Oct. 14, 1969 E. E. RHOADS 3,472,397

APPARATUS FOR MANIPULATING BILLETS AND THE LIKE

Filed June 17, 1966 4 Sheets-Sheet 1

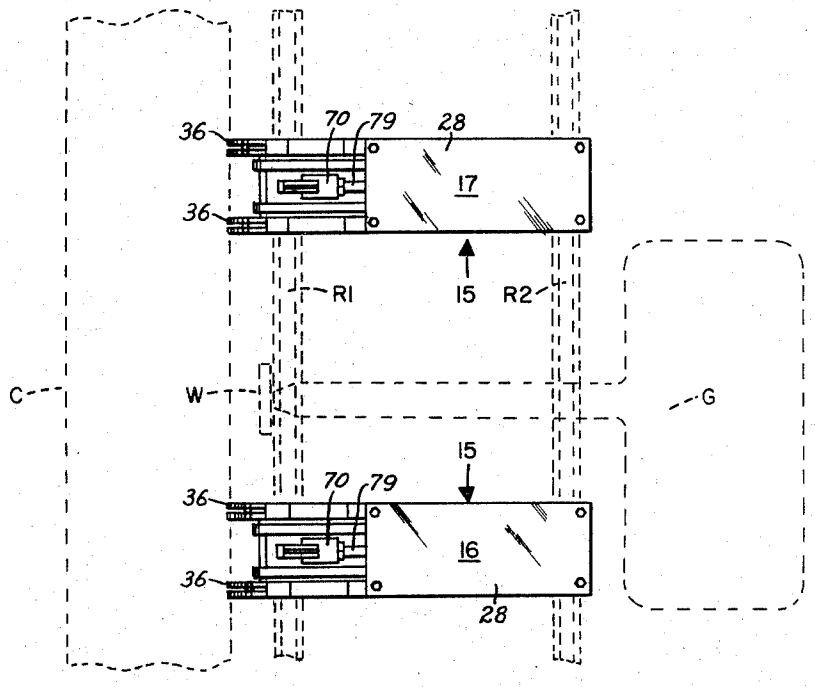


Fig. 1

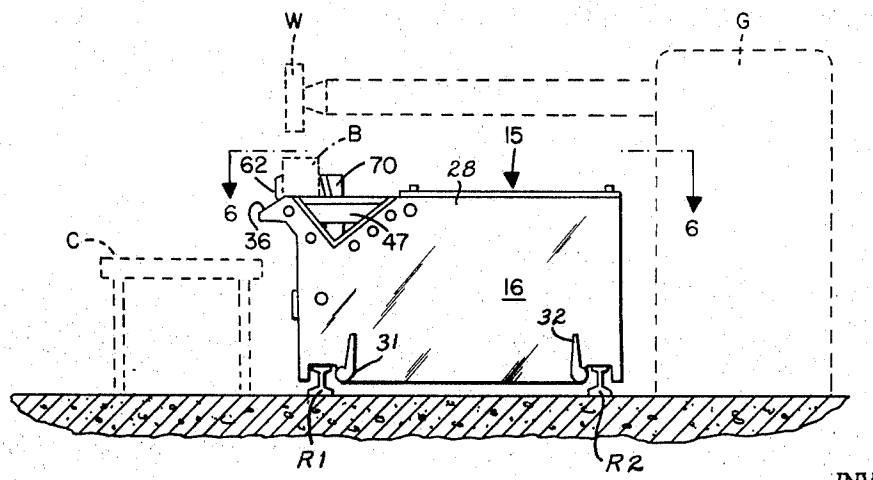


Fig. 2

INVENTOR
EDWIN E. RHOADS

BY Hoffmann & Yount
ATTORNEYS

Oct. 14, 1969 E. E. RHOADS 3,472,397

APPARATUS FOR MANIPULATING BILLETS AND THE LIKE

Filed June 17, 1966 4 Sheets-Sheet 2

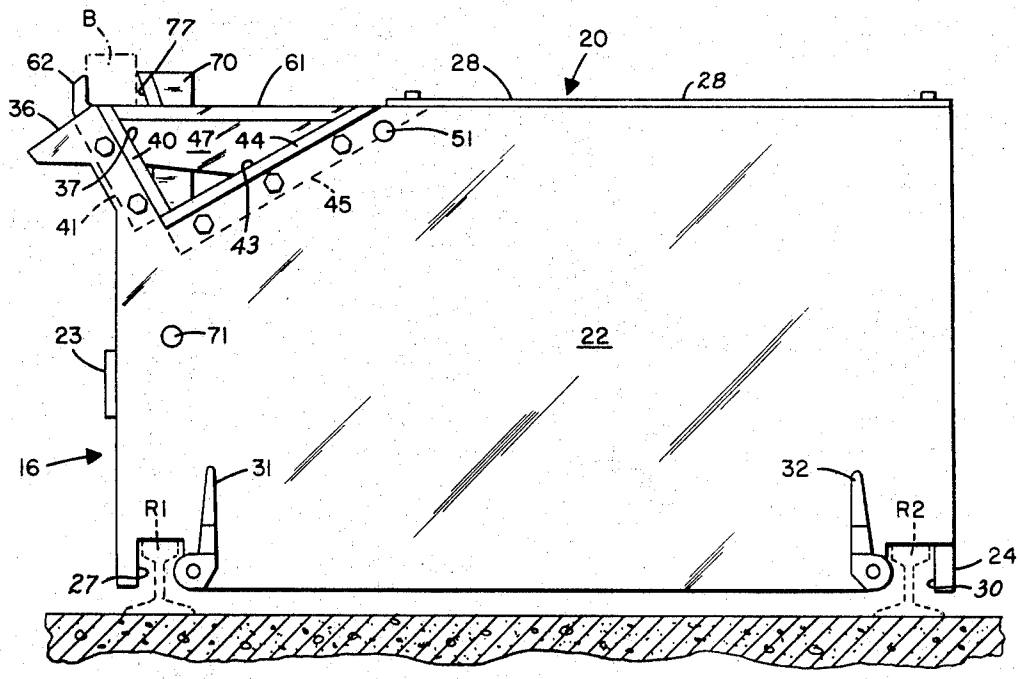


Fig. 3

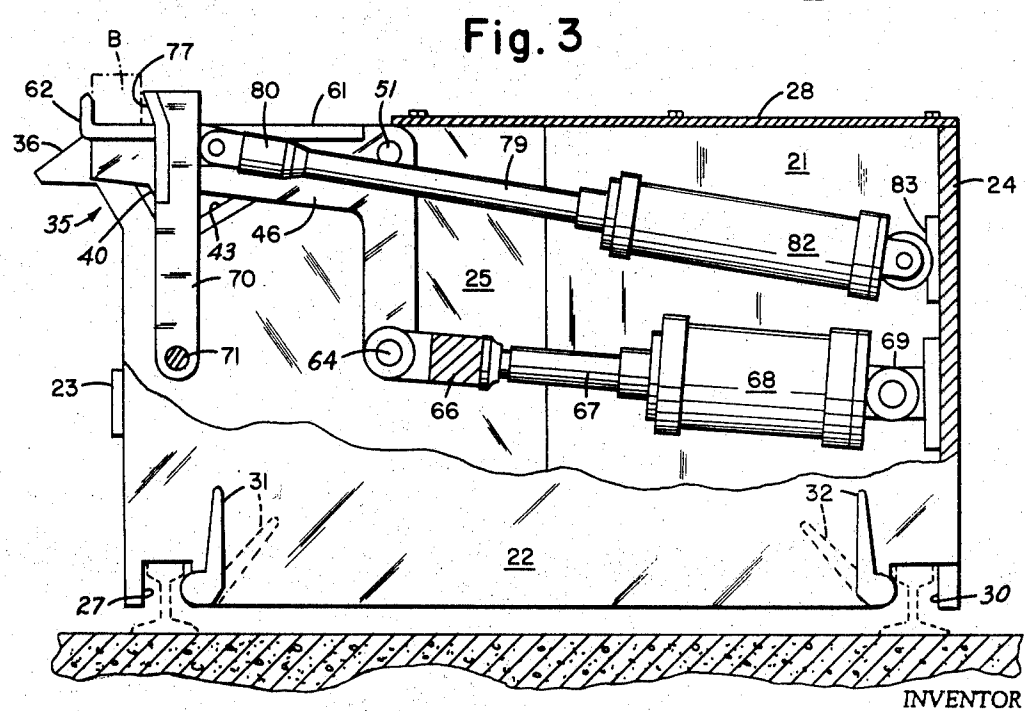


Fig. 4

INVENTOR
EDWIN E. RHOADS

BY Hoffmann & Yount
ATTORNEYS

