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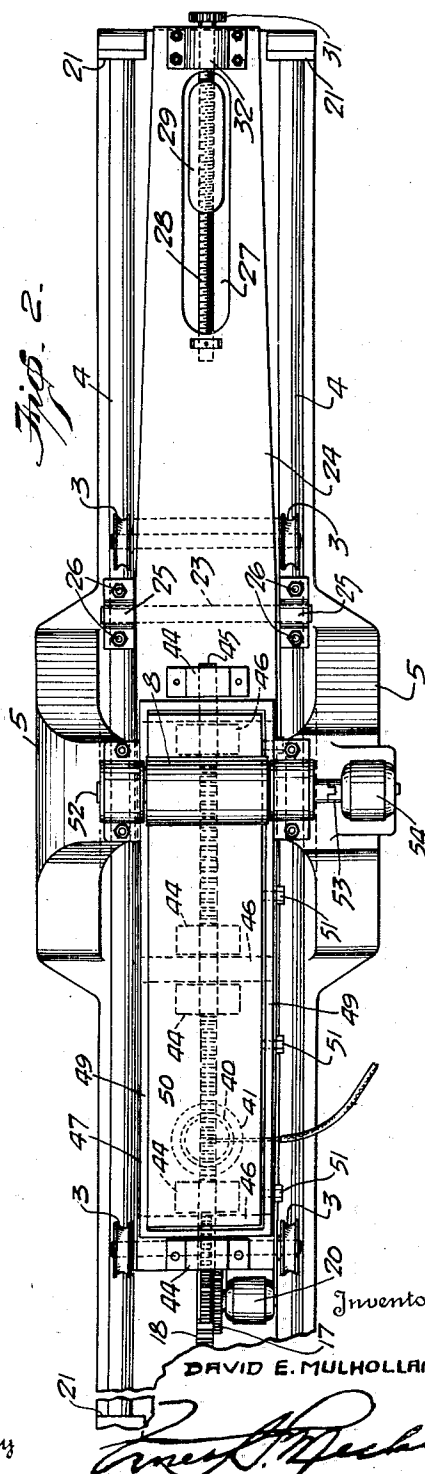
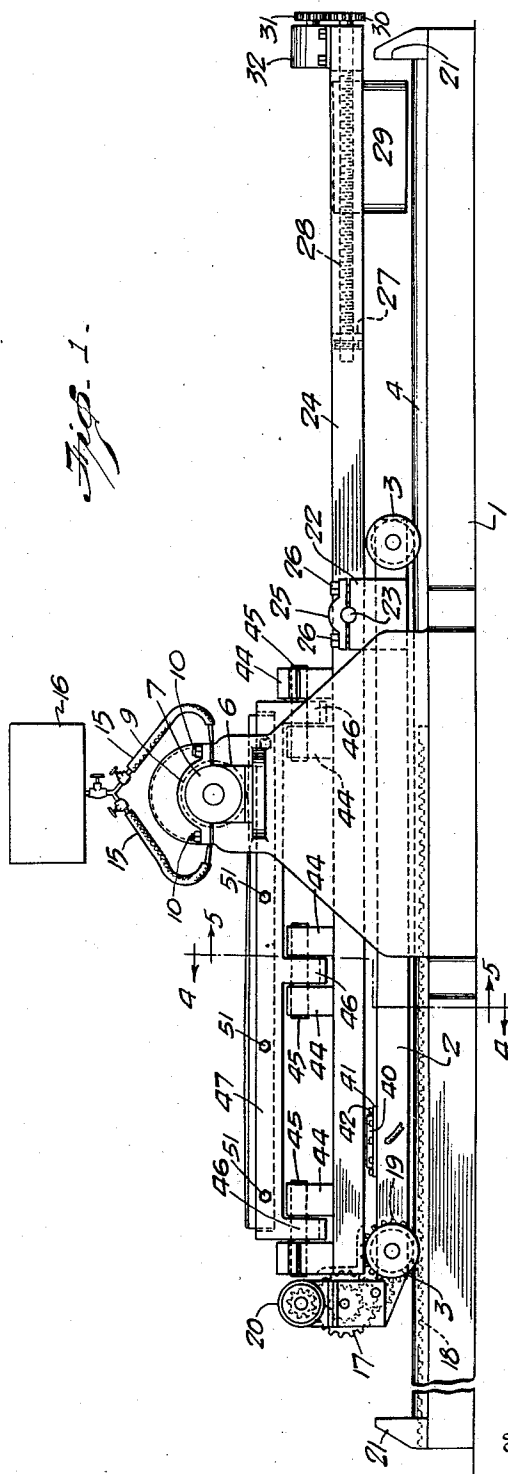
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2,334,023

