt backing shoe supported by said frame, said shoe including a body of resilient material mounted on said frame, a guide pin adapted to have limited free movement toward and away from said belt, a belt engaging plate having a grooved belt engaging surface and being secured to said pin and disposed between said belt and said resilient body, and means for directing air under pressure between said belt and grooved surface.

14. In combination in a portable surface finishing machine of the class described, a surface finishing belt, means for supporting and driving said belt, a backing member for said belt having a substantially plane face elongated in the direction of belt movement, a plurality of grooves in said face extending substantially parallel to the direction of belt movement and stopping short of each end of said face, and means for discharging air under pressure into said grooves at one end thereof.

BERT F. FOWLER.