Oct. 14, 1969 E. E. RHOADS 3,472,397

APPARATUS FOR MANIPULATING BILLETS AND THE LIKE

Filed June 17, 1966 4 Sheets-Sheet 3

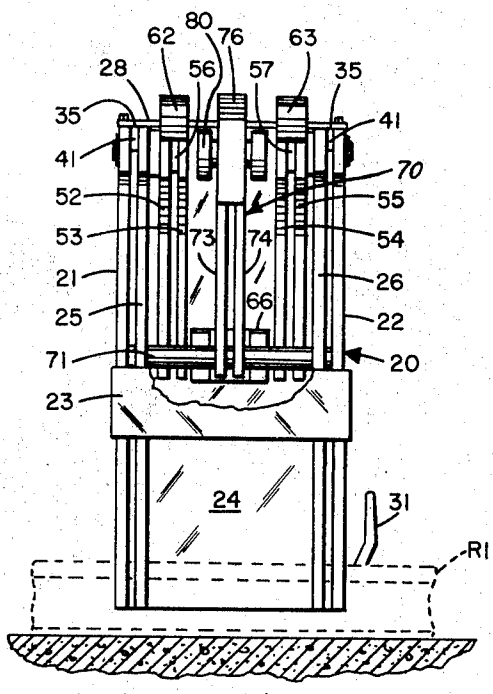


Fig. 5

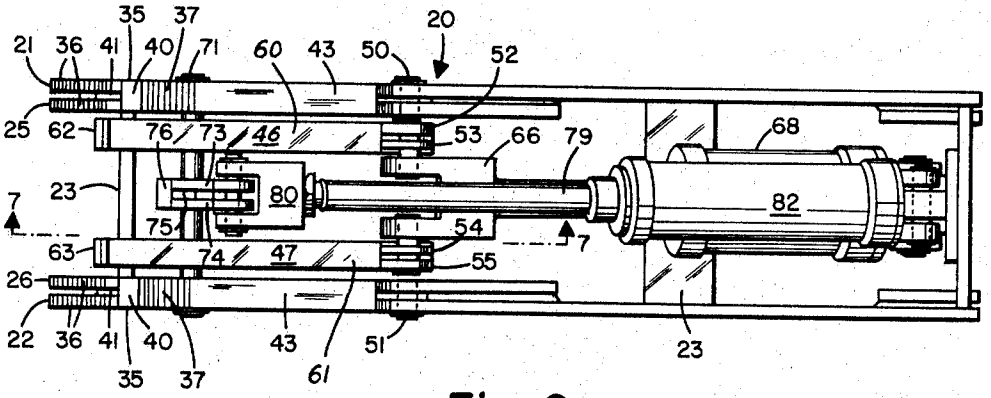


Fig. 6

INVENTOR
EDWIN E. RHOADS

BY Hoffmann & Yount
ATTORNEYS

Oct. 14, 1969 E. E. RHOADS 3,472,397

APPARATUS FOR MANIPULATING BILLETS AND THE LIKE

Filed June 17, 1966 4 Sheets-Sheet 4

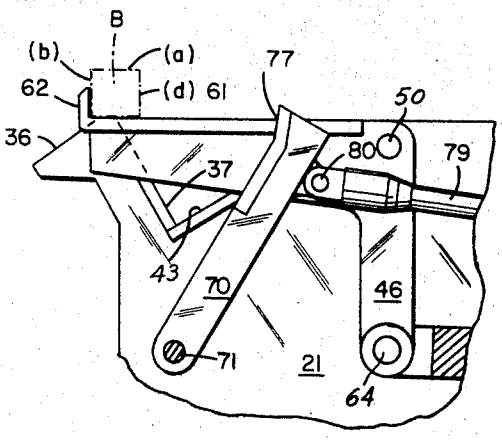


Fig. 7

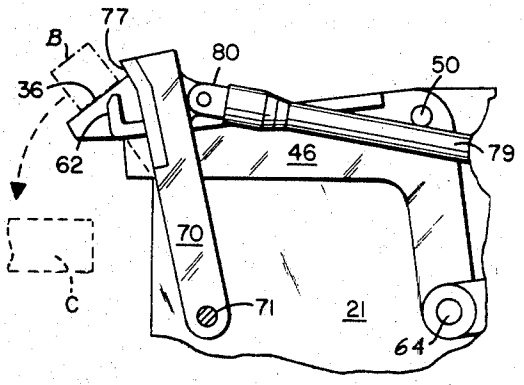


Fig. 10

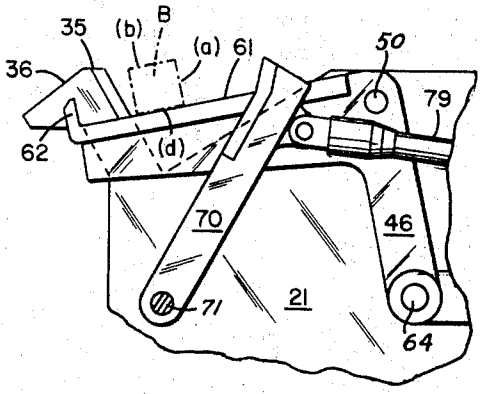


Fig. 8

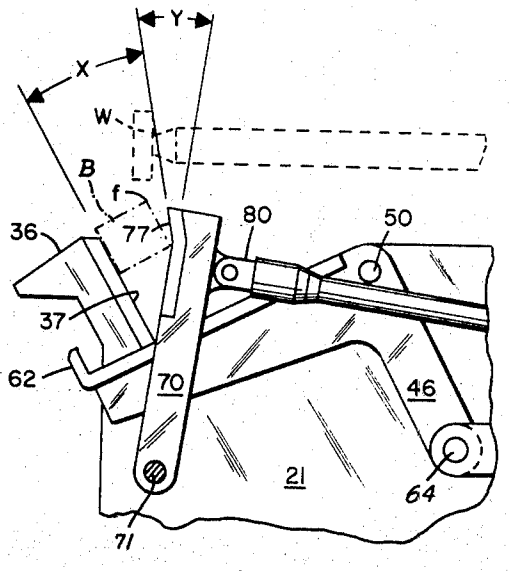


