July 2, 1963 H. P. LEE 3,095,674

ABRASIVE BELT FINISHING MACHINE

Filed Feb. 2, 1961 2 Sheets-Sheet 1

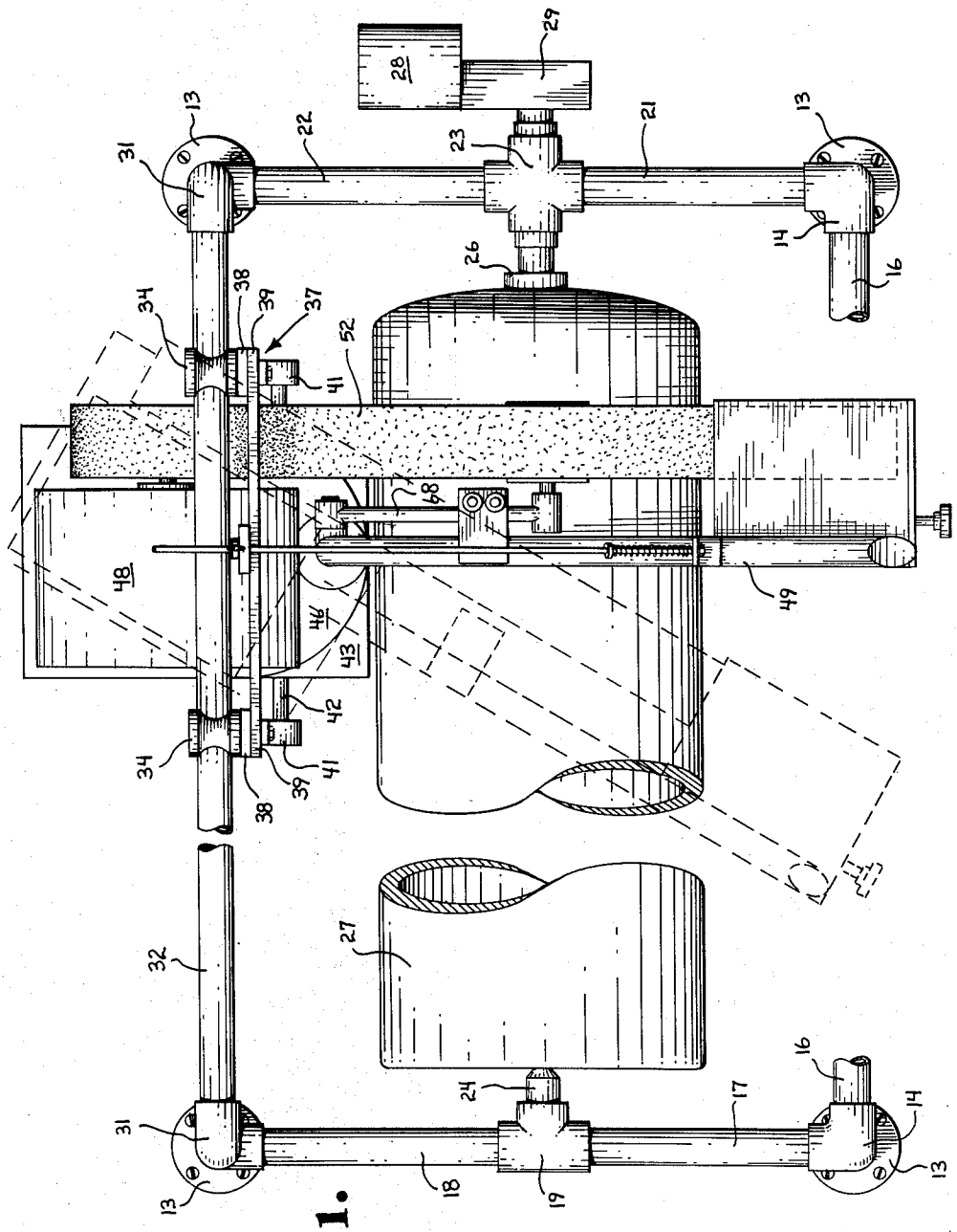


Fig. 1.