BILLET GRINDING MACHINE

Filed May 26, 1941

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

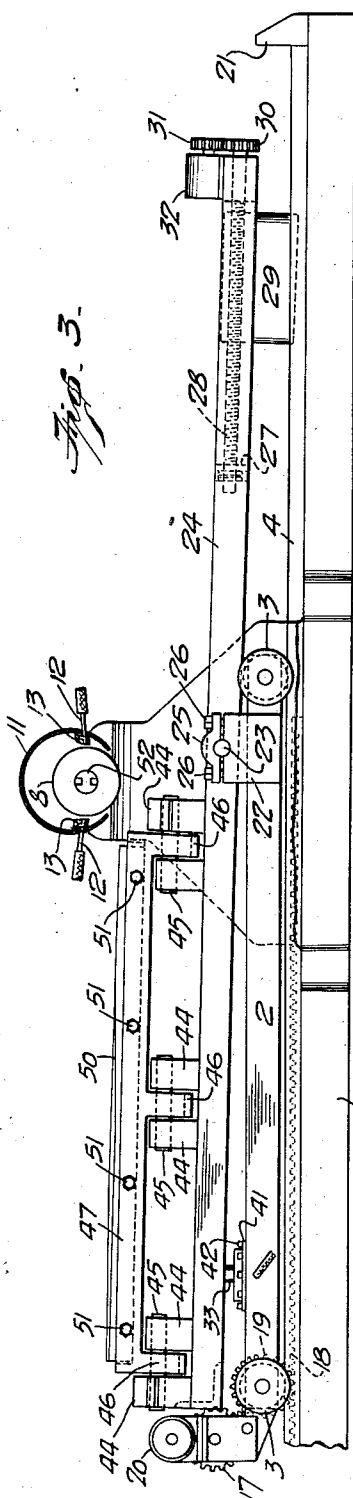


Fig. 3.

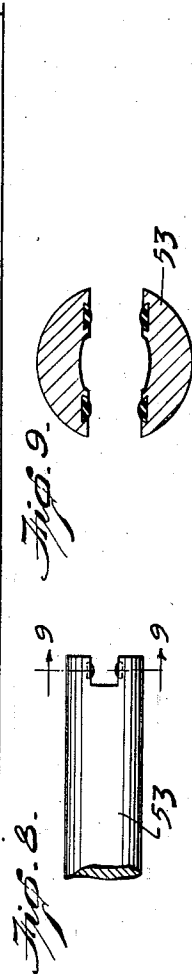


Fig. 8.

Fig. 9.

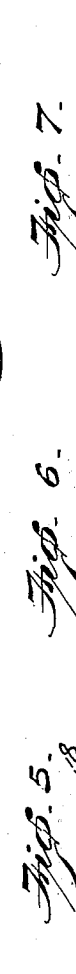
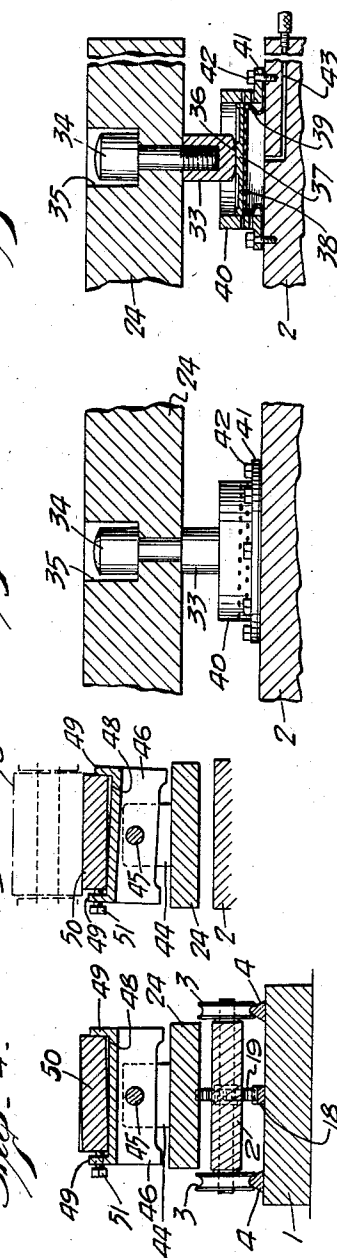


Fig. 6.