Fig. 11

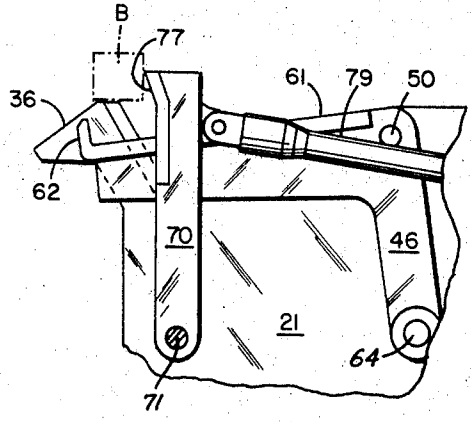


Fig. 9

INVENTOR
EDWIN E. RHOADS

BY Hoffmann & Yount
ATTORNEYS

United States Patent Office 3,472,397
Patented Oct. 14, 1969

3,472,397

APPARATUS FOR MANIPULATING BILLETS AND THE LIKE

Edwin Egbert Rhoads, Cleveland, Ohio, assignor, by mesne assignments, to Pettibone Mulliken Corporation, Chicago, Ill., a corporation of Delaware

Filed June 17, 1966, Ser. No. 558,448
Int. Cl. B25j *11/00*
U.S. Cl. 214—1 6 Claims

ABSTRACT OF THE DISCLOSURE

Disclosed herein is an apparatus for manipulating elongated workpieces, such as billets. The apparatus includes an abutment on which a workpiece can be partially supported and from which the workpiece can be toppled to either of two opposite sides. A first support structure is provided for cooperating with the abutment for supporting the workpiece and is movable relative to the abutment to topple the workpiece toward a first side of the abutment. A workpiece shifting member is provided for toppling the workpiece to a second side of the abutment and for clamping the workpiece against a sloping support surface on the first side of the abutment.

