United States Patent [19]

Parris

[11] **3,724,682**

[45] **Apr. 3, 1973**

[54] **APPARATUS FOR MANIPULATING A WORKPIECE**

[75] Inventor: **John L. Parris**, Knoxville, Tenn.

[73] Assignee: **The Carborundum Company**, Niagara Falls, N.Y.

[22] Filed: **June 25, 1971**

[21] Appl. No.: **156,770**

[52] **U.S. Cl.** .....**214/1 QG**

[51] **Int. Cl.**.....**B65g 7/00**

[58] **Field of Search**.....214/1 Q, 1 QA, 1 QG, 130 R; 198/33 AC, 33 AD

[56] **References Cited**

UNITED STATES PATENTS

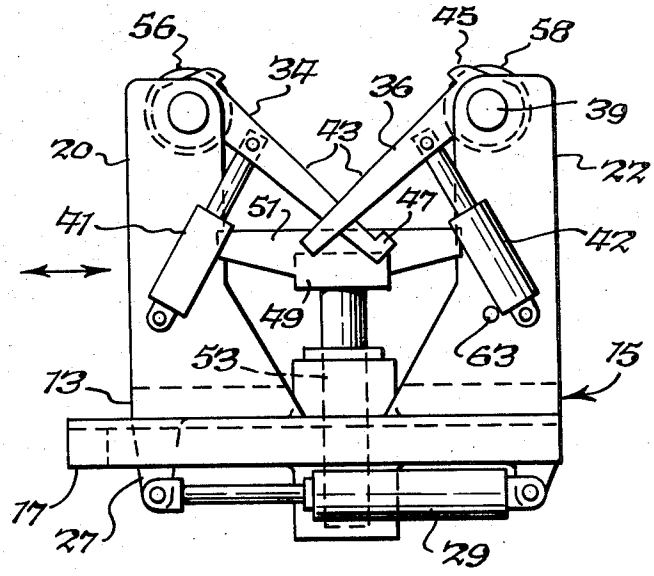
3,487,953	1/1970	Wolf	214/1 QG
3,428,199	2/1969	Rhoads	214/1 QG X
3,243,987	4/1966	Saylor	214/1 QA X
3,400,835	9/1968	Rhoads	214/1 QG

Primary Examiner—Robert G. Sheridan
Assistant Examiner—Frank E. Werner
Attorney—David E. Dougherty et al.

[57] **ABSTRACT**

In an apparatus for manipulating workpieces, especially billets of various sizes and shapes, a first frame includes a plurality of arms pivotably mounted for movement about a first axis and a second frame includes a plurality of arms pivotably mounted for movement about a second axis which is substantially parallel to and spaced from the first axis. The second frame is movable toward and away from the first frame so that workpieces of various sizes are accommodated. A supporting surface intermediate the first and second frame which may be raised or lowered is utilized for supporting slabs during turning thereof. At least two rollers are rotatably mounted on each frame for turning cylindrically-shaped workpieces.

20 Claims, 17 Drawing Figures



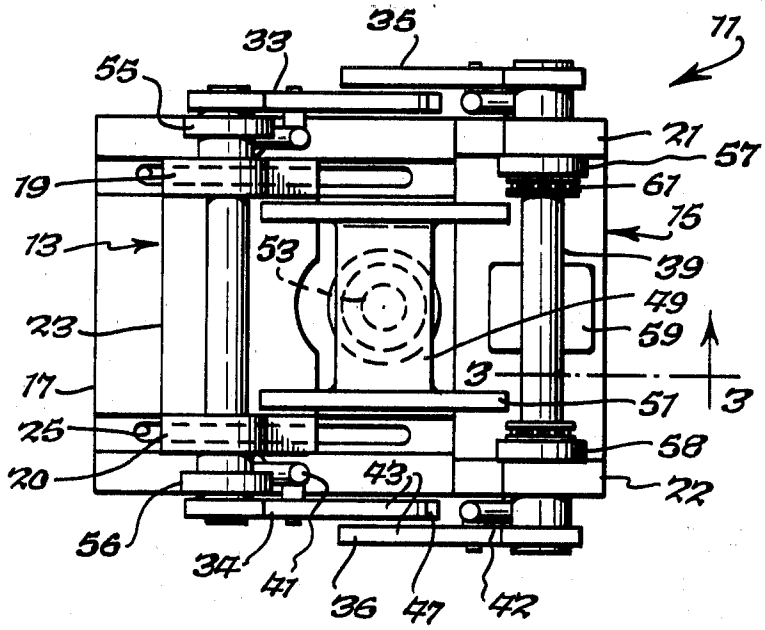


Fig. 1.