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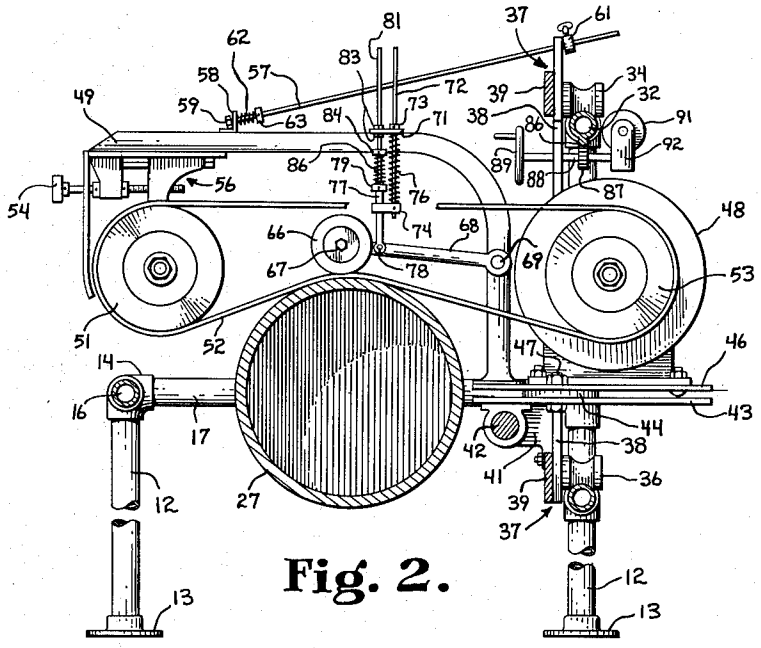


Fig. 2.

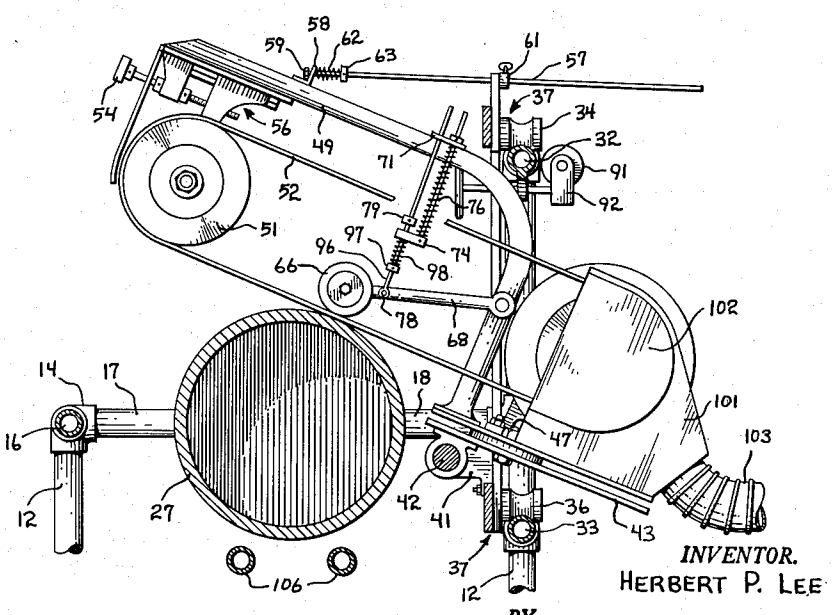


Fig. 3.

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ABRASIVE BELT FINISHING MACHINE

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This invention relates generally to finishing machines and more particularly to a machine adapted to finish the exterior surface of cylindrical articles.

Of the various products which are familiar to the general public, tanks of various sorts are among the most familiar. They are manufactured in various sizes and shapes but one type which is well known and which has been successfully used for many years is the galvanized iron or steel tank of a generally cylindrical form.