Fig. 7.

Fig. 5.

Fig. 4.



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BILLET GRINDING MACHINE

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Application May 26, 1941, Serial No. 395,279

7 Claims. (Cl. 51—92)

The invention relates to means for grinding the surfaces of billets and slabs and more particularly to apparatus so designed and constructed as to provide a continuous line contact transversely of the billet between the billet and abrasive drum whereby surface defects of the billet may be removed by a relative longitudinal movement between the billet and the abrasive drum.

The principal object of my invention, generally stated, is to provide novel and compact apparatus having mounted thereon a rotatable abrasive drum and to provide such apparatus with means by which a billet may be transported beneath and in contact with said drum, said transporting means being so arranged and disposed as to provide, first, a continuous transverse line contact between the surface of the abrasive drum and the contacting surface of the billet, and, second, to provide for a uniform pressure between billet and drum without regard to the variations in thickness or the surface configuration of the billet.

Still another object of the invention is to provide a billet grinding mechanism having a power driven abrasive drum rotatably supported in fixed bearings, said drum bridging the base member and adapted to have a line contact with the adjacent surface of the billet, the latter being supported by a plurality of members having their pivotal axes at right angles to each other, together with means carried by one of said members for equalizing the pressure between said billet and drum during relative longitudinal movement of said billet with respect to the axis of said drum.

There are numerous other objects of the invention as will hereinafter more fully appear from the detailed description of the single embodiment of the invention illustrated in the accompanying drawings in which:

Figure 1 is a side elevational view of a billet grinding machine constructed in accordance with my invention.

Figure 2 is a top plan view of the machine.

Figure 3 is a view partially in side elevation and partially in vertical cross section of the machine shown in Figure 1.

Figures 4 and 5 are, respectively, vertical cross sectional views taken on the lines 4—4 and 5—5 of Figure 1.

Figures 6 and 7 are, respectively, side elevational and vertical sectional views of a diaphragm member used to apply pressure to one end of the pivot beam illustrated in Figures 1 to 3, inclusive.

Figures 7 and 8 are, respectively, a plan view and a cross sectional view of the means by which the motor is connected to the driving shaft of the abrasive drum.

Figure 9 is a sectional view taken on the line 9—9 of Figure 8.

Throughout the specification and drawings like parts are designated by like reference characters.

Before describing the invention in detail, it is perhaps advisable to point out that billets, before being reheated and subjected to the action of the forming rolls, have on their upper and lower faces surfaces which are irregular in shape but which, in any vertical plane at right angles to the major axis of the billet, are in a single plane. The angle of the respective planes on the surface of the billet in respect to the horizontal plane varies through wide degrees. As a result it has heretofore been considered impossible to treat the surface of billets before the same are reheated and subjected to passage through the forming rolls with any other mechanism than hand grinders since to attempt to grind the surface with a fixed abrasive drum would result in a loss of from fifteen percent (15%) to twenty percent (20%) of the total volume of billet. Hand grinding is expensive and exceedingly unsatisfactory unless done by a highly skilled operator since the bluing of the surface produced by hand grinding tends to hide the seams, checks and other defects in the surface of the billet.

The machine illustrated is so arranged and disposed as to permit the rapid and economical surfacing of billets. When billets are subjected to the primary roll the opposite surfaces thereof will be parallel when the rolls are moved but as the rolls wear the surfaces of the billets operated on by such rolls become weighted. Since these irregular surfaces on the billet are formed by surfaces of revolution acting at right angles to the general plane of the surfaces any transverse cross section of the billet will show that each of the opposite surfaces of the billet lies in a single plane although the opposite plane may not be parallel. By positioning the billet in a support which is permitted to adjust itself to the irregularity of any transverse plane on the billet surface the entire surface of the billet will be subjected to the periphery of the grinding drum during the longitudinal passage of the billet beneath the same, and by using the instrumentalities hereinafter described it has been found possible to so control the action of the billet during its passage beneath the grinding drum that there is a substantially uniform pressure always exerted

by the billet at any instant against the grinding drum.