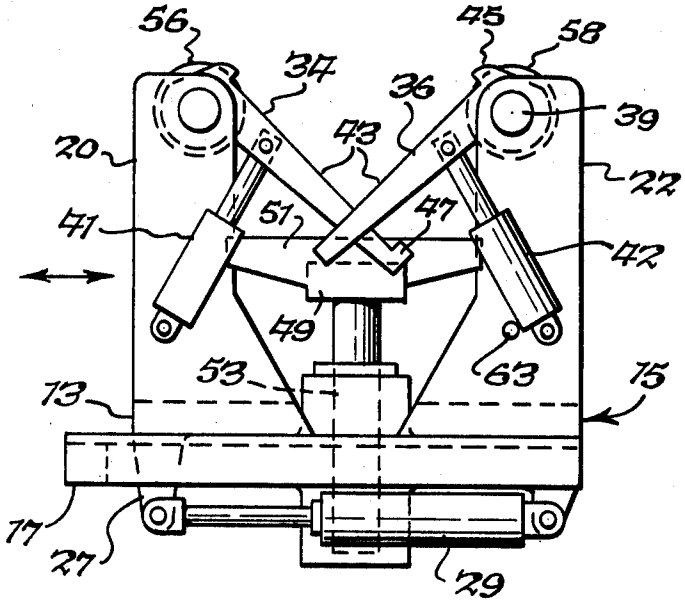


Fig. 2.

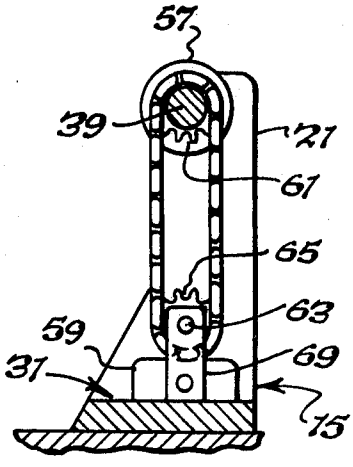


Fig. 3.

INVENTOR.
John L. Parris
BY Robert E. Walker
David E. Dougherty
ATTORNEY.

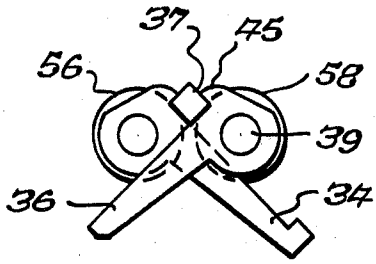


Fig. 4.

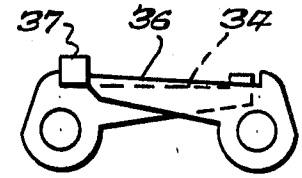


Fig. 5.

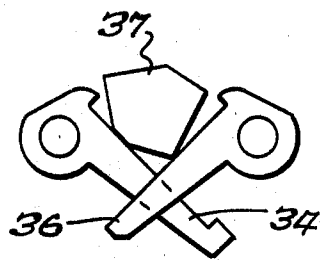


Fig. 6.

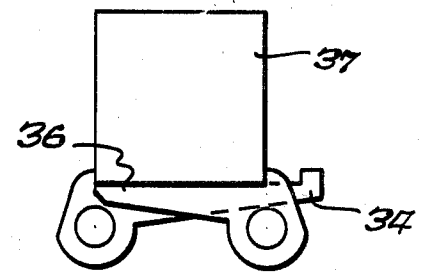


Fig. 7.

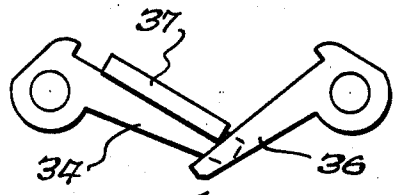


Fig. 8.

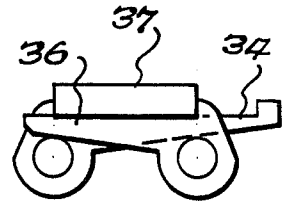


Fig. 9.