In the manufacture of galvanized tanks, the zinc coating applied in the galvanizing operation is frequently extremely irregular in character. As long as there is an adequate coating at the places where the coating is of minimum thickness, the irregularities are not of any particular consequence on the interior of the tank or even on the exterior thereof if the tank is to be later provided with an insulating or decorative shroud. Yet, it has been recognized that if the galvanized coating could be satisfactorily finished followed by an application of paint, an attractive product could be produced without the need of a decorative shroud with its additional cost, weight and space requirements.

While tanks have been manufactured in which the galvanized exterior surface was finished and paint subsequently applied, this has not been done without some difficulty. One difficulty is the fact that the zinc coating is rather thin. Consequently, when conventional methods are used to remove the rough places caused by excess accumulations, the coating is frequently removed completely where it was originally of normal thickness. Moreover, there is frequently an excess accumulation appearing generally along one side of a tank creating an unround condition and difficulty has been encountered in properly finishing such tanks.

Because of the above mentioned factors and the fact that the rough galvanized condition of each tank is different, which has heretofore required individual attention to each tank, finishing has been done predominantly by manual labor with some help from portable hand finishing machines. The attendant dirt and atmospheric contamination problems are obvious. In addition to these problems of conventional practice, it is difficult to handle a tank during finishing and the time required is excessive. The natural consequence is a comparatively unsafe and costly finishing operation.

It is, therefore, a general object of this invention to provide improved means for finishing exterior surfaces of cylindrical articles.

It is a further object of this invention to provide a machine adapted to remove irregularities in a metallic coating without excessive removal of the coating entirely in places where it was originally of the proper thickness.

It is a further object of this invention to provide means of the foregoing character adapted to finishing surfaces of tanks which are unround.

It is a further object of this invention to provide means of the foregoing character capable of rapidly finishing the exterior cylindrical surface of tanks without excessive dirt and air contamination.

It is a further object of this invention to provide means of the foregoing character expediting finishing operations and increasing the safety thereof.

It is a further object of this invention to provide means of the foregoing character requiring only nominal attention of a machine operator.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims:

FIG. 1 is a plan view of the principal parts of a typical embodiment of my invention.

FIG. 2 is a side elevation of the machine of FIG. 1.

FIG. 3 is a side elevation of the machine of FIG. 1 showing a variation of the work-wheel loading means and also showing a position adapting the machine to a specific type of finishing operation.

Referring to FIGS. 1 and 2, a frame shown constructed of pipe sections though it could, of course, be constructed of many other types of structural members. The frame includes upright sections **12** in the four corners thereof mounted to the floor by mounting flanges **13**. In FIG. 1, the junctions **14** at the upper ends of the upstanding sections **12** at the front of the machine are joined by a section **16** which is broken in the illustration to save space. At the left-hand end of the machine, a horizontal member extending to the rear of the frame consists of the pipe sections **17** and **18** joined by a T **19**. Similarly at the right-hand end of the machine, a horizontal member consists of the sections **21** and **22** joined by the cross **23**.

The T **19** and the cross **23** provide supports for the centers **24** and **26**, respectively. These centers support the cylindrical tank **27** which is illustrated in two portions to save space in the drawing. The center **24** may be stationary or it may rotate and the center **26** is a live center which may be driven by the motor **28** through the speed reducing unit **29**.

At the rear of the machine, upright members are provided extending above the two horizontal members mentioned and at the upper margin thereof are elbows **31** joined by a horizontal section **32**. There is also a horizontal section **33** parallel to and below section **32** supported by the upright sections **12**. The sections **32** and **33** provide support through the upper rollers **34** and the lower rollers **36** for the carriage **37**.

The carriage **37** is usually of a generally rectangular form having parallel upright members **38** and parallel horizontal cross members **39**. The upright members **38** of the carriage serve as mounts for a pair of pillow blocks **41**. The blocks **41** provide a support for the ends of the shaft **42**. The shaft **42**, in turn, provides a pivotal mounting for the base member **43**. The base member can thus be rocked about an axis parallel to the axis between the centers **24** and **26**.

The base member **43** provides a pivotal support through the bearing block **44** to the swing member **46**. Thus, the swing member **46** can be swung in a plane parallel to that of the base member **43**. The fastening of the swing member to the base member is usually accomplished by means of a bolt **47** whereby any desired amount of friction between the bearing block and the two members can be provided.