Referring now to the drawings, the numeral 1 indicates a base member which is of suitable length and is adapted to afford a rigid support for a carriage 2 mounted, by means of grooved wheels 3, on track members 4 carried by the base 1. At a convenient point intermediate the ends of the base 1 provide a pair of aligned standards 5 and at the upper end of each standard there is provided a bearing seat portion 6 into which is received the bearing 7 of the abrasive drum 8. It will, of course, be understood that the bearing seats are closed by an upper bearing seat portion 9, the portions 9 being detachably secured to the standards 5 by bolts 10 so that, upon the removal of the bolts 10 and the upper bearing portions 9, the abrasive drum may be removed from the standards 5 for repairs or to permit a new abrasive drum to be substituted therefor. Overlying the abrasive drum and preferably connected to the upper portions 9, I provide a housing member 11 enclosing the upper surface of the drum and into said housing there is adapted to project nozzles 12 through which a coolant may be applied to the peripheral surface of the drum. It will be understood that the nozzles 12 project into diaphragm members 13 which extend the full length of the abrading surface of the drum in order that the coolant may be distributed over the entire surface. The abrading surface 14 of the drum is preferably formed of abrasive grains bonded in a vulcanized rubber, as set forth in my prior Patent No. 2,106,186. The coolant diaphragms 13 are preferably connected through the nozzles 12 to the pipes 15 with a coolant chamber 16, said coolant chamber being supplied with coolant in any desired manner.

The carriage 2 is provided adjacent one end with a series of intermeshing gears 17 and the base member 1 is provided with a rack 18 engaged by a pinion 19, the pinion being driven through the intermeshing gears 17 by means of a motor 20 supported by said carriage 2. It will be obvious that upon the rotation of the motor in one direction or the other the carriage 2 will be caused to travel longitudinally of the base member and between the limit strips 21 carried at the opposite ends of said base member. Adjacent its opposite ends the carriage 2 is provided with standards 22 adapted to pivotally engage and support a pivot bar or shaft 23 which is in turn carried by the pivot beam 24. The standards 22 are preferably closed by a bearing cap 25, the members being maintained in proper position by the bolts 26.

The beam 24 is of much greater length than the carriage 2 and the pivot 23 thereof is preferably positioned adjacent the central portion of said beam, the projecting end of the beam, that is the portion of the beam projecting beyond the carriage 2, is provided with a slot or opening 27 and longitudinally disposed in said slot is a threaded shaft 28, and threadably mounted on said shaft is a counter-weight or counter-poise 29.

To operate the shaft 28 I provide the same with a gear wheel 30 meshing with a gear 31 carried by a motor 32, the motor being mounted on the upper face of the beam 24. By rotating the motor 32 in one direction or the other, the position of the counter-poise 29 with respect to the beam 24 will be changed as desired. Adjacent its opposite end the beam 24 is provided on its lower face with a projection 33 which may

be secured thereto by providing a threaded member 34 adapted to fit within a recess 35 in the beam 24 and to threadably engage the member 33. The latter is provided on its lower end with a spherical head 36 adapted to engage the thickened portion 37 of a diaphragm plate 38, the said plate being supported by a flexible diaphragm 39 housed within a diaphragm chamber 40, the flexible diaphragm member being adapted to extend under the peripheral flange 41 of the diaphragm chamber and when the latter is secured to the carriage 2 by means of the bolt 42 an airtight connection is produced between the lower face of the flexible diaphragm member 39 and the upper face of the carriage 2. Leading to the space beneath the flexible diaphragm is a passage 43 through which fluid pressure from a source not shown may enter or leave the space beneath the diaphragm.

On its upper face of a portion of the beam 24 lying to the left of the pivot 23 I provide a plurality of pivoted bearings 44, the latter being disposed on the medial line of the beam 24 and each pair of bearings 44 being adapted to support a stub shaft 45, the shafts 45 extending longitudinally of the beam 24 and forming pivot bearings for the projecting portions 46 formed on the lower face of the cradle 47. The said cradle has surrounding its upper face 48 flanges 49 forming a channel into which the billet 50 is adapted to be positioned. One or both of the lateral flanges 49 may be provided with billet securing means 51 such as, for instance, threaded bolts adapted to engage on one of the lateral edges of the billet to force the same into intimate contact with the opposite flange and hold the billet in a fixed position.