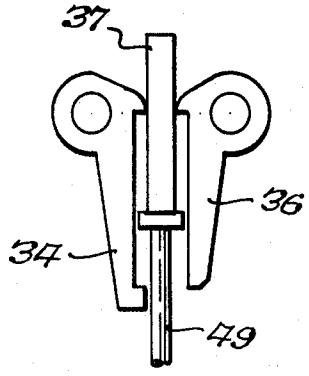


Fig. 10.

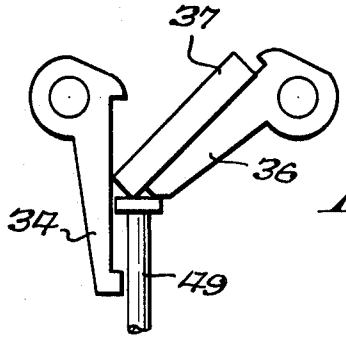


Fig. 11.

INVENTOR.
John L. Parris
BY Robert E. Walter
David Rabinowitz
ATTORNEY.

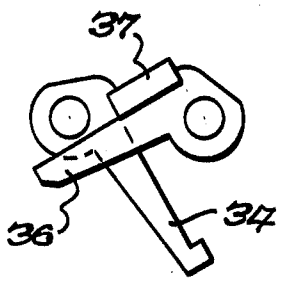


Fig. 12.

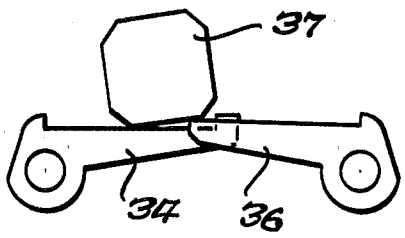


Fig. 13.

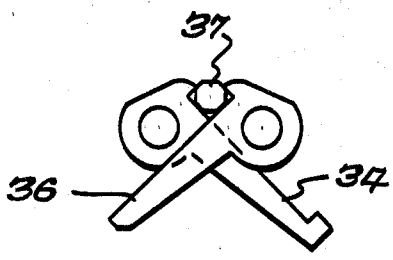


Fig. 14.

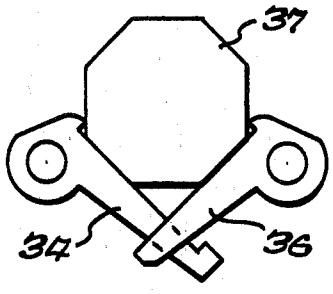


Fig. 15.

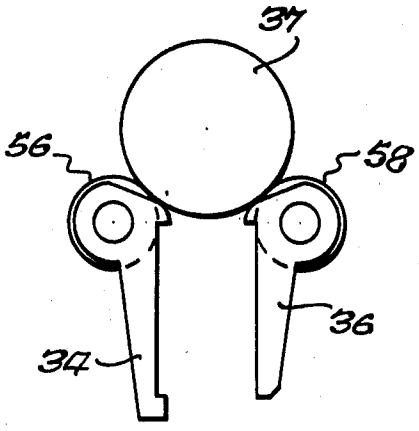


Fig. 16.

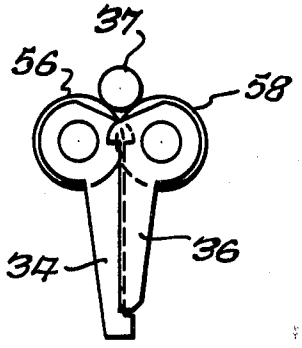


Fig. 17.

INVENTOR.
John L. Parris
BY Robert E. Walter
David E. Dougherty
ATTORNEY.

APPARATUS FOR MANIPULATING A WORKPIECE

BACKGROUND OF THE INVENTION

The present invention relates to the art of material handling devices, especially those devices utilized in conjunction with automatic machinery such as billet or slab grinders which are well-known in the prior art. In automatic grinding, it is necessary to turn a slab after successive passes of the grinding wheel to present a new side for grinding. Thus, while the present invention is described with reference to the turning and manipulating of billets, it is to be appreciated that this invention is suited for manipulating all types of workpieces.

Heretofore, it has been a problem in the prior art to manipulate workpieces of different cross sectional configurations, such as square, rectangular, hexagonal, octagonal, or arcuate. The prior art devices either do not accommodate all of the aforementioned shapes or require complex adjustments to handle different shapes. Thus, production is uneconomically interrupted when it is desired to manipulate workpieces of various shapes one after another.