The swing member **46** provides a support for the motor **48**. It also mounts the L-shaped or outwardly extending arm **49**. The arm **49** supports the idler wheel or pulley **51**. An abrasive belt **52** is carried by the pulley **51** and the pulley or wheel **53** driven by the motor **48**. Belt tension may be adjusted by the knob **54** operating a conventional belt adjusting mechanism **56**.

FIG. 2 shows a considerable wrap of the belt **52** about the cylinder or tank **27**. The extent of the wrap is determined by a height-setting gauge comprising a rod or link **57** passing through an aperture in the bracket **58** fastened to the arm **49** and an aperture in the carriage **37**. An abutment **59** is located on one end of the link **57** and an adjustable collar **61** is located on the rod and the cooperation of the abutment **59** and collar **61** determines the extent to which the arm **49** is able to move downwardly by the rocking action of the base member **43**. A spring **62**

compressed between the bracket 58 and the adjustable collar 63 prevents rattling of the height adjusting gauge particularly when a very irregular or unround surface is being finished. The abutment 59 may be in the form of a nut applied to a threaded end of the rod 57 and a second nut may be employed in lieu of collar 63 to provide a spring seat.

A work-wheel 66 is journalled on a shaft 67 fastened to the work-wheel carrying arm 68. The arm 68 is pivotally mounted at the pin 69 to the L-shaped arm 49. The work-wheel 66 provides a means for removing large irregularities in the surface of the tank 27 without at the same time causing excessive removal of the coating where it is comparatively thin. This effect is achieved even though the surface of the cylinder is unround.

Means for loading the work-wheel are shown in two variations. The first is shown in FIG. 2 and includes a bracket 71 fastened to the arm 49. A rod 72 having an adjustable collar 73 fastened thereto passes through an aperture in the bracket 71. An intermediate member 74 is fastened to the lower end of the rod 72. A spring 76 is compressed between the bracket 71 and the intermediate member 74 and resiliently maintains the member 74 in a constant position with respect to arm 49. A second rod or tube 77 is pivotally fastened at pin 78 to the arm 68. Rod 77 passes upwardly through an aperture in the member 74 and has an adjustable collar 79 fastened thereto toward its upper end. A third rod 81 passing through an aperture in the bracket 71 is maintained in a fixed position with respect to the bracket by the adjustable collars 83. Another adjustable collar 84 is fastened to the rod 81 and affords an upper seat for the compression spring 86. The rod 77 is provided with a hollow upper end or as indicated above a tube may be used instead of a rod so that the rod 81 can descend partially into the rod or tube 77 providing axial alignment of the two and yet permitting freedom of motion therebetween in the axial direction. It should be apparent therefor that in the embodiment of FIG. 2 the spring 86 provides the vertical loading force on the wheel 66. This force may be varied by appropriate adjustments of the collars. It should be apparent also that upon removal of the cylinder 27 or upon rocking of the arm 49 to a position where the belt is no longer engaged with a cylinder, the spring 86 will force the work-wheel downwardly with respect to the arm 49 until the collar 79 abutting the member 74 terminates further descent of the wheel.

It should be mentioned at this point that a feature of this invention is the balancing of components so that when the arm 49 is rocked to a position engaging the belt with the article to be finished, the center of gravity is slightly forward or toward the front of the machine with respect to the shaft 42. On the other hand, upon disengaging the belt from the article to be finished by raising arm 49, and then raising the arm somewhat further, the center of gravity can be shifted to the rear of the shaft 42 to maintain the belt disengaged from the article so that the article may be removed.

FIG. 2 shows in cross section a gear rack 86 which is mountd on the underside of the horizontal section 32 and extends therealong. This rack is engaged by pinion 87 journalled in a bushing 88 mounted to the carriage 37. A hand wheel 89 is available to manually move the carriage horizontally whereby the surface of the cylinder can be finished from end to end. It should be noted that the carriage is normally driven horizontally by means of an appropriate motor and speed reducer 91 and 92, respectively, and the extent of traverse can be controlled by cams or stops and limit switches according to well known practices.

