

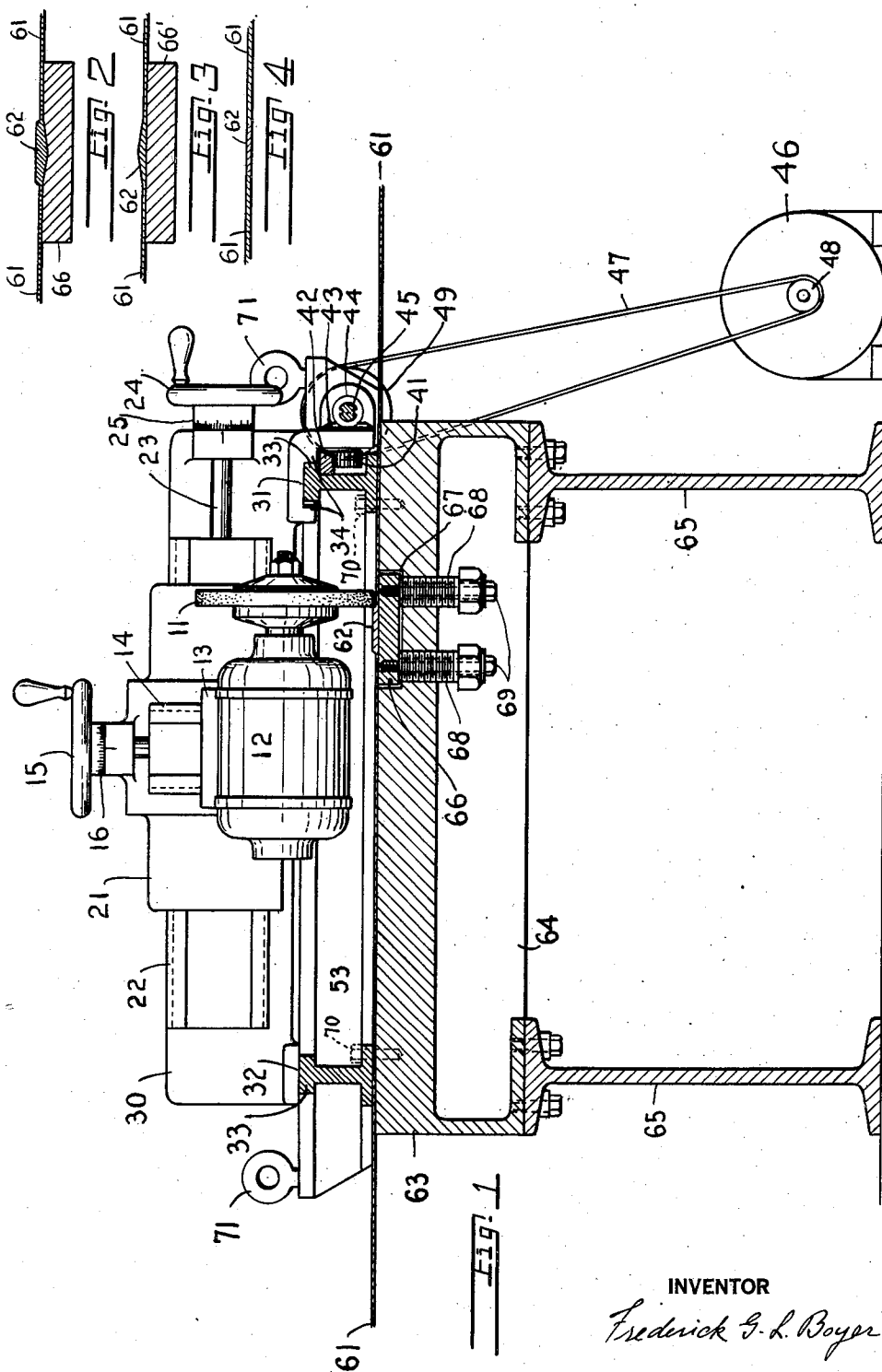
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GRINDING DEVICE

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GRINDING DEVICE

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The present invention relates to grinding methods and devices, and has for its primary object the provision of an accurate method and apparatus for removing protuberances such as welds, specifically electrolytic welds, in extensive, otherwise plane surfaces, particularly of thin or sheet metal, which surfaces should not be cut down or otherwise disturbed by the grinding operation. Another object of the invention is the provision of an accurate method and apparatus for grinding extensive plane surfaces of such magnitude that the entire grinder must be on one side of the surface and is advantageously traversed over the surface while being accurately maintained in a true plane. Other objects and advantages of the invention will become apparent from the following description.