The present invention relates to apparatus for manipulating relatively heavy workpieces, such as metal billets and the like, so that different surfaces of workpieces can be successively presented to a machine tool, for example, for working or inspecting the surfaces of the workpieces.

One known form of apparatus for axially turning metal billets is comprised of two cooperating work support structures, one of which supports the workpiece on a horizontal plane to present an upper face thereof for a machining operation or the like and the other of which structure supports the work on a sloping plane to cause the workpiece to tend to tumble or roll when supported thereby, the support structures having relative movements whereby a workpiece can be transferred from the horizontal support to the sloping support and then returned to the horizontal support structure resting on a side which faced downwardly on the sloping support whereby a fresh upper surface is presented for working. Power-operated clamp means is provided for engaging and clamping opposite sides of the workpiece to firmly position the same on the horizontal support during work operations thereon.

One prime object of the present invention is the provision of a new and improved apparatus of the type mentioned having clamping means for positioning the workpiece on the horizontal support structure and which is also operative to eject the workpiece laterally from the apparatus onto a conveyor or the like.

Another important object of the invention is the provision of a new and improved apparatus of the character mentioned in which the clamping means is effective to clamp a workpiece, which is rectangular in transverse section, to the inclined support structure, whereby a corner portion of the workpiece may be presented for a working operation as well as the flat surfaces thereof.

Other objects and advantages of the invention will be apparent from the following description of a preferred form thereof, reference being made to the accompanying drawings wherein:

FIG. 1 is a more or less schematic plan view of an apparatus embodying the invention and associated with a grinding machine for grinding surfaces of billets and the like supported by the apparatus to present different surfaces of the billets to the grinding wheel of the machine;

FIG. 2 is a side elevational view of the apparatus shown in FIG. 1;

FIG. 3 is a side elevational view of one unit of the billet turning apparatus drawn on a larger scale;

FIG. 4 is a view of the unit of the apparatus in FIG. 3, a portion thereof being shown broken away;

FIG. 5 is an end view of the unit shown in FIG. 4, showing a portion broken away;

FIG. 6 is a plan view of the unit shown in FIG. 2 taken along line **6—6** and on a larger scale;

FIG. 7 is a fragmentary sectional view taken substantially along line **7—7** of FIG. 6;

FIGS. 8, 9, 10 and 11 are schematic views of the unit similar to that shown in FIG. 7 showing parts of the apparatus in different positions during the turning and ejecting of a billet.

Referring to FIGS. 1 and 2, a grinding machine G is indicated in broken lines having a grinding wheel W for grinding the surfaces of a billet B supported on a billet turning apparatus **15** embodying the invention and positioned alongside the grinding machine. A table type conveyor C is positioned at the forward end of the apparatus **11** to receive finished workpieces. It will be understood that the billet turning apparatus **15** could be employed with any other type machine or equipment for performing work on different surfaces of a billet or the like, particularly billets rectangular in transverse section. The turning apparatus **15** is comprised of two substantially identical units **16, 17** and for the sake of brevity only unit **16** is described in detail.

Referring to FIGS. 2 through 6, the unit **16** is comprised of a box-like frame **20** formed by two spaced vertically extending sides **21, 22** formed of steel plates cross braced by suitable bracing including cross members **23** and an end plate **24** welded thereto. The left-hand end, or the forward end of the frame **20**, as viewed in FIGS. 2 and 7 has double wall sides at the forward or left-hand end portion formed by plates **25, 26** welded to the inside of plates **21, 22**, respectively, and slightly spaced therefrom. The rearward section of the top of the frame **20** is closed by a plate **28** bolted thereto. In practice, appropriate openings, not shown, may be formed for access to various portions of the frame for maintenance and servicing thereof.