In Figures 8 and 9 I have shown means by which the shaft 52 of the abrasive drum 7 may be releasably connected to the shaft 53 of the motor 54 which serves to drive the abrasive drum 8. The shaft 52 is provided with a tongue adapted to enter the slot in the shaft 53, as set forth in my co-pending Ser. No. 310,248, Couplings for shafts and the like, filed December 20, 1939, whereby the abrasive drum may be removed by either a vertical movement or a transverse movement with respect to the motor.

The operation of the mechanism is as follows: After a billet has been positioned in the cradle the grinding drum is caused to rotate and the motor propelling the carriage is connected to a source of power so that the billet is caused to move beneath the grinding drum and each portion of the billet face is subjected to the abrasive action of the drum. At the same time the motor 32 is caused to operate, causing the counter-poise to move longitudinally of the beam and in the direction of the cradle. In addition, fluid pressure is applied to the diaphragm and by the proper manipulation of the diaphragm and by a control of speed of the motor 32 the pressure exerted by the billet against the undersurface of the abrasive drum is positively and definitely controlled in order that the amount of material removed from the surface of the billet may be regulated to any desired degree.

Attention is again called to the function of applicant's device which is merely to remove from the surface of the billet such surface defects as would result in imperfections in the finished bar or sheet produced from the billet, and not to grind the billet to a flat plane surface.

After the billet has passed beneath the drum, as above described, the direction of rotation of

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the drum may be reversed and the billet moved in the opposite direction for further grinding of the surface, or if a single pass is sufficient, by releasing the pressure in the diaphragm, the billet may be returned without contact with the roll. The fastening devices are then released and the billet is reversed so as to bring the opposite surface of the same uppermost and the operation or operations repeated, after which the billet may be removed from the cradle and a new billet substituted.

I have shown and described in my co-pending application, Ser. No. 377,237, Fluid pressure diaphragms, filed February 3, 1941, a specific means for controlling the pressure of the diaphragm and such means may be employed in connection with this apparatus, or other suitable means common to the art may be utilized.

It might be noted that the diaphragm housing is provided with a series of openings, the object and purpose of which is to permit the escape of air between the flexible diaphragm and the adjacent housing wall upon the expansion of the diaphragm and to permit the breaking of the seal between the housing wall and the diaphragm upon the release of pressure. This construction is set forth and claimed in my co-pending application, Ser. No. 377,237.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A billet grinding machine comprising a base member, a movable carriage mounted thereon, a beam pivotally mounted intermediate its ends on said carriage, a cradle rockably supported on bearings extending longitudinally of and carried by said beam, said cradle being adapted to receive and support a billet, an abrasive drum mounted on said base member and overlying said cradle, and means for causing the rotation of said abrasive drum, and separate means for causing a relative longitudinal movement of said cradle and drum relative to the axis of said drum.

2. A billet grinding machine comprising a base member, a carriage mounted thereon and movable longitudinally of said base member, a beam pivotally supported by said carriage, said pivot being horizontally disposed intermediate the ends of said beam, a cradle rockably supported on said beam on bearings disposed at a right angle to said beam pivot, said cradle being adapted to receive and support a billet, an abrasive drum mounted on said base member and overlying said cradle, means for rotating said abrasive drum, and means for causing said carriage to move longitudinally of said base, said means being adapted to control the movement of said carriage in either of two directions.

3. A billet grinding machine including a rotatable abrasive drum, and means for supporting a billet in contact with said drum, said means comprising a movably mounted carriage, a rockable beam carried by said carriage and extending longitudinally thereof, said beam being supported intermediate its ends on a horizontal pivot, and a cradle rockably supported on said beam, said cradle being adapted to rock about a pivot arranged at right angles to said beam axis.

4. A billet grinding machine comprising a base member, said member being provided with bearing means positioned on opposite sides thereof, an abrasive drum mounted in said bearing means for rotatable movement, a carriage movable longitudinally of said base member, a beam extending longitudinally of said carriage and rockably supported from said carriage at a point intermediate the ends of said beam, means carried by said beam and spaced from said carriage for causing a pivotal movement of said beam about its pivot, a cradle carried by said beam and overlying said carriage, said cradle being rockable at right angles to the movement of said beam, said cradle also serving to support a billet, and means for causing a longitudinal movement of said cradle, said beam and cradle being adapted to cause a line contact between the upper surface