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BAR MANIPULATOR MECHANISM

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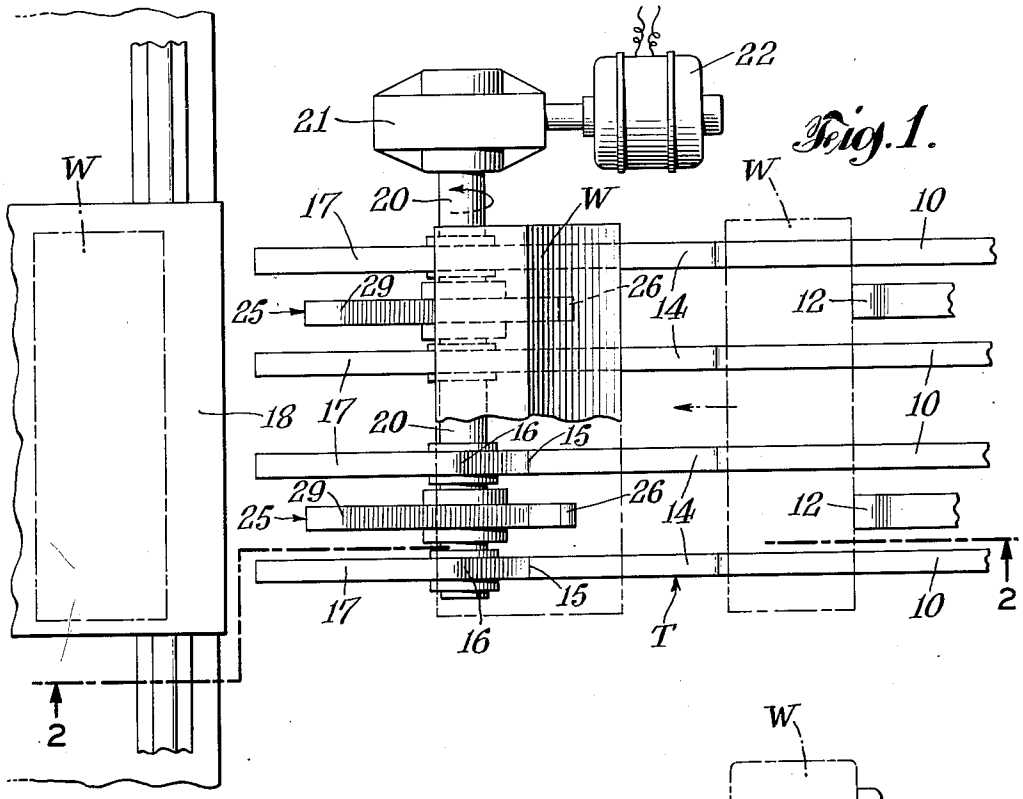


Fig. 1.

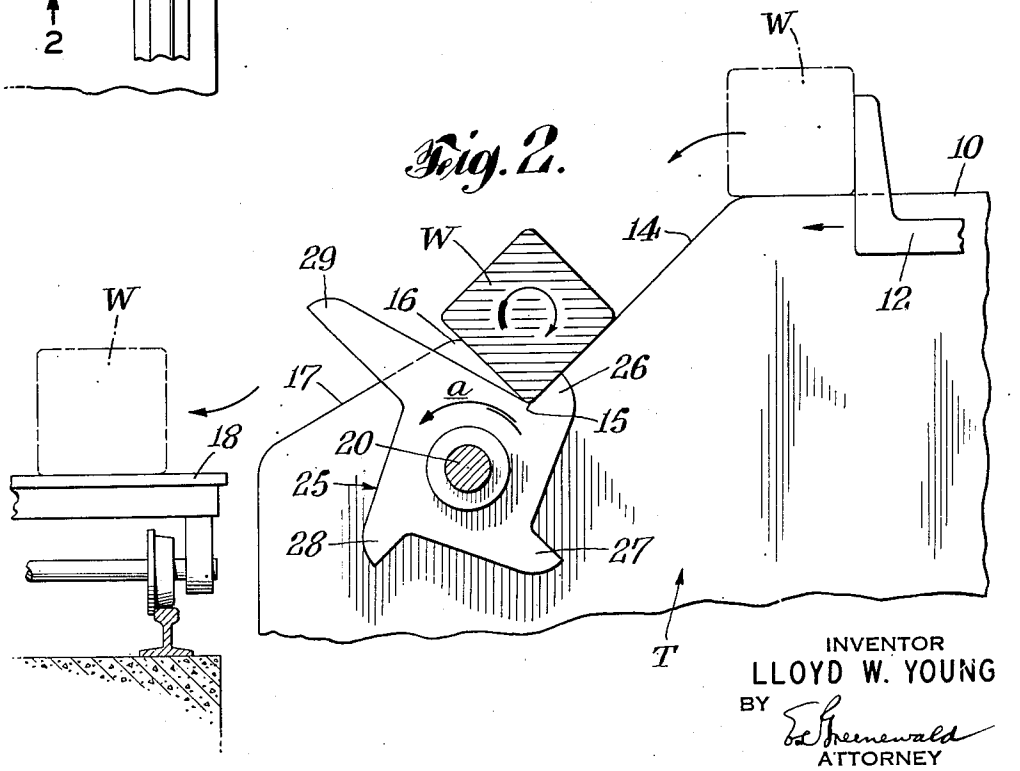


Fig. 2.