The frame **20** is supported on two parallel rails **R1, R2** which are installed on the floor alongside the grinder G and the sides of the frame are notched or cut-away at **27** and **30** to receive the rails **R1, R2** respectively. The frame **20** may be clamped to the rails by two cam type clamp members **31, 32** pivoted to the sides **21, 22** and which have cam surfaces adapted to be wedged beneath the heads of the rails to firmly clamp each end of the frame to the rails, as shown in dotted lines.

The forward end of the frame **20** has upwardly facing abutments **35** formed on the upper portions of the sides **21, 22** which are relatively narrow and which are defined by inclined surfaces **36, 37** at opposite sides thereof. The surfaces **36** are formed of the top edges of forwardly extending projections formed on the frame plates **21, 22, 25, 26**, and the surfaces **37** are formed by the head portions of rail sections **40** having the webs **41** thereof received in the spaces between the plates **21, 25** and **22, 26**, respectively, and which webs are bolted in place.

The upper ends of the rail sections **40** are cut to conform to the horizontal plane of the abutments **35**.

The lower ends of the sloping surfaces **37** join oppositely sloping surfaces **43** which are formed by the heads of rail sections **44**, respectively, which rail sections have their webs **45** received between the plates **21, 25**, and **22, 26**, respectively, and which webs are bolted in place as shown. The heads of the rails sections **40, 44** form wear

surfaces of the adjoining sloping sides **37** and **43**, which surfaces lie in two common planes at 90° to one another. Preferably, the sides **37** are about 60° to horizontal so that a billet resting on one side of the abutments **35** with its center of gravity over the sloping surfaces **37** will tumble onto these surfaces with the center of gravity of the billet to the right of a vertical plane therethrough, the purpose of which is made apparent hereinafter.

Two L-shaped billet supporting arms **46, 47** are pivoted on the plate **21, 25**, and **22, 26** by studs **50, 51** respectively, which are conveniently journaled in bushings in the plates. Each of the arms **46, 47** are formed by two identically shaped plates **52, 53** and **54, 55**, respectively, and rail sections which have their webs **56, 57** received between the respective plates of the arms with the heads thereof forming billet supporting surfaces **60, 61**. The forward (left-hand) ends of the rail heads extend beyond the respective rail webs and are turned upwardly at 90° to form lamp jaws **62, 63** at the outer or swinging ends of the arms **46, 47**.

The downwardly extending portions of the arms **46, 47** are pivotly attached by pins **64, 65** to a clevis **66** attached to a piston rod **67** connected with a piston, not shown, adapted to reciprocate in a cylinder **68**, one end of which is pivotly attached by a bracket **69** to the plate **24**. The cylinder **68** may comprise a hydraulic or pneumatic motor controlled through suitable hosing and valve mechanisms, not shown, to cause the piston rod **67** to be reciprocated and rock the arms **46, 47** in unison about their pivot studs **50, 51** to raise the surfaces **60, 61** to a horizontal billet supporting position and to be lowered to an inclined plane coextensive with the planes of the surfaces **43**.

By the construction thus far described a billet, rectangular in transverse section, such as that indicated at B, can be supported on the arms **46, 47** so that when the billet is against the stops **61, 62** and the arms **46, 47** are horizontal the left-hand edge of the billet, as viewed in FIGS. 3 and 7 will be in part supported by the abutments **35**, and as the arms **46, 47** are lowered to at least in the plane of the surfaces **43**, the billet will tilt clockwise and slide on the sloping surfaces **37** downwardly as indicated by the arrow in FIG. 11 until it rests against the surfaces **43** which appears in FIGS. 3 and 7. The arms **46, 47** may then be raised to elevate the billet to the horizontal position shown in FIG. 3 but in so doing the billet is now supported on the side which was at 90° to that on which it was formerly supported.

To clamp the billet in position on the surfaces **35** and arms **46, 47** a clamp arm **70** is pivotally supported on a shaft **71**, the ends of which are journaled in suitable bearings formed in openings through the side plates **21, 25** and **22, 26**. The clamp arm **71** is comprised of two bars **73, 74** which receive the web **75** of rail section, the head portion **76** thereof forming a wear surface. The rail section has a slightly forwardly inclined portion **77** formed adjacent the upper end thereof so that the clamp arm may apply force to a billet on the sloping surfaces **37** in a direction to clamp the billet to these surfaces, as is explained more fully hereinafter.

