Jan. 16, 1940. D. E. MULHOLLAND 2,187,463

POLISHING MACHINE

Filed April 19, 1938 3 Sheets-Sheet 1

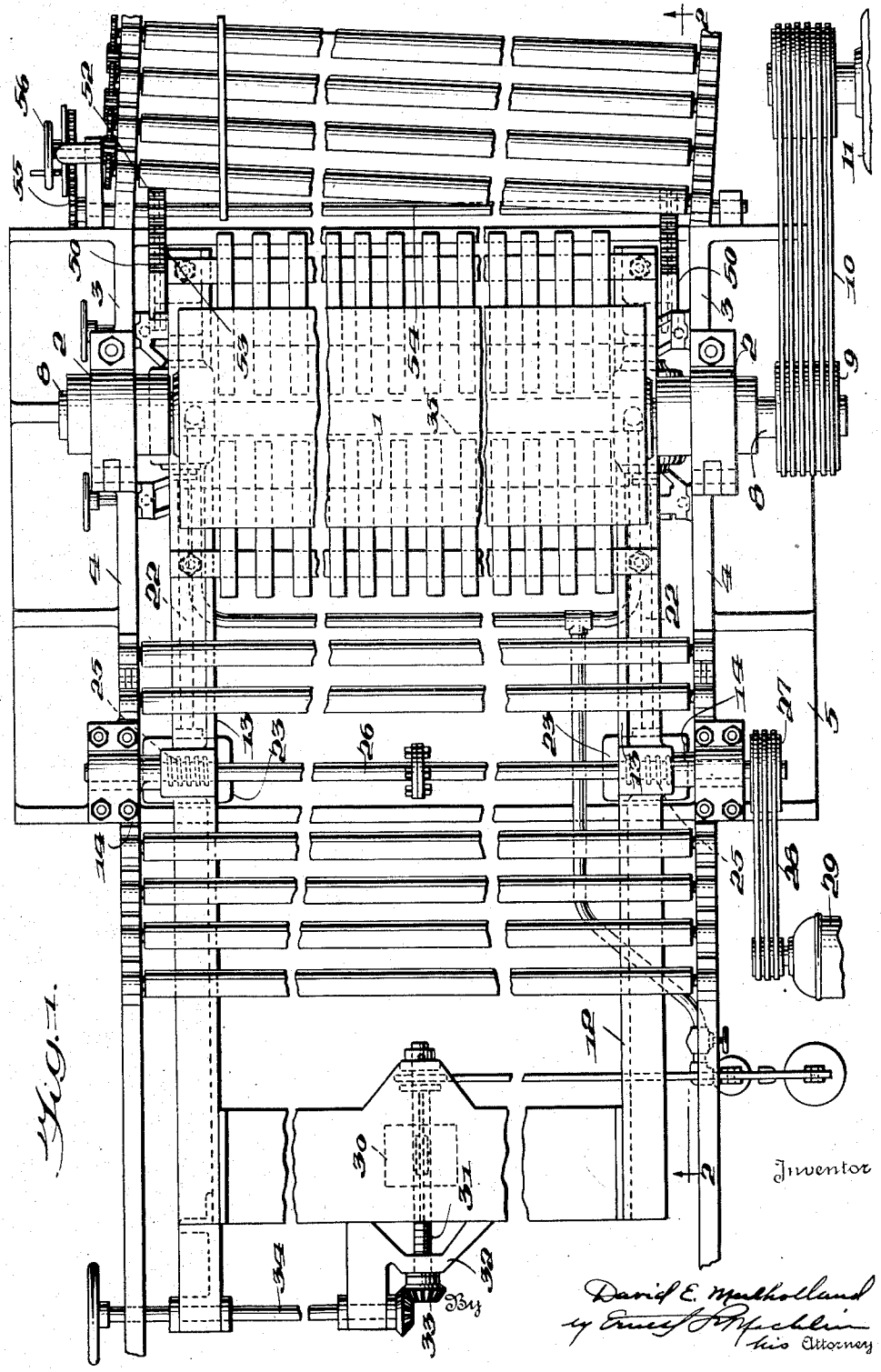


Fig. 1.