The invention by which these objects are accomplished will be described by reference to the accompanying drawing in which: Figure 1 represents a view in elevation and partly in section of a device embodying the invention, set up to remove the protruding portions of an electrolytic weld in sheet metal; and Figures 2, 3, and 4 are detail views showing the successive steps in the operation of finishing both surfaces of an electrolytically welded joint.

Referring to the drawing, the grinding wheel 11 is provided with suitable means for driving it at cutting speeds suited to the material being ground and the size and type of wheel used. It is advantageously mounted directly on the shaft of a driving motor 12 to form a complete grinding unit. This unit is mounted for vertical adjustment on a slide 13 which moves on suitable ways 14 and is advantageously provided with the usual adjustable gibs, not shown, to insure the necessary tightness and freedom from vibration in the slide. Vertical adjustment is provided by means of the hand wheel 15 in the usual manner and its amount may be accurately controlled by means of the micrometer dial 16.

Lateral movement or crossfeed of the grinding unit may be provided by mounting the vertical ways 14 on a horizontally sliding carriage 21 which may also be provided with adjustable gibs, not shown, and slide on horizontal ways 22. The crossfeed may be accomplished in the known manner by means of a screw 23 provided with hand wheel 24 and a micrometer dial 25 for accurately measuring the movement. Obviously, automatic feed, adjustment, and stop devices of types well known in the machine tool art can be provided, in addition to the hand wheel 24, for operating screw 23 to accomplish the crossfeeding operation.

The horizontal ways 22 are mounted on, or formed integrally with, a carriage 30 which is provided with sliding bearings 31 and 32 which are adapted to slide on suitable horizontal tracks

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or guides 33, as hereinafter more particularly described, to provide the traverse or working stroke of the grinding device. To guide the movement of carriage 30, guides 34 are provided on sliding bearing 31 to cooperate with track 33. These guides 34 are made of sufficient length along track 33 to provide a guide of ample strength and accuracy, and may if desired be provided with adjustable gibs to prevent undue play and to take up for wear. The guiding surfaces on track 33 are advantageously substantially horizontal and either vertical or undercut in the well known manner, to prevent any tendency towards lifting of the carriage 30 upward from its proper plane of motion during its operation, since any slight or momentary lifting will result in a corresponding inaccuracy of the ground surface.

The traversing motion of carriage 30, carrying the grinding unit, may be produced in any convenient manner as by a pinion 41 mounted on the carriage and meshing with a stationary rack 42. The pinion 41 may be driven by bevel gear 43 which meshes with bevel pinion 44 which in turn is driven by splined shaft 45 in a usual manner. The splined shaft 45 may in turn be driven by a motor 46 through the medium of a belt 47 and pulleys 48, 49. The traverse speed may be varied by the use of cone pulleys at 48, 49 and/or by the use of an adjustable speed motor at 46. Conventional adjustable mechanical or electrical stops and/or reversing devices, not shown, may be provided if desired.

The upper and lower surfaces of guide tracks 33 are accurately parallel. These tracks are further firmly joined together at each end by a rigid cross member 53 which cross members unite the whole into a rigid structure which has its upper and lower surfaces accurately plane and parallel. The length of the tracks 33 and their lateral spacing, and the corresponding length of cross feed guides 22, are made to suit the size of the area to be ground, the size and proportion being not otherwise fixed or limited.

In addition to the structures shown, there may advantageously be provided the customary means for circulating coolant to the point of contact between the grinding wheel and the work, the conventional safety guards around the grinding wheel, gears, belts, etc., and usual means for protecting sliding and rotating bearings from abrasive dust.