The clamp arm **70** is swung or actuated by a piston rod **79**, one end of which is attached to the arm **70** by a pin and clevis **80** and the other end of which is connected with a piston which reciprocates in a cylinder **82**, the rear end of which is pivotly supported to the plate **24** by a bracket **83**. Conventional hose connections and valving, not shown, are appropriately connected with the cylinder **82** to control the flow of a fluid, such as air or hydraulic fluid from a suitable pneumatic or hydraulic power system, to effect operation of the piston in the cylinder. Pneumatic and hydraulic systems suitable for actuating the piston rods **67, 79** are well known and for sake of brevity are not further described.

It will be understood that the piston rods **67** and **79** of both units **16, 17** are operated in unison so that a billet supported at opposite end portions thereof by the two units is acted upon in concert to effect turning and manipulation thereof in the manner described hereinafter with reference to the elements comprising unit **16**.

To prepare the apparatus for receiving a billet, the clamp arm **70** is retracted to the position shown in FIG. 7 and the arms **46, 47** are elevated to their horizontal support position by movement of the piston rod **67** outwardly of the cylinder **68**. A billet B is then deposited on the arms **46** and extends transversely of the arms **46, 47** of both of the units **16, 17**. Piston rod **79** is then forced from cylinder **82** so that the clamp arm **70** engages a side of the billet B and slides the billet laterally against the upright clamp lugs **62, 63** of the arms **46, 47** thereby firmly clamping the billet in position with the surface (*a*) thereof uppermost for grinding by the wheel W. When it is desired to turn the billet to present side (*b*), arm **70** is retracted and the arms **46, 47** are lowered, which removes the major support from the billet, thus destroying the stable equilibrium thereof so that it rolls or tumbles from the supports **35** onto the inclined surfaces **37**, which causes the surface (*d*) of the billet to rest on the arms **46, 47** as seen in FIG. 8 and indicated by the broken-line arrow. Arms **46, 47** are then raised to their horizontal positions so that the surface (*b*) is then presented upright to the wheel W. Clamp arm **70** is then moved forwardly to clamp the billet between the jaws **63** and the upper end portion of the clamp arm. When the grinding operations have been completed on the billet, it is discharged or ejected laterally from the front of the apparatus onto the conveyor C merely by dropping the arms **46, 47** as shown in FIG. 9 to lower the clamp jaws **63** thereof below the horizontal surfaces **35** while retaining the clamp arm **70** in position to prevent the billet from toppling onto the sloping surfaces **37**. When the clamp lug **63** has moved below the bottom surface of the billet B, arm **70** is driven counterclockwise to the position shown in FIG. 10 which topples the billet B down the forwardly sloping surfaces **36** and onto the conveyor C.

Should it be desired to dress the corner edges of a rectangular billet, this can be accomplished by withdrawing clamp arm **70** from the billet while maintaining arms **46, 47** horizontal and then gradually lowering the arms **46, 47** to permit the billet B to roll onto surface **37** so that corner (*f*) is uppermost as seen in FIG. 8. Arm **70** is then driven counterclockwise and the portion thereof below section **77** thereof engages the billet and slides it upwardly until the inclined portion **77** thereof engages the billet at which event the angle between the side of the billet engaged by the arm and the surface **77** is less than the angle of repose of the billet material which results in the billet being firmly clamped with the corner (*f*) uppermost, as seen in FIG. 11. It is but routine design to form the surface of the arm **70** which engages the billet and to position the pivot for the arm so that the inclined surface **77** will clamp billets, of a given range of dimensions, to the sloping surfaces **37**. By referring to FIG. 11, it will be seen that the angle (*x*), which is the angle between the two billet engaging surfaces **37** and **77**, should be less than the angle of repose of the material forming the billet B. In a unit for handling billets of from 3" to 8" on a side, the angle (*y*) between section **77** and the arm **70** proper is about 17°.