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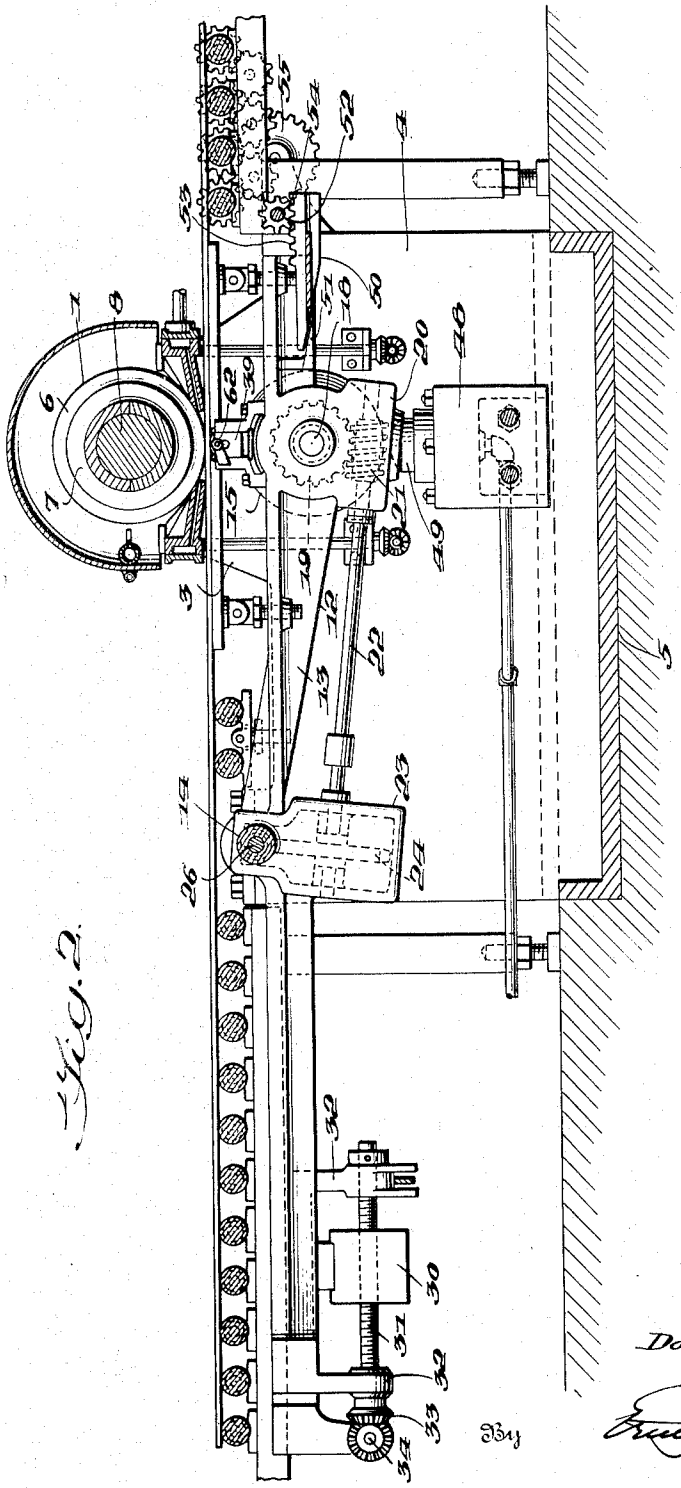


Fig. 2.

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Fig. 3.

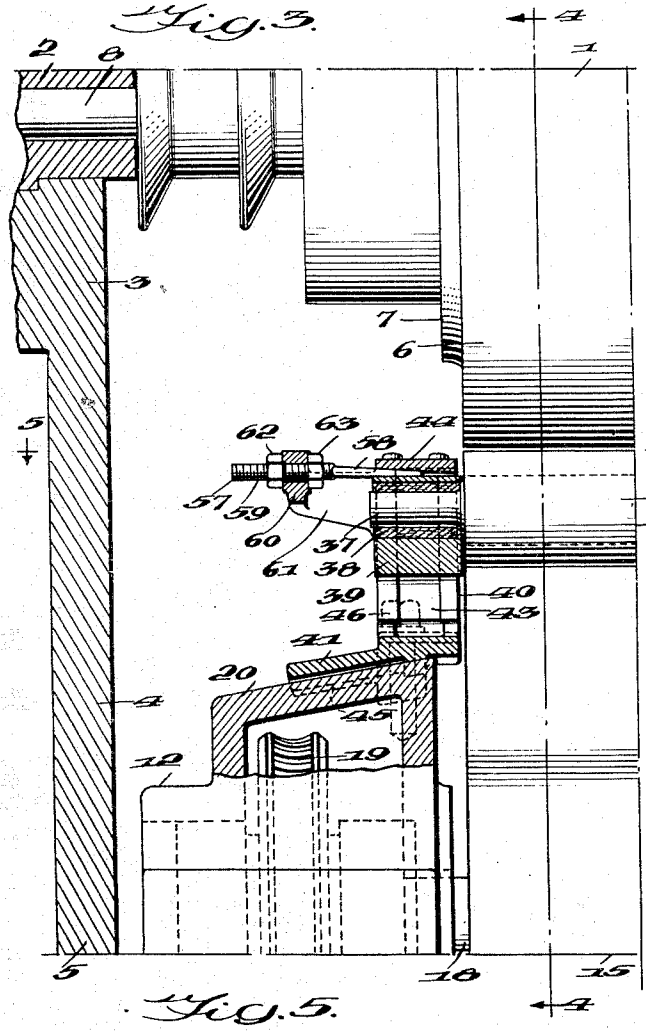


Fig. 4.

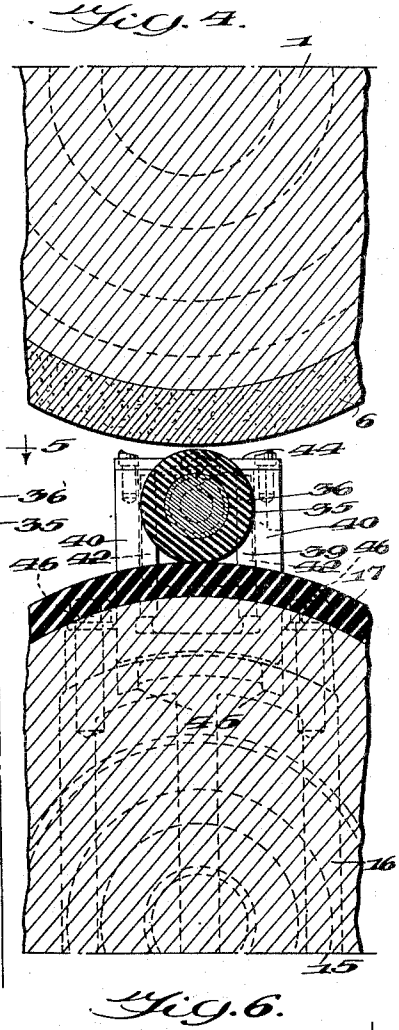


Fig. 5.

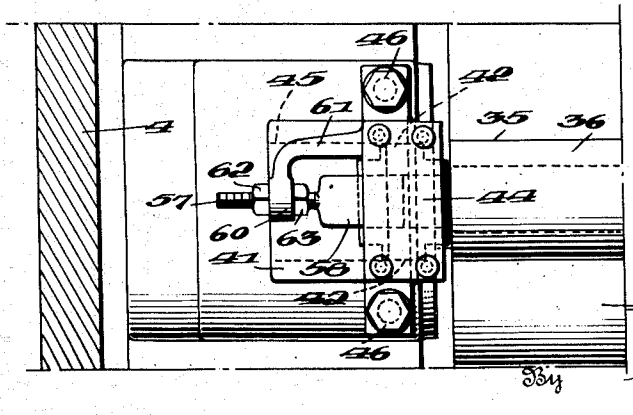
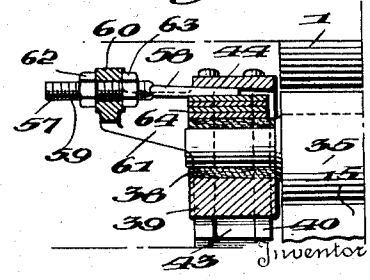


Fig. 6.



Inventor

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Patented Jan. 16, 1940 2,187,463

UNITED STATES PATENT OFFICE

2,187,463

POLISHING MACHINE

David E. Mulholland, Reading, Pa.

Application April 19, 1938, Serial No. 202,979

11 Claims. (Cl. 51—78)

My invention relates to polishing machines and more particularly to machines for polishing sheets of stainless steel and the like.

Some of the features of the invention are especially applicable to the type of polishing machine disclosed in my copending application Serial No. 108,846, filed November 2, 1936, wherein a driven work supporting roll, which is mounted on a movable support or carriage for pressing the work upwardly against a polishing wheel, is provided with a yielding surface to control the rate of travel of the work past the polishing wheel. As the yielding surface must be capable of being compressed against the under side of the work for it to function effectively to control the rate of travel of the work, it tends to cause portions of the work immediately adjacent the polishing wheel to conform to the curvature thereof and, in the case of very thin sheets, areas as great as three-eighths of an inch in width are forced into contact with the polishing wheel. When portions of the work of such substantial width are forced into contact with the polishing wheel, the force acting between them is distributed over so large an area of the work that the pressure of the wheel on the work is reduced to such an extent that the desired finish cannot be imparted to the work in a single pass through the machine unless the pressure applied to the machine is inordinately high.

One of the principal objects of the invention is, therefore, to provide a work supporting roll which, while having a yielding surface, is of such character that only areas of the work of such narrow width will be forced into engagement with the polishing wheel as will not materially reduce the pressure of the polishing wheel on the work.

Another object of the invention is to provide means whereby the space between the polishing wheel and the work supporting roll may be made either of uniform or progressively varying width from end to end so that, depending upon whether the sheet being polished is or is not of uniform thickness from one side to the other, the polishing wheel may remove the same amount or different amounts of metal from adjacent each of the side edges of the sheet.

Still another object of the invention is to provide means whereby the yielding surface of the work supporting roll which is adapted to be compressed under normal working loads against the work as well as against the driven roll with which it is in frictional engagement may be initially compressed against the driven roll so as to decrease the amount of compression of the yielding surface normally effected by the working load to such extent that, when the machine is set to polish very thin sheets, the yielding surface cannot expand sufficiently to contact the polishing roll after the sheet has passed from engagement therewith.

The novel features of the invention residing in advantageous forms, combinations and relations of parts will hereinafter appear and be pointed out in the claims.

In the drawings:

Figure 1 is a plan view of the polishing machine.

Figure 2 is a sectional view taken on line 2—2 of Figure 1.

Figure 3 is an enlarged fragmentary view, adjacent corresponding ends of the polishing wheel, the work supporting roll and the driven roll, the means for adjusting the work supporting roll with respect to the driven roll being shown partly in section.

Figure 4 is a sectional view taken on line 4—4 of Figure 3.

Figure 5 is a view taken on line 5—5 of Figure 3.

Figure 6 is a view of the work supporting roll similar to that shown in Figure 3, illustrating means for compensating for wear of the work supporting and driven roll.

For purposes of illustrating the invention, it has been shown as applied to a polishing machine of the character illustrated in my copending application Serial No. 108,846, filed November 2, 1936, but those skilled in the art will readily appreciate that the invention is as equally applicable to other types of polishing machines.

The machine is provided with a polishing wheel or roll 1 which is journaled in suitable bearings 2 mounted in portions 3 projecting upwardly from the side walls 4 of a preferably unitary casting 5 constituting the main frame of the machine. The polishing wheel has a sleeve 6 encircling a drum 7 provided with an axle 8, the sleeve being preferably formed of abrasive grain of very small size bonded in a suitable organic material. One end of the axle projects beyond its adjacent bearing 2 and it is provided with a pulley 9 adapted to be driven through the intermediacy of a suitable belt 10 by an electric motor 11.

Pivotally mounted on the casting or frame 5 adjacent one end thereof is a rigid carriage or the like 12 having side members 13 which may be advantageously formed of cast metal. Intermediate their ends the side members are respectively formed with outwardly projecting hollow trunnions 14 which are journaled in the main frame

5 of the machine and thus afford a pivotal support for the carriage.

Mounted on the carriage so as to be positioned beneath the polishing wheel 1 is a driven roll 15 consisting of a drum 16 having an outer rubber covering 17 and a shaft 18 which is journaled at its opposite ends in the side members 13 of the carriage. On the ends of the shaft are worm wheels 19 which are respectively disposed within housings 20 formed in the adjacent side members of the carriage. These worm wheels respectively mesh with worms 21 mounted on the forward ends of shafts 22 which extend longitudinally of the carriage adjacent the opposite sides thereof. The inner ends of shafts 22 which extend within housings 23, also formed in the side members of the carriage, are provided with worm wheels 24 for respectively cooperating with worms 25 mounted on a transversely extending shaft 26 whose axis is coincident with the pivotal axis of the carriage. Shaft 26 is journaled within the hollow trunnions 14 of the carriage and one end thereof extends beyond the adjacent side wall 4 of the frame of the machine where it is provided with a pulley 27 around which passes a belt 28 adapted to be driven by an electric motor 29. It will thus be seen that the driven roll 15 is capable of being rotated by the electric motor 29.

As the axis of shaft 26 is coincident with the pivotal axis of the carriage, the driven roll may be rotated in all positions of adjustment the carriage may assume and the mechanism for rotating it offers no resistance whatever to pivotal movement of the carriage.

The carriage is preferably maintained in a condition of equilibrium by an adjustable counterweight 30 which is mounted on a rotatable screw threaded shaft 31 supported at its opposite ends in brackets 32 depending from the carriage. At one end, shaft 31 is provided with a bevel gear 33 whereby it may be easily rotated as by means of a manually operable shaft 34 to properly position the counterweight.

Superposed on the driven roll 15 and in frictional engagement therewith is a work supporting roll 35 having a rubber covering in the form of a sleeve 36 and reduced end portions 37 journaled in anti-friction members 38 mounted within bearings 39 which are vertically movable between upstanding legs 40 of brackets 41 respectively secured to the top walls of the housings 20 of the carriage 12. The sides of the bearings 39 are provided with laterally projecting vertically disposed ribs 42 which extend within corresponding recesses 43 formed in the inner faces of the upstanding legs 40 and at their upper ends the legs of each bracket are rigidly connected by a removable plate or the like 44. The base portion of each bracket 41 is formed with depending ribs 45 which fit within recesses in the upper surface of the adjacent housing 20 and they are also provided with apertured bosses for receiving bolts 46 for rigidly connecting the bracket to the housing.

The yielding surface of the work supporting roll prevents the roll from slipping with respect to the driven roll and also with respect to the work and, as the coefficient of friction of the yielding surface on the work is greater than the coefficient of friction of the unyielding surface of the polishing wheel on the work, the rate of travel of the work past the polishing wheel is controlled by the peripheral speed of the work supporting roll.

To induce pivotal movement of the carriage causing the work supporting roll to move toward the polishing wheel and to yieldingly maintain the work in engagement with the latter under the desired pressure, two chambers 48 are provided into which fluid under pressure, such as air, may be admitted. These chambers are respectively positioned below the driven roll 15 adjacent the opposite ends thereof and each is preferably provided with a diaphragm, not shown. Interposed between the diaphragm of each chamber and an adjacent portion of the carriage is a cylindrical strut or the like 49 which is adapted to transmit to the carriage the pressure of the fluid admitted to the chamber. The chambers may be advantageously connected to a fluid pressure reservoir having a capacity many times that of both the chambers so that the work supporting roll may readily accommodate itself to changes in thickness of the work and yet exert a constant and uniform pressure on the work in all positions it may assume.

As it is desirable to set the polishing wheel and the work supporting and driven rolls in motion before the work is fed to the machine, means is employed for preventing the work supporting roll from contacting the polishing wheel which comprises horizontally adjustable stop members 50 which are adapted to be engaged at their inner ends by any suitable portions of the carriage, such as those designated 51 in the drawings. The inner ends of the stop members are inclined in such manner that the gap between the polishing wheel and the supporting roll may be easily controlled by shifting the stop members horizontally. Any suitable means may be employed for adjustably moving the stop members, such as pinions 52 which cooperate with racks 53 formed on the top of the stop members, the pinions being mounted upon a shaft 54 which extends transversely of the machine and may be conveniently rotated through suitable gears 55 by a hand wheel 56.

As the pressure normally exerted on the work by the supporting roll is of sufficient magnitude to compress the yielding surface of the latter against the under side of the work, the portions of the work immediately adjacent the polishing wheel tend to conform to the curvature of the latter with the result that, instead of there being only a line contact between the work and the polishing wheel, there is an area of contact between them of appreciable width. Should areas of the sheet of as much as three-eighths of an inch in width be forced into engagement with the polishing wheel, as is likely to occur in polishing thin sheets when a work supporting roll of a size comparable to that of the polishing wheel is employed, the force acting between the polishing wheel and the work is so distributed that the pressure per square inch of their contacting areas is decreased to such an extent that the proper finish will not be imparted to the work in a single pass through the machine unless the pressure to the machine is increased to an undesirable degree. I have discovered, however, that by employing a work supporting roll which is small in diameter as compared with the polishing wheel, that is one whose diameter is at the most no greater than one-half the diameter of the polishing wheel, the tendency of the work to conform to the curvature of the polishing wheel will be so minimized and, therefore, the areas of the sheet which are forced into engagement with the polishing wheel will be so narrow that the pres-

sure between the polishing wheel and the work will not be reduced to any substantial extent. While in some cases the diameter of the supporting roll may be as great as one-half the diameter of the polishing wheel, I have found that for a polishing wheel of eighteen inches in diameter optimum results are obtained by using a supporting roll of approximately three inches in diameter.

Since the yielding surfaces of the work supporting roll and the driven roll are capable of being compressed under normal working loads an amount greater than the thickness of the thinnest sheet capable of being polished by the machine, the work supporting roll will be incapable of delivering to such sheets a pressure sufficient to impart the desired finish thereto, if the stop members **50** are set so as to provide even the smallest possible gap between the polishing wheel and the work supporting roll. While the desired pressure could be imparted to even the thinnest sheet if the stop members were moved into a totally inoperative position, it would not be feasible to do this because the supporting roll would then contact with the polishing wheel before and after the sheet passes between them with the result that, since the polishing wheel rotates at a considerably higher speed than the supporting roll, the yielding surface of the latter would soon be worn away.

To enable the requisite amount of pressure to be applied to very thin sheets and at the same time to maintain a gap between the polishing wheel and the work supporting roll, means is provided for initially compressing the contacting portions of the work supporting roll and the driven roll an amount corresponding to that normally effected by the working load. The yielding surface of the driven roll being somewhat more compressible than the yielding surface of the supporting roll, the total compression which will be effected by the working load when the contacting portions of the two rolls are initially compressed will be less, therefore, than one-third of the compression which would otherwise be effected by the working load. Thus, as the thinnest sheet which it is practical to polish is of greater thickness than one-third the distance the two rolls would be normally compressed by the working load, it is possible by the present invention to maintain a gap between the polishing wheel and supporting roll and yet subject very thin sheets to the pressure required to produce the desired finish thereon.

The means for initially compressing the contacting portions of the supporting and driven rolls comprises a plurality of members **57** which are respectively cooperable with the vertically movable bearings **39** of the supporting roll.

Each of these members is provided with a wedge-shaped portion **58** which projects between the top of the adjacent bearing **39** and the plate **44** of the bracket **41** and also with a screw threaded portion **59** which extends through an aperture in the offset end **60** of an arm **61** which may be conveniently formed integrally with the bracket. Threaded on the portion **59** of each member on opposite sides of the offset end of the arm **60** are nuts **62** and **63** respectively, whereby the member may be horizontally adjusted in either direction or rigidly secured in a desired position of adjustment.

Normally members **57** are so disposed that the contacting portions of the work supporting roll and the driven roll will not be under compression and, when they occupy such positions, the contacting portions of the rolls will be compressed by normal working loads but, when very thin sheets are to be polished, nuts **62** are backed off while nuts **63** are rotated in such direction as to cause the wedge portions of the members to extend further between the bearings **39** and the top walls **44** of the brackets **41** and thus force the bearings downwardly. Rotation of nuts **63** is continued until the bearings are forced down far enough to subject the contacting portions of the work supporting and driven roll to substantially the same pressure as they would be subjected to by the working load. After the members have been moved into the desired position of adjustment, nuts **62** are rotated until they jam against the adjacent face of the offset ends of the arms **61**. With the nuts of both pair in contact with opposing faces of the arms, the members will be rigidly maintained in their adjusted positions.

Not only may both of the wedge-shaped members **57** be adjusted corresponding amounts to uniformly compress the contacting portions of the work supporting and driven rolls but they may be adjusted independently of each other so that only one instead of both ends of the supporting roll is forced downwardly with respect to the driven roll. When this is done, the axis of the work supporting roll will be angularly disposed, instead of being parallel, with the axis of the polishing wheel and the gap between the supporting roll and the polishing wheel will, therefore, be of progressively varying width from end to end rather than of uniform width as would be the case if both members were adjusted a corresponding amount. As the sheets to be polished are sometimes of greater width adjacent one side edge than adjacent the opposite side edge, it will be appreciated that by making the gap between the polishing wheel and the supporting roll of progressively varying width such sheets will be subjected to a substantially uniform pressure from side to side and thus be provided with a uniform finish.

To compensate for wear of the surfaces of the work supporting and driven rolls, a plurality of shims **64**, as illustrated in Figure 6 of the drawings, may be inserted between the top of the bearings **39** and the wedge portions of the members **57** so that the latter may always be capable of exerting the required downward force on the bearings.

While some features of the machine illustrated in the drawings are not described herein since an understanding of them is not essential to a complete disclosure and appreciation of the present invention, such features will be found to be fully described in my copending application heretofore mentioned.

Various modifications and changes in details of construction of the specific embodiment of the invention described and illustrated herein may, of course, be made without departing from the spirit of the invention as defined by the appended claims.

What I claim is:

1. A machine for polishing metal sheets and the like including a rotatable polishing wheel having a substantially unyielding surface, guiding means carried by said machine and positioned on opposite sides of said polishing wheel for maintaining the work substantially in a single plane, and means disposed beneath said wheel for maintaining the work in engagement there-

with, said means including a driven roll and a work supporting roll in frictional engagement with the driven roll interposed between the latter and the polishing wheel said driven roll and work supporting roll being substantially of equal length, said work supporting roll being of small diameter as compared with the polishing wheel and having a relatively yielding surface adapted to be compressed under normal working loads against the work for controlling the rate of travel of the work past the polishing wheel.

2. A machine for polishing metal sheets and the like including a rotatable polishing wheel having a substantially unyielding surface, guiding means carried by said machine and positioned on opposite sides of said polishing wheel for maintaining the work substantially in a single plane, a work supporting roll disposed beneath the polishing wheel for maintaining the work in engagement therewith, said work supporting roll being of less diameter than one-half the diameter of the polishing wheel and having a relatively yielding surface adapted to be compressed under normal working loads against the work for controlling the rate of travel of the work past the polishing wheel, and a driven roll in frictional engagement with the work supporting roll for rotating the latter, said driven roll and said work supporting roll being of substantially equal length.

3. A machine for polishing metal sheets and the like including a rotatable polishing wheel having a substantially unyielding surface, guiding means carried by said machine and positioned on opposite sides of said polishing wheel for maintaining the work substantially in a single plane, two superposed rolls disposed below the polishing wheel, the upper one of said superposed rolls being of less diameter than one-half the diameter of the polishing wheel and having a relatively yielding surface adapted to be compressed against the work for controlling the rate of travel thereof past the polishing wheel and the lower one of said superposed rolls being driven and in frictional engagement with said upper roll for rotating the latter, said superposed rolls being substantially of uniform length, and means for moving said superposed rolls upwardly for forcing the work into engagement with the polishing wheel.

4. A machine for polishing metal sheets and the like including a cylindrical polishing wheel, a pair of superposed cylindrical rolls disposed beneath the polishing wheel for maintaining the work in engagement therewith, the axes of said rolls being normally parallel with the axis of the polishing wheel and one of said rolls having a yielding surface, the upper one of said rolls being in frictional engagement with the lower one and being normally spaced from the polishing wheel, and means for moving one end of the upper roll downwardly relatively to the lower roll to compress a portion of said yielding surface and thereby cause the axis of the upper roll to be angularly disposed with respect to the axis of the polishing wheel, whereby the space between the polishing wheel and the upper roll is of progressively increased width from one end to the other.

5. A machine for polishing metal sheets and the like including a cylindrical polishing wheel, a pair of superposed contacting rolls disposed beneath the polishing wheel for maintaining the work in engagement therewith, the axes of said rolls being normally parallel with the axis of the polishing wheel and one of said rolls having a yielding surface, the upper one of said rolls being normally spaced from the polishing wheel and being vertically movable with respect to the lower one of said rolls, and wedge means for forcing one end of the upper roll downwardly with respect to the lower roll to compress said yielding surface and thus cause the axis of the upper roll to be angularly disposed with respect to the polishing wheel and the space between the latter and the upper roll to be greater adjacent one end thereof than adjacent the other.

6. A machine for polishing metal sheets and the like including a cylindrical polishing wheel, a pair of superposed cylindrical rolls disposed beneath the polishing wheel for maintaining the work in engagement therewith, the axes of said rolls being normally parallel with the axis of the polishing wheel and one of said rolls having a yielding surface, the upper one of said rolls being in frictional engagement with the lower one and being normally spaced from the polishing wheel, and selectively operable means respectively cooperable with the end portions of said upper roll for moving one or the other end of said roll downwardly relatively to the lower roll to compress a portion of said yielding surface to thereby cause the space between the polishing wheel and the upper roll to be of greater width adjacent one end of the latter than adjacent the other.

7. A machine for polishing metal sheets and the like including a cylindrical polishing wheel, a pair of superposed cylindrical rolls, one of which has a yielding surface, disposed below the polishing wheel for maintaining the work in engagement therewith, the axes of said rolls being normally parallel with the axis of the polishing wheel and said rolls being in frictional engagement, a support in which the lower one of said rolls is journalled, bearings for the end portions of the upper one of said rolls, housings within which said bearings are vertically movable, and adjustable means adapted to selectively move one or the other of said bearings downwardly relatively to the lower roll to compress a portion of said yielding surface and thus cause the axis of the upper roll to be angularly disposed with respect to the axis of the polishing wheel.

8. A machine for polishing metal sheets and the like including a cylindrical polishing wheel, a pair of superposed cylindrical rolls, one of which has a yielding surface, disposed below the polishing wheel for maintaining the work in engagement therewith, the axes of said rolls being normally parallel with the axis of the polishing wheel and said rolls being in frictional engagement, a support in which the lower one of said rolls is journalled, bearings for the end portions of the upper one of said rolls, housings within which said bearings are respectively vertically movable, and adjustable means operatively interposed between each of said bearings and a portion of the adjacent housing adapted to selectively force one or the other of said bearings downwardly to compress a portion of said yielding surface and thus cause the axis of the upper roll to be angularly disposed with respect to the axis of the polishing wheel.

9. A machine for polishing metal sheets and the like including a rotatable polishing wheel, a pair of superposed contacting rolls disposed below the polishing wheel, a support for said rolls, means for moving the support to cause the upper

one of said rolls to press the work against the polishing wheel, one of said rolls having a yielding surface and said upper roll being vertically movable with respect to the lower roll whereby said yielding surface is adapted to be compressed under a normal working load, and means for forcing the upper roll downwardly relatively to the lower roll and for securing it in such position with respect thereto as to initially compress said yielding surface and thereby decrease the amount of compression of the yielding surface normally effected by the working load.

10. A machine for polishing metal sheets and the like including a rotatable polishing wheel, a pair of superposed contacting rolls disposed below the polishing wheel, a support for said rolls, means for moving the support upwardly to cause the upper one of said rolls to press the work against the polishing wheel, said upper roll having a yielding surface and being vertically movable with respect to the lower one of said rolls whereby said yielding surface is adapted to be compressed under a normal working load against said lower roll as well as against the work, and means for forcing said upper roll downwardly relatively to the lower roll and for securing it in such position with respect thereto as to initially compress said yielding surface against the lower roll and thereby decrease the amount of compression of the yielding surface normally effected by the working load.

11. A machine for polishing metal sheets and the like including a rotatable polishing wheel, a pair of superposed rolls disposed below the polishing wheel, a support for said rolls, means for moving said support upwardly to cause the upper one of said rolls to press the work against the polishing wheel, stop means limiting upward movement of said support to prevent said upper roll contacting the polishing wheel, said upper roll being in frictional engagement with the lower one of said rolls and having a yielding surface compressible under a normal working load against the work and the lower roll, and means for forcing said upper roll downwardly with respect to the lower roll and for maintaining it in such position with respect thereto as to initially compress said yielding surface against the lower roll an amount substantially corresponding to that effected by the working load whereby when the work being polished is of such thinness that said yielding surface is compressible under the working load an amount greater than the thickness of the work but less than twice the thickness thereof the upper roll will not contact the polishing wheel when the work passes from engagement with the latter.

DAVID E. MULHOLLAND.