The specific embodiment of my invention shown in the drawing is a machine particularly adapted for removing the excess metal from an electrolytically welded joint between the ends of a metal belt for use as a casting surface in the manufacture of plastic films, "cast surfaced" coated paper, and the like. A belt for such use is required to have uniformity of thickness and a continuity and

smoothness of surface which are free from interruptions by any joint present therein.

Because of the thinness and flexibility desirable in belts for these uses, it is necessary to provide supports which will hold the parts to be ground, with the necessary rigidity, in preparation for and during the grinding operation. These supports must hold the parts of the surface to which the finished ground surface must conform, firmly and accurately in a plane parallel to the plane of the tracks 33, i. e. the plane of motion of the grinding device. For this purpose the parts of the belt surface adjacent the welded joint are smoothly, firmly, and accurately held in the same plane, as by being soldered or otherwise cemented or fastened to co-planar portions of the surface of a bar 66, on opposite sides of a depression in which the part of the joint protruding on that side of the belt is firmly soldered or otherwise fastened, as illustrated in Figure 2. This soldering, cementing, or other fastening operation may be carried out as a part of the preparation for the grinding operation. However, in some processes for the manufacture of endless metal belts of the type and for the purposes set forth, the accomplishment of the welding operation involves fastening the parts as described, and joints made according to that process are ready for insertion into the grinding device and alignment with the plane of the guides 33.

Such an arrangement is illustrated in the drawing. Sheet metal parts 61 are joined by weld metal 62 which protrudes above, and is to be ground down to, the level of the surface of the sheets 61. The sheet metal rests flat upon the smooth and accurately plane surface of a heavy and extremely rigid metal base or support 63 which may be additionally stiffened by a plurality of ribs 64 and rest on firm and rigid supports such as beams 65. The tracks 33 carrying the grinding mechanism rest and are advantageously clamped in place upon the surface of the sheets 61 where they are supported on the base 63. The tracks 33 thus guide the carriage with the grinding device in a plane path accurately parallel to the surfaces of base plate 63 and of the sheets 61 supported thereon. As above described, the weld and adjacent sheet metal are firmly fastened to the relatively rigid metal bar 66. The bar 66 rests in a recessed channel 67 formed in base plate 63. The channel 67 may conveniently be somewhat wider and deeper than the width and thickness respectively of the bar 66. The surface of the sheets 61 adjacent to the weld 62, which sheets are there firmly and smoothly fastened to bar 66, may then be adjusted into a plane accurately parallel to the surface of support 63 and to the plane of motion of the grinding device, as determined by the guides 33, flexing the sheet metal 61 to the slight degree that may be required, by means of a plurality of hollow jack screws 68 which are threaded through the base plate 63. The parallelism may be checked, before grinding is initiated, in the customary manner by the use of a test indicator which may be mounted on carriage 30 and ride on the surfaces of sheet 61 where it is fastened to bar 66. In order that the bar 66 and thereby the upper surfaces of the sheets 61, 61 may be firmly held rather than merely supported, a plurality of screws 69, threaded into bar 66, are provided. These screws are advantageously passed through the hollow jack screws 68 to prevent unwanted bending stresses in bar 66. The pairs of screws 68, 69 are advantageously spaced at intervals suffi-

cient to make possible the correction of any warpage of bar 66 or other lack of flatness in the surface of sheets 61 where they are fastened to the bar.

It may be noted that the adjustment of bar 66 may be such as to maintain the surface of sheets 61, where they are attached to the bar 66, in, or parallel to and above, the plane of the surface of the sheets 61 where they are supported on base 63. They are advantageously never adjusted to a position below this plane because of the danger of bending the sheets and of cutting into their surface at the extremities of the cross feed of the grinder.

With the work thus set up, the grinding operation is carried out as follows: The motor 12 is set in motion, rotating the grinding wheel 11 at suitable cutting speed. The motor 46 is then set in motion, starting the traversing movement of the grinding mechanism. The automatic stops or reversing mechanisms, if provided, are set to give the required length of traverse. By means of hand wheel 15, the grinding wheel 11 is lowered until it just touches the high point of the work. The speeds and feeds are thereafter controlled, as is usual in grinding practice, and the operation is continued until all of the weld metal protruding above the level of the adjacent surface of the sheets 61, has been removed. The usual precautions are advantageously taken in the finishing cuts, to give the required surface finish.