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BAR MANIPULATOR MECHANISM

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8 Claims. (Cl. 214—1)

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This invention relates to bar manipulator mechanisms for rotating polygonal metal workpieces such as ingots, billets and blooms about their longitudinal axes, thereby exposing successive sides for desurfacing, inspection or deseaming operations.

To expedite desurfacing operations it is frequently desirable to desurface two sides of a billet in one passage, rotate the billet through the necessary angle, and desurface the remaining sides. When the two sides desurfaced in the first pass are adjacent, the angle of rotation is 180° to expose the remaining two adjacent sides. When the surfaces of the billets are in generally good condition, desurfacing may not be necessary, but the rotation is essential for inspection, and cracks and the like so discovered may be removed by deseaming. For such inspection the desirable angle of rotation is 90°, so as to successively present the four sides of the billet.

A principal object of the invention is to provide an improved manipulator mechanism for revolving a billet or similar polygonal metal workpiece about its longitudinal axis to expose successive sides thereof for inspection or work operations.

Other objects are to provide manipulator apparatus having a station arranged for supporting a billet in a diamond position, and to provide apparatus for feeding a billet to, and ejecting the billet from such station.

Other objects and features of novelty will be apparent from the following description and the accompanying drawing, in which

Fig. 1 is a plan view of bar manipulator mechanism according to the preferred embodiment of the present invention; and

Fig. 2 is a vertical cross section taken along the line 2—2 of Fig 1.

As shown in the drawing, the work W, such as steel bars or billets of rectangular cross section, rests on a transfer table T comprising a plurality of rails 10 on which the bars may slide laterally, being propelled by dogs 12. The rails 10 have parallel downward inclines 14 terminating in right-angle notches 15 which constitute a scarfing or inspection station, and support work in a diamond position so that two adjacent longitudinal sides of a square bar or billet will be visible from above for inspection or scarfing. The other side of each notch 15 is shorter than and perpendicular to the incline 14, terminating a hump 16, beyond which is a lower downward incline 17. When the work is lifted laterally over the humps 16, it slides down the inclines 17 onto a car or delivery table 18.

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For rotating the work through the desired angle while it is at the station in the notch 15, a shaft 20 is journaled in the rails 10, and is driven in the direction of the arrow *a* through suitable speed reducing gearing 21 from a drive motor 22.

The shaft 20 is located below and forwardly of a vertical plane through the centers of the notches 15, which are vertically aligned with the center of gravity of the work W. Keyed on the shaft 20 between adjacent pairs of rails 10 are manipulator rotors 25. In the form shown each rotor 25 has three billet turning fingers 26, 27 and 28 of equal length and a longer billet ejecting arm 29. The work-engaging faces of the fingers 26, 27 and 28 extend radially from the shaft 20 and are at equal angular spacing, the form shown being 90°.

The spacing of the shaft from the notches 15, and the length and disposition of the fingers 26, 27 and 28 is such that when the motor 22 is energized to turn the shaft 20 and rotors 25 in the direction of the arrow *a*, the fingers move through arcs in a plane perpendicular to the longitudinal axis of the work W to engage the lower corner of the work and turn it 90° about its longitudinal axis.

Each turning fingers 26, 27 and 28 is at least slightly shorter than the distance from the axis of the shaft 20 to the center of gravity of the work W. The tendency for the billet W to overturn is increased by the inertia of the billet and because the direction of force applied is not vertical but in a direction tangent to the arc through which the finger is moved. Accordingly, the first increment of the 90° arc causes the tips of the fingers 26 to push the billet up toward the humps 16. This removes the lower corner of the billet W from the bottom of the notches 15. But as the fingers 26 are rotating about the axis of the shaft 20, the points of contact of the tips of the fingers 26 against the billet W moves down toward the lower corner of the billet, and the direction of the force applied becomes more nearly horizontal. The fingers 27 and 28 are identical with the fingers 26 in shape and operation, so as to turn the billet for the second and third arcs of 90°.

The ejecting arms 29 are longer than the distance from the pivot axes of the arms to the center of gravity of the billet W, so that when the arms 29 are moved through the 90° arc the ingot is not turned but lifted out of the notches 15 over the humps 16, so as to slide down the inclines 17 onto the delivery table 18.

With the bar manipulator mechanism according to the present invention, secondary scarfing

can be accomplished without cooling the billet and without taking it out of the roll table path. The primary scarfing may be done with a desurfacing machine, and the desurfaced billets passed to the manipulator mechanism. Any seams discovered upon inspection can be removed by a hand-operated deseaming blowpipe, and the billet passed along the production line.