SUMMARY OF THE INVENTION

In an apparatus for manipulating workpieces of different cross sectional configurations, a first frame includes a plurality of arms pivotably mounted for movement about a first axis and a second frame includes a plurality of arms pivotably mounted for movement about a second axis which is substantially parallel to and spaced from the first axis. The arms are operable to engage and manipulate workpieces, especially those workpieces having planar surfaces. A supporting surface is positioned intermediate the first and second frame for supporting the underside of the workpiece. Each frame includes at least two rollers which engage arcuate workpieces for turning thereof.

The present invention obviates many of the above discussed deficiencies of the prior art devices. The manipulator may accommodate billets and workpieces of various sizes and shapes successively without requiring time consuming or difficult adjustments to the manipulating apparatus. Furthermore, in addition to turning workpieces of various size, workpieces may conveniently be clamped into position while operations are performed thereon.

BRIEF DESCRIPTION OF THE DRAWINGS

For purposes of illustration the accompanying drawings illustrate one embodiment of the present invention wherein:

FIG. 1 is a top elevational view of the manipulator;

FIG. 2 is a side elevational view of the manipulator;

FIG. 3 is a partial sectional view on line 3—3 of FIG. 1; and

FIGS. 4–17 are side views showing the arms of the manipulator in various positions of clamping and turning workpieces of various shapes and sizes.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

The workpiece manipulator, generally indicated at 11, includes a pair of laterally spaced frames 13 and 15 mounted on any suitable support 17. Each of the

frames 13 and 15 includes at least a pair of upright members 19–20 and 21–22, respectively. As illustrated in the drawings, the upright members 19–20 of at least one frame 13 include a base portion 23 movable along the support 17. As illustrated in FIG. 1, the support 17 includes a groove 25 through which a bottom portion 27 of the movable frame 13 projects so as to guide the frame 13 toward and away from the other frame 15 so that workpieces of various sizes may be accommodated. Means other than a groove 25 may be conveniently used as a guide. A means for moving the frame along the track, such as a hydraulic cylinder 29 positioned between the movable frame 13 and a fixed point at the support 17, is provided. The upright members 21–22 of the other frame 15 are rigidly fixed to the base 31. Each of the frames 13 and 15 is provided with a plurality of arms 33–34 and 35–36, pivotably mounted on respective frames 13 and 15. The arms 35 and 36 on the fixed frame 15 are mounted for movement about an axis which is substantially parallel to and spaced from an axis upon which the arms 33 and 34 of the movable frame 13 are mounted for rotation.

The workpiece 37 is received and supported by the arms 33–36 which are controlled to move together to turn a workpiece 37 about its longitudinal axis and present different parts of the peripheral surface thereof in succession to a grinding wheel of a grinding machine (not shown). Other operations such as inspecting and shot blasting in addition to grinding may be performed. A workpiece 37 may be delivered to the arms 33–36 by an overhead crane or other means well-known in the prior art. A grinding machine which is of conventional construction and forms no part of the present invention is not described herein. Since the arms 33–36 are operated together, any number of upright 19–22 members and arms 33–36 may be provided depending on the weight and length of the workpiece 37.

Each of the frames 13 and 15 include an axle 39 supported by respective upright members 19–20 and 21–22 for rotation. Each upright member 19–22 includes suitable bearings which journal an axle 39 for rotation. Each of the arms 33–36 is rigidly secured to one of the axles 39 which are disposed on either side of the manipulator 11. Each frame 13 and 15 includes means for moving the arms 33–36. As illustrated in the drawings each of the hydraulic cylinders 41–42 is attached pivotably at one end to one of the arms 33–36 and at the other end to a fixed point of frames 13 and 15.

The present invention contemplates other methods of mounting the arms 33–36 to the frames 13 and 15, such as pivotably mounting the arms 33–36 to the axles 39 which in turn can be rigidly secured to the frames 13 and 15. In another method, a single hydraulic cylinder can be used for moving arms 33–36 which are rigidly mounted to a rotatable axle by connecting the cylinder between an eccentric lobe of the axle 39 and a fixed point on the frame 13 and 15.

Each of the arms 33–36 extends transversely to the longitudinal axis of the workpiece 37 and is substantially parallel to other arms 33–36 mounted on respective frames 13 and 15. The upper surface 43 of the arms 33–36 are level, thereby establishing a work plane.