The belt is then removed from the machine, unsoldered from bar 66, turned over and soldered, on its freshly ground surface, to a smooth surfaced bar 66', as shown in Figure 3. It is then reinserted into the machine and the block 66' is fastened in recess 67 and leveled as was bar 66. The protruding weld metal is ground from this side in the manner described, so that the weld when unsoldered from bar 66' is of the same thickness as the adjacent parts of the belt, as indicated in Figure 4, and the joint is free from surface discontinuities.

In order to facilitate the use of the device described, means are advantageously provided for lifting tracks 33, together with the entire grinding mechanism, from the working surface 61. For this purpose eye bolts 71 for attaching to an overhead crane or tackle block, may be provided on extensions of the cross members 53 which join the tracks 33, or at any other convenient location.

Obviously the grinding wheel should traverse the entire width of the sheets 61, i. e. the entire length of the weld, or other surface which must be ground, and therefore the tracks 33 should normally extend beyond this at each end. In order to maintain accurate parallelism of the plane of operation of the grinder with the plane surface to the level of which the grinding must be carried, it is usually desirable to clamp or otherwise secure the tracks 33 firmly in place. Clamping devices of known type may be used or, in case of the weld in the sheet metal 61, the tracks may be screwed down to the base 63 beyond the edges of the sheets 61 by means of screws indicated at 70. To prevent bending stresses in tracks 33, a spacer of the exact thickness of metal 61 should be interposed between tracks 33 and base 63 at each of the clamps or screws 70. Furthermore, great care should be taken to exclude all dirt and foreign matter from between base 63 and sheets 61 and from between sheets 61 and tracks 33.

The mechanism described, while primarily designed for removing protruding weld metal from

welded joints in endless metal belts, is useful for removing protuberances of almost any type from sheet metal. It can also be used to advantage for removing protuberances or rugosities from extensive rigid surfaces which will maintain their plane form without external support. For this purpose the tracks 33 carrying the grinding devices can be set, and advantageously clamped in position, on the surface from which the protuberances are to be ground, without the use of bed plates 63 and its supporting structures.

If it is desired to operate on curved rather than plane surfaces, the device illustrated may be provided with suitably curved guides instead of the straight tracks and guides, so that the grinding wheel will travel in a path conforming to the surface to which the metal is to be finished.

While not in general desirable, it is possible where narrow surfaces only, such as welded seams, are to be ground down by the device, to omit the cross feed devices 22, 23, 24, 25, etc., and use a grinding wheel having a width of face at least equal to the width of the metal to be ground, if the face of the wheel is kept accurately trued. However, I consider the form illustrated to be generally preferable even for grinding down narrow seams.

It will be obvious to those skilled in the machine tool art that many different known forms of guides, slides, feeding, traversing, stopping, and reversing mechanisms, driving means, etc., may be substituted for the particular forms shown, without departing from the present invention as defined in the appended claims.

I claim:

1. A device for removing protuberances from an extensive plane surface, which comprises a grinding device, a guide track for supporting and guiding said grinding device in a plane path, said track being adapted to rest upon said extensive surface, means for adjusting into accurate parallelism the plane path of said grinding device and the part of said extensive surface on which said grinding device is to operate, means for adjusting said grinding device towards and away from said surface, means for operating said grinding device, and means for moving said grinding device in said plane path.

2. A device for removing protuberances from an extensive surface of sheet metal, which comprises a grinding device, a rigid plane surface for supporting the sheet metal, a guide track for supporting and guiding said grinding device in a plane path, said guide track being adapted to rest on and be firmly clamped against the sheet metal lying on said rigid surface and thereby to serve to guide said grinding device in a plane substantially parallel to said surface, means for adjusting into accurate parallelism the plane path of said grinding device and the part of the sheet metal on which said grinding device is to operate, means for operating said grinding device, and means for moving said grinding device in said plane path.