What is claimed is:

1. Apparatus for overturning a body of polygonal cross section which comprises means for supporting the body in position for overturning, said supporting means including guiding means tending to urge said body by gravity into a predetermined position on said supporting means when said body is slightly displaced therefrom; finger means movable through an arc about a fixed pivot center transversely spaced from said body; said finger means having angularly spaced fingers shorter than the distance from said pivot center to the center of gravity of said body with angular recesses therebetween respectively adapted to receive successive corners of said body, said finger means also having a longer ejecting arm; and means for moving said finger means through said arc to slightly lift said body out of said recess and overturn said body and for moving said finger means past said body and then move said arm into contact with a lower surface of the body and through an equal subsequent arc to lift said body from said supporting means and to transversely move said body therefrom.

2. Apparatus for overturning an ingot or the like of rectangular cross section which comprises means for supporting the ingot in a predetermined position, means forming a fixed pivotal axis transversely spaced from said position, ingot engaging means rotatable about said axis and including finger means and a longer ejecting arm, said ingot engaging means having right angular recesses on each side of said finger means adapted to receive successive corners of said ingot and movable through an arc of 90° in a plane perpendicular to the longitudinal axis of said ingot, said finger means being of such length that the outer end of said finger means may contact a surface of said ingot nearer said center axis than the center of said surface; and means for moving said ingot engaging means to move said finger means through an arc to turn said ingot 90° about its longitudinal axis and to move said longer ejecting arm through a subsequent 90° to move said ingot from said supporting means.

3. Apparatus as claimed in claim 2 which includes at least one inclined, ingot guiding surface associated with said supporting means to guide movement of said ingot into said predetermined position.

4. Apparatus for turning an ingot or the like of polygonal cross section through an angle of 90° about its longitudinal axis which comprises means for supporting the ingot and for normally guiding the ingot into a predetermined position; means forming a fixed pivotal axis transversely spaced from said position, ingot engaging means rotatable about said axis and including finger means and a longer ejecting arm, said ingot engaging means having right angular recesses therein on each side of said finger means and on each side of said longer ejecting arm adapted to receive successive corners of said ingot and movable through successive arcs of 90° in a plane perpendicular to the longitudinal axis of said ingot and about said fixed pivotal axis; and means for moving said ingot engaging means through said arcs while at least the outer end of said finger means is in contact with said ingot to turn said ingot at least 45° about its longitudinal axis and for moving said finger means beyond said ingot so that by gravity the ingot turns the remaining portion of the 90° and is guided by said supporting and guiding means to a predetermined position on said supporting means, and said longer ejecting arm moves the ingot from said supporting means during the final 90° arc.

5. Apparatus for overturning an ingot or the like, comprising means having a notch for supporting the ingot in the diamond position; at least one cam-like member movable about a fixed axis transversely spaced from said ingot and parallel to the longitudinal axis of said ingot, said member being provided with at least two outwardly extending overturning fingers and an outwardly extending longer ejecting arm; and means for turning said member to successively move said fingers into contact with the lower portion of said ingot to turn said ingot about its longitudinal axis in a direction opposite to the direction said member is turned to permit successive corners of the ingot to rest in said notch, and then to move said ejecting arm into contact with a lower surface of the ingot to lift said ingot out of said notch and to remove said ingot from said supporting means.

6. Apparatus for overturning a body comprising means for supporting the body in position for overturning; a cam-like member turnable about a fixed axis transversely spaced from said body and parallel to the longitudinal axis of said body, said member being provided with at least two overturning fingers and a longer ejecting arm; and means for turning said member one revolution to successively move said fingers into contact with the lower portion of and past said body to turn said body at least 180° about its longitudinal axis in increments of 90° and to then move said arm into contact with a lower surface of body to lift said body from said supporting means and to transversely move said body therefrom.

7. The combination of transversely spaced ingot supporting means; means disposed between said spaced means for supporting an ingot in turning position; at least one member turnable about a fixed axis transversely spaced from said ingot and parallel to the longitudinal axis of said ingot, said member being provided with at least one outwardly extending finger and an outwardly extending arm; means for transversely moving said ingot from one of said spaced supporting means to the means supporting said ingot in position for turning; and means for turning said member whereby said ingot is successively turned 90° about its longitudinal axis by said finger, and said ingot is moved from said last-mentioned supporting means and deposited on the second spaced supporting means.

8. The combination of transversely spaced supporting means such as substantially parallel tables for supporting bodies such as ingots or the like; and means for transferring said bodies from one of said tables to the other of said tables including, means disposed between said tables for supporting a body in position for overturning, means for transversely moving said body from one of said tables to said overturning supporting means, a cam-like member having at least two overturning fingers movable through successive arcs of 90° about a fixed axis transversely

spaced from said ingot body when in position for overturning, means for moving said cam-like member to move said fingers through said successive arcs to turn said body about its longitudinal axis, said cam-like member also having a longer ejecting arm movable through an arc of 90° about the same fixed pivot axis transversely spaced from said body when in position for overturning, said means for moving said cam-like member for said arm through said last-mentioned arc to lift said body from said overturning supporting means and move said body transversely toward said other table, for causing said body to be deposited thereon.

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