Each of the arms 33–36 is provided with an abutment 45 in the form of a vertical surface at the inner end thereof which is in proximity to the axle 39. The arms 33–36 of each frame 13 and 15 describe a substantially level plane projecting outwardly from the abutment 45. Preferably the arms of only one frame 13 which describe a substantially level plane with the outer end thereof have an outer abutment 47 projecting outwardly from the level surface 43. The inner and outer abutments are used for clamping and pushing or pulling workpieces during manipulation thereof.

Intermediate the frames 13 and 15, a member 49 and means for raising and lowering the member 49 into position is provided. The member 49 includes a surface 51 for contacting and supporting the underside of a workpiece 37 during manipulation thereof. As illustrated in the drawings, the surface 51 is raised or lowered by a screw jack 53 or other means which is powered by a suitable means such as a motor. It is contemplated that a surface 51 be formed by a plurality of arms, each arm pivotably mounted to a lower position of the frames 13 and 15. The arms are raised and lowered by conventional means, such as hydraulic cylinders so as to form a supporting surface 51. The supporting surface 51 is particularly useful for supporting the narrow side of a slab when it is desired to perform operations on a top narrow side.

A pair of rollers 55–56 are mounted on the movable frame 13 for rotation about an axis parallel to the elongated axis of the workpiece 37. The fixed frame 15 includes a pair of rollers 57–58 mounted for rotation about an axis substantially parallel to and spaced from the axis of roller rotation of the movable frame 13. One pair of rollers 57–58 on one frame 15 are driven by a motor 59 or other means so as to rotate an arcuate workpiece 37 while the rollers 55–56 on the other frame 13 serve as idlers. Each of the axles 39 has one of the rollers 55–58 mounted at each end thereof and journaled in bearings. Each of the rollers 57–58 mounted on one axle 39 includes a sprocket 61 connected thereto. A driven shaft 63 journaled for rotation in the lower part of the frame 15 includes sprockets 65 at the ends thereof. The driven shaft 63 is driven by a motor 59 or other means. The sprockets 65 of the driven shaft 63 are connected to respective sprockets 61 of the driven rollers 57–58 so that the rollers 57–58 rotate in unison. With the arms 33–36 withdrawn, the outer surfaces of the rollers are exposed to engage an arcuate workpiece 37, such as a cylindrical billet. In this latter case, the cylindrical billet can be continuously rotated about its longitudinal axis. A grinding wheel is transversely positioned above the billet and moved longitudinally along the length of the billet as it is being rotated, so as to grind the billet in a spiral fashion.

To manipulate a rectangular or square billet from a flat clamping position as shown in FIG. 5, 7 or 9, the arms 33 and 34 on one side of the billet are tilted downwardly as shown in FIG. 8 so that a rotation is accomplished. At this position the billet may be clamped as shown in FIG. 4 between the abutments 45 adjacent the pivotable ends. Further rotation is accomplished by raising the arms 35 and 36 supporting a new undersurface while using the other arms 33 and 34 to engage the billet 37 at a point above its center of gravity on the previous undersurface. In positioning narrow slabs 37 for grinding operations, the member 49 is raised to a proper height so that the top surface of the slab will be in position for grinding with the bottom surface resting on the support surface 51 as shown in FIGS. 10 and 11. The billet 37 is then manipulated in a manner similar to the manipulation of rectangular billets 37 as shown in FIGS. 11 and 12. The arms 35 and 36 without abutments at the outer ends thereof may be used for supporting portions of the billet surface.

To turn arcuate members such as cylindrical billets 37, the arms 33–36 are dropped in a downward position as shown in FIGS. 16 and 17 so that the rollers are exposed for engaging the cylindrical surface. At least a portion each of the arms 33–36 is disposed entirely within the outer radius of the rollers 55–58 so that the rollers 55–58 may be positioned for engaging cylindrical billets. The movable frame 13 is moved closer to the fixed frame 15 for accommodating billets of smaller sizes as shown in FIGS. 4, 12 and 14.

For odd shaped pieces such as hexagonal or octagonal billets, the arms may be disposed at angles conforming to the outer surface of the workpiece for clamping as shown in FIGS. 14 and 15. The workpiece can be clamped between the abutments 45 adjacent the pivoting points. In turning billets of odd shape, they may be conveniently rolled down an incline as shown in FIG. 6 or turned while resting flat on one pair of arms 33 and 34 while the other pair of arms 35 and 36 engage an underside at a point away from the center of gravity so as to flip the billet as shown in FIG. 13.