3. A grinding device for dressing down the protruding parts of electrolytic welded joints in sheet metal, which joints, with the adjacent parts of the sheet metal, are firmly mounted on a relatively rigid metallic member, said device comprising: a support having a truly plane surface for supporting said sheet metal and a recess for receiving the metallic member on which the welded joint is mounted, said support hav-

ing a much higher order of rigidity than said member; a grinding wheel provided with suitable bearings and means for causing its rotation at cutting speeds; a track or guide on which said wheel may be moved, said track being adapted to be supported on and firmly clamped to said support, clamping the sheet metal therebetween, and when so supported and clamped, to guide said wheel in a plane parallel to the plane surface of said support; means associated with said support and the metallic member on which the welded joint is mounted, for adjusting and firmly holding said member at a plurality of points to bring and hold the surface of the sheet metal adjacent the weld accurately in parallelism with the surface of said support and the paths of movement of said grinding wheel.

4. In an apparatus for grinding protrusions from the surfaces of sheet metal, the combination of a supporting bed plate, a cavity in the bed plate, removable bars adapted to be attached to the surface of the sheet opposite the protrusion, positioning devices for supporting said bars in said cavity with their surfaces in a plane parallel to the surface of the bed plate, a grinder mounted above said bed plate, means for traversing said grinder, means for maintaining its grinding surface in a plane parallel with the bed plate during said traverse, and means for adjusting the grinder toward and from the bed plate.

5. The apparatus of claim 4 wherein the positioning devices comprise a plurality of hollow jack screws for locating said bars with reference to said bed plate and concentric screw means for maintaining contact between said bars and each of said jack screws.

6. A device for removing protuberances from an extensive surface of sheet metal, which comprises a grinding device, a rigid plane surface for supporting a sheet of metal, a guide track for supporting and guiding said grinding device in a plane path, said guide track being adapted to rest on and be firmly clamped against a sheet of metal supported on said rigid surface and thereby to serve to guide said grinding device in a plane substantially parallel to said surface, means for adjusting the part of the sheet metal on which the grinding device is to operate into accurate parallelism with the plane path of the grinding device and for firmly holding it in that position during the operation of the grinding device thereon, means for operating said grinding device, and means for moving said grinding device in said plane path.

7. Method of smoothing the surface of an extensive sheet of metal by removing protruding parts therefrom, which comprises: temporarily but firmly cementing a portion of the surface, directly opposite the area from which protruding parts are to be removed, to a more rigid body; supporting the sheet metal in the vicinity of said cemented portion on a rigid plane surface; then, by adjustment of said body, locally adjusting the cemented portion of the sheet metal to bring the portion of the surface from which the parts to be removed protrude, into substantial coincidence with a plane parallel to and at least as high as the surface of the supported portion; holding said body, and the portion of the sheet metal cemented thereto, firmly in said adjusted position; moving an abrading device in a plane path parallel to said plane surface; and adjusting said plane path downward

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as the protruding portions are cut down, until the desired removal has been accomplished.

8. The method of removing protruding metal down to the surface level of an extensive sheet of metal, which comprises: temporarily but 5 firmly cementing a portion of the surface, directly opposite the area from which protruding metal is to be removed, to a more rigid body; holding the sheet metal near said cemented portion, on a rigid plane surface; then, adjusting 10 said body and flexing adjacent portions of said sheet metal as required to bring the portion of the surface from which the metal to be removed protrudes, into substantially accurate coincidence with a plane parallel to a predetermined 15 plane of motion of an abrading device, and at least as high as the adjacent portions of the surface of the sheet metal; holding said body, and the portion of the sheet metal cemented thereto, firmly in said adjusted position; mov- 20

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ing the abrading device in said predetermined plane, to remove the protruding metal; and adjusting the cutting level downward, as metal is removed, until the desired removal has been accomplished.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,562,558	Hobson	Nov. 24, 1925
1,716,279	Owen	June 4, 1929
1,843,758	Bugbee	Feb. 2, 1932
2,109,827	Moffett	Mar. 1, 1938
2,282,145	Indge	May 5, 1942
2,419,543	Ellis et al.	Apr. 29, 1947