It will be apparent that I have provided a highly versatile billet manipulating apparatus by which billets can be quickly and easily turned about their longitudinal axis to present different surfaces thereof for machining or inspection and which includes clamping means for not only clamping the billet at 90° position intervals but positions intermediate 90°, and which clamping means also serves to eject the machined workpieces onto a conveyor or the like in an expeditious manner.

I claim:

1. Apparatus for manipulating elongated workpieces, such as billets and the like, and comprising means forming a relatively narrow upwardly facing abutment on

which a workpiece may be partially supported so as to topple to either of two opposite sides of said abutment, a first support structure having a work supporting surface at one side of said abutment and adapted to cooperate with said abutment to support a workpiece in a substantially horizontal plane, a second support structure having a workpiece supporting surface at said one side of said abutment and lying in a sloping plane, the last mentioned surface being disposed to receive a workpiece toppled to said one side of said abutment and to support said workpiece on a sloping plane, means for effecting relative vertical movements of said first and second support structures to shift a workpiece from one of said support structures to the other, a reciprocable member movable from a point at one side of a vertical plane at one of said sides of said abutment toward said plane to engage the side of a workpiece supported on said abutment and move the workpiece to topple it from said abutment to the other side of said abutment, said reciprocable member comprising an upwardly extending arm pivoted for swinging movement about an axis disposed below the supporting surface of the second supporting structure and extending transversely of said sloping plane, the upper end of said arm projecting above said abutment and being engageable with the workpiece when the reciprocable member is swung toward said abutment, and power means to move said member.

2. Apparatus as defined in claim 1 in which said arm has an upper portion thereof inclined relative to the portion therebelow towards said sloping plane to engage a workpiece supported on said second support structure and clamp said workpiece to said sloping surface of said second support structure.

3. Apparatus as defined in claim 1 further characterized by the provision of a laterally extending abutment on the upper end of said arm and toward which the reciprocable member is movable, said abutment on the upper end of said arm constituting a stop to limit the movement of a workpiece supported by said arm.

4. An apparatus for aligning elongated workpieces such as billets and the like, said apparatus comprising means forming a relatively narrow abutment upon which a workpiece may be at least partially supported with one surface upwardly so as to topple to either of two sides of said abutment, a sloping support surface positioned on a first side of said abutment, means for selectively toppling the workpiece toward said first side from said abutment to move the workpiece along said sloping support surface to an orientation wherein another surface of the workpiece adjacent to said one surface is positioned upwardly, a workpiece shifting member movable toward and away from said abutment for selectively clamping the workpiece against said sloping support surface to thereby position the workpiece in an orientation with a portion of the workpiece between said surfaces of the workpiece upwardly, said workpiece shifting member being movable toward said abutment when the workpiece is at least partially supported on said abutment to topple the workpiece from said abutment toward said second side, and power means for selectively moving said workpiece shifting member.

5. An apparatus as defined in claim 4 wherein said means for selectively toppling the workpiece toward said first side includes a support structure having a work supporting surface on said first side of said abutment and adapted to cooperate with said abutment to support the workpiece and means for effecting movement between said support structure and said sloping support surface to topple the workpiece toward said first side from said abutment.

6. An apparatus as defined in claim 4 wherein said workpiece shifting member includes a first and second workpiece engaging surfaces, said first workpiece engaging surface being positioned to form an angle with said sloping support surface which is greater than an angle of repose of the workpiece to enable the workpiece to be moved upwardly along said sloping support surface by moving said workpiece shifting member toward said abutment, said second workpiece engaging surface being positioned to form an angle with said sloping support surface which is less than an angle of repose of the workpiece to enable the workpiece to be clamped between said workpiece shifting member and said sloping support surface to thereby provide said clamping of the workpiece with the portion of the workpiece between said surfaces of the workpiece upwardly.

References Cited

UNITED STATES PATENTS

1,340,129	5/1920	Williams	198—33
3,128,888	4/1964	Di Lella	214—1
3,182,815	5/1965	Di Lella et al.	214—1

GERALD M. FORLENZA, Primary Examiner

F. E. WERNER, Assistant Examiner