Conventional controls are provided to control the application of fluid to the hydraulic cylinders 41–42 to simultaneously pivot the arms 33–36 on each frame 13 and 15. The driven rolls 55–58 are preferably driven by an electric motor 59 having a conventional speed reducing gear arrangement 69 drivingly connected with the lower shaft 63. Conventional electrical controls are provided to operate the motor. The member 49 is similarly moved by a conventional motor means (not shown).

It is within the scope of the present invention to use a plurality of workpiece manipulators 11 along the length of a workpiece to permit the manipulation of longer workpieces or a wider single manipulator 11 or a combination of both.

While preferred embodiments of this invention have been described and illustrated, it is to be recognized that modifications and variations thereof may be made without departing from the spirit and scope of this invention as described in the appended claims.

What is claimed is:

1. An apparatus for manipulating a workpiece comprising a first frame provided with a plurality of arms pivotably mounted thereon for movement about a first axis, a second frame provided with a plurality of arms pivotably mounted for movement about a second axis substantially parallel to and spaced from the first axis, said second frame being movable toward and away from said first frame and said arms being operable to engage and manipulate a workpiece, a supporting surface intermediate said frames for supporting the underside of a workpiece, said supporting surface comprising a member having a supporting surface and means for raising and lowering said member, and at least two rol-

lers rotatably mounted on each frame for engaging a workpiece.

2. An apparatus according to claim 1 comprising means for moving the arms of said first frame and means for moving the arms of said second frame.

3. An apparatus according to claim 1 comprising an abutment adjacent the pivotable end of each arm for engaging a workpiece.

4. An apparatus according to claim 1 including an abutment on the arms mounted on one axis, said abutment being located at the end of the arm opposite the pivotable end for engaging a workpiece.

5. An apparatus according to claim 1 including means for moving said second frame toward and away from said first frame.

6. An apparatus according to claim 1 wherein said first frame and said second frame each comprise a plurality of upright members, said upright members of one frame supporting a shaft parallel to the elongated axis of a workpiece and said upright members of the other frame supporting an elongated shaft substantially parallel and spaced from the elongated shaft of said first frame.

7. An apparatus according to claim 6 wherein said roller members are each mounted on the ends of said shafts.

8. An apparatus according to claim 7 wherein a portion of said arms are disposed within the periphery of said rollers.

9. An apparatus according to claim 1 wherein said arms are mounted on said shafts.

10. An apparatus according to claim 9 including means for driving at least a pair of rollers mounted on a shaft.

11. An apparatus for manipulating a workpiece comprising a first frame provided with a plurality of arms pivotably mounted thereon for movement about a first axis, a second frame provided with a plurality of arms pivotably mounted for movement about a second axis substantially parallel to and spaced from the first axis, said second frame being movable toward and away from said first frame and said arms being operable to engage and manipulate a workpiece, a plurality of first abutments for engaging a workpiece, each of said first abutments being adjacent the pivotable end of each of a plurality of arms, and a plurality of second abutments, each of said second abutments being located at the end of each of a plurality of arms opposite the pivotable end thereof, said second abutments being on arms mounted for movement about one axis.

12. An apparatus according to claim 11 comprising means for moving said arms of said first frame and means for moving the arms of said second frame.

13. An apparatus according to claim 11 including means for moving said second frame toward and away from said first frame.

14. An apparatus according to claim 13 wherein said supporting surface comprises a member having a supporting surface and means for raising and lowering said member.

15. An apparatus according to claim 14 wherein said first frame and said second frame each comprise a plurality of upright members, said upright members of one frame supporting a shaft parallel to the elongated axis of a workpiece and said upright members of the other frame supporting an elongated shaft substantially parallel and spaced from the elongated shaft of the second frame.

16. An apparatus according to claim 15 wherein said arms are mounted on said shafts.

17. An apparatus according to claim 16 comprising at least two rollers rotatably mounted on each frame for engaging the workpiece.

18. An apparatus according to claim 17 wherein said roller members are each mounted on the ends of said shafts.

19. An apparatus according to claim 18 including means for driving at least a pair of rollers mounted on a shaft.

20. An apparatus according to claim 19 wherein a portion of said arms are disposed within the periphery of said rollers.

* * * * *