FIG. 3 shows a slight variation in the means provided to load the work-wheel arm. In this instance, a rod 96 pivotally pinned to the arm 68 passes through an aperture in the intermediate member 74 and in the bracket 71. However, an adjustable collar 97 is fastened to the rod 96 below the intermediate member 74 and the spring 98 is compressed between this collar and the intermediate member. In this construction, both the springs 98 and 76 provide the load on the work-wheel instead of only one spring such as spring 86 in FIG. 2.

FIG. 3 also shows an enclosure 101 having a removable plate 102 in the side thereof, providing a chamber. A flexible hose 103 is fastened to the chamber and may be connected to a source of vacuum to suitably deposit the dirt created in the finishing operation.

A pair of pipes 106 extending horizontally parallel to the axis between centers may be provided as shown in FIG. 3. They may be supported by any portion of the frame of the machine and may be conveniently suspended from the horizontal members at the left-hand and right-hand ends of the machine. They provide a rest for the tank facilitating the loading and unloading of the machine.

It should be noted that FIG. 3 illustrates the situation when the height gauge is adjusted to permit the belt to merely touch but not wrap around the cylinder 27. By so doing, the only abrasive effort which can be applied to the cylinder is that which is applicable by the work-wheel, itself. This feature is particularly useful for finishing the build-up of material created by the welding of a longitudinal seam in the tank. In order to provide a flat finished surface along the seam, the assembly carried by the swing member 46 and including the motor, the belt and the work-wheel, is swung on the block 44 about the axis through the bolt 47 to a position such as is illustrated by the dotted lines in FIG. 1. The cylinder is, of course, not rotated for this operation. The carriage is moved along either by manual or powered traverse and the portion of the belt loaded by the work-wheel creates a flat surface along the seam. Either version of the work-wheel loading means may be used for this operation.

Either version of the work-wheel loading means makes it possible to remove large irregularities from the surface of the article being finished as it rotates and at the same time, with the belt wrapping the drum to some extent as illustrated in FIG. 2, the portions of the belt engaging the drum beyond the line directly under the work-wheel effect a polishing action. The amount of polishing may be controlled, of course, by the adjustment of the collar 61 of the height gauge. The effort or force directed to removal of large irregularities can be adjusted by movement of the collars on the rods 77 or 97 as the case may be and/or by substitution of springs of various capacities.

It should be pointed out that a cylinder may be finished during one passage of the carriage over the length thereof or may be finished in several passages, the belt working and removing material during travel of the carriage in both directions. Automatic reversal of the direction of travel of the carriage can be accomplished by appropriate cams and switches.

While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character, it being understood that only the preferred embodiment has been shown and described and that all changes and modifications that come within the spirit of the invention and the scope of the claims are also desired to be protected.

The invention claimed is:

1. A finishing machine for cylindrical articles and comprising: a frame; means coupled to said frame for supporting an article to be finished and facilitating rotation of the article about an axis; means pivotally coupled to said frame and carrying an abrasive belt, said belt being engageable with the article to be finished; a work-wheel mounted to a carrier movably mounted to said belt carrying means, the pivotal mounting of said carrying means and the movable mounting of said carrier to said

carrying means cooperating to accommodate engagement of said work-wheel with said belt opposite a point of engagement of said belt with the article to be finished; resilient means coupled to said belt carrying means and to said workwheel carrier to engage said workwheel with said belt opposite a point of engagement of said belt with the article to be finished and apply a desired load on said workwheel to compressively load said belt between said workwheel and the article to be finished when said belt is engaged with said article whereby the machine is adapted to rapidly remove comparatively large irregularities in an unsmooth cylindrical surface of said article when said article is rotated, and simultaneously remove at a slower rate smaller irregularities in said surface; and means coupled to said belt carrying means to determine the extent of engagement of said belt with said article.

2. A finishing machine for cylindrical articles and comprising: a frame; means on said frame for supporting an article to be finished and facilitating rotation of the article about an axis; carriage means mounted to said frame; an outwardly extending arm; means pivotally coupling said arm to said carriage means; means coupled to said arm and carrying an abrasive belt, said belt being engageable with said article to be finished; a workwheel mounted to an arm pivotally mounted on said outwardly extending arm, the pivotal mountings of said arms being located to accommodate engagement of said workwheel with said belt immediately opposite a point of engagement of said belt with said article to be finished; means connected to said outwardly extending arm and said workwheel arm keeping said workwheel disengaged from said belt when said belt is disengaged from said article; resilient means coupled between said arms to engage said workwheel with said belt immediately opposite a point of engagement of said belt with said article to be finished and apply a desired load on said workwheel to compressively load said belt between said workwheel and said article to be finished when said belt is engaged with said article whereby the machine is adapted to rapidly remove comparatively large irregularities in an unsmooth cylindrical surface of said article when said article is rotated and simultaneously remove at a slower rate smaller irregularities in said surface; and means coupled to said outwardly extending arm and said carriage means to determine the extent of engagement of said belt with said article.

3. A finishing machine for cylindrical articles and comprising: a frame; centers on said frame for supporting an article to be finished to facilitate rotation of the article about an axis between said centers; carriage means mounted to said frame through rollers for movement parallel to said axis; a base member pivotally mounted to said carriage means for rocking about an axis parallel to the axis between said centers; a swing member pivotally mounted to said base member; an outwardly extending arm fastened to said swing member and carrying a pulley; a motor fastened to said swing member and having a pulley; an abrasive belt carried by said pulleys and having a side engageable with an article supported on said centers, by rocking of said base member a predetermined amount in one direction; a workwheel mounted to an arm pivotally mounted on said outwardly extending arm and disposed on a side of said belt opposite the said engageable side and engageable with said opposite side; means connected between said outwardly extending arm and said workwheel arm keeping said workwheel disengaged from said belt when said belt is disengaged from said mounted article; resilient means coupled between said arms to apply a desired load on said workwheel when said belt engages said article and said workwheel engages said belt whereby the machine is adapted to rapidly remove comparatively large irregularities in an unsmooth cylindrical surface of said article when said article is rotated and simultaneously remove at a slower rate smaller irregularities in said surface; and a link adjustably coupled to said outwardly extending arm and said carriage to determine the extent of wrap of said belt around said article, the said link and said pivotal mounting between said base member and said swing member being cooperable to provide for removal of material from said article and generation of a plane surface thereby when said article is stationary.

4. A finishing machine for cylindrical articles and comprising: a frame; centers on said frame for supporting and rotating a cylinder about an axis between said centers; carriage means mounted to said frame for movement parallel to said axis; a base member pivotally mounted to said carriage means for rocking about an axis parallel to said axis between centers; a swing member pivotally mounted to said base member to swing in planes parallel to said axes; an outwardly extending arm fastened to said swing member and carrying a pulley; a motor fastened to said swing member and having a pulley; an abrasive belt carried by said pulleys and engageable with the cylinder by rocking said base member; a workwheel mounted to an arm pivotally mounted on said outwardly extending arm, part of said belt lying between said workwheel and the cylinder mounted between said centers; means connected between said outwardly extending arm and said workwheel arm keeping said workwheel disengaged from said belt when said belt is disengaged from the mounted cylinder; resilient means coupled between said arms to apply a desired load on said workwheel when said belt engages the cylinder and said workwheel engages said belt whereby the machine is adapted to rapidly remove comparatively large irregularities in an unsmooth cylindrical surface of said cylinder when said cylinder is rotated and simultaneously remove at a slower rate smaller irregularities in the said surface; and a height setting gauge adjustably coupled to said outwardly extending arm and said carriage to determine the extent of wrap of said belt around the cylinder, the said gauge and said pivotal mounting between said base member and said swing member being cooperable to provide for removal of material from the cylinder and generation of a plane surface on the cylinder when said article is stationary.

5. A finishing machine for cylindrical articles and comprising: a frame; centers on said frame for supporting an article to be finished and adapted to cause rotation of said article about an axis between said centers; carriage means mounted to said frame for movement parallel to said axis; a base member pivotally mounted to said carriage means for rocking about an axis parallel to said axis between centers; a swing member pivotally mounted to said base member; an outwardly extending arm fastened to said swing member and carrying a pulley; a motor fastened to said swing member and having a pulley; an abrasive belt carried by said pulleys and driveable by said motor and engageable with the article to be finished by rocking said base member; a workwheel mounted to an arm pivotally mounted on said outwardly extending arm and disposed such that part of said belt lies between said workwheel and the article to be finished supported by said centers; means connected between said outwardly extending arm and said workwheel arm keeping said workwheel disengaged from said belt when said belt is disengaged from said article; resilient means coupled between said arms to apply a desired load on said workwheel when said belt engages said article and said workwheel engages said belt whereby the machine is adapted to rapidly remove comparatively large irregularities in an unsmooth cylindrical surface of said article when said article is rotated and simultaneously remove at a slower rate smaller irregularities in said surface; and a height setting gauge adjustably coupled to said outwardly extending arm and said carriage to determine the extent of wrap of said belt around said article, the said gauge and said pivotal mounting between said base member and said swing member being cooperable to provide for removal of material from

said article and generation of a plane surface along a longitudinally extending path on said article when said article is stationary.

6. The machine of claim 5 wherein said means for keeping the workwheel disengaged comprises: a bracket fastened to one of said arms and having an aperture therethrough; an intermediate member having an aperture therethrough and a first rod fastened thereto, said rod extending through said bracket aperture; an adjustable collar fastened to said rod and abuttingly engageable with said bracket to limit the separation between said bracket and said intermediate member; a second rod pivotally attached to the other of said arms and extending through said member aperture; and an adjustable collar fastened to said second rod and abuttingly engageable with said intermediate member to limit the distance between said other arm and said intermediate member.

7. The machine of claim 5 wherein said means for keeping the workwheel disengaged and the resilient means comprise: a bracket fastened to one of said arms and having an aperture therethrough; an intermediate member having an aperture therethrough and a first rod fastened thereto, said rod extending through said bracket aperture; a spring disposed between said bracket and said intermediate member providing a bias therebetween tending to increase distance between said bracket and said member; an adjustable collar fastened to said rod and abuttingly engageable with said bracket to limit the the distance between said bracket and said intermediate member; a second rod pivotally attached to the other of said arms and extending through said member apertures; an adjustable collar fastened to said second rod and abuttingly engageable with said intermediate member to limit the distance between said other arm and said intermediate member; an abutment coupled to said bracket and having means for adjusting its location with respect to said bracket; and a spring disposed between said adjustable collar fastened to said second rod and said adjustable abutment for transmitting the required force to apply said desired load.

8. The machine of claim 5 wherein said means for keeping the workwheel disengaged and the resilient means comprise: a bracket fastened to one of said arms and having an aperture therethrough; an intermediate member having an aperture therethrough and a first rod fastened thereto, said rod extending through said bracket aperture; a spring disposed between said bracket and said intermediate member providing a bias therebetween tending to increase distance between said bracket and said member; an adjustable collar fastened to said rod and abuttingly engageable with said bracket to limit the distance between said bracket and said intermediate member; a second rod pivotally attached to the other of said arms and extending through said member aperture; and an adjustable collar fastened to said second rod and abuttingly engageable with said intermediate member to limit the distance between said other arm and said intermediate member; a second adjustable collar fastened to said second rod; and a spring disposed between said second adjustable collar and said intermediate member, said springs being cooperable for transmitting the force required to apply said desired load.

9. The machine of claim 5 wherein said height setting gauge comprises: a bracket mounted on said outwardly extending arm and having an aperture therethrough; an aperture in said carriage; a rod extending through said apertures and having an abutment thereon; an adjustable collar fastened to said rod, with said bracket and said aperture being between said abutment and said collar whereby said gauge is adapted to limit the extent to which said base member may be rocked for limiting the positions of said pulleys with respect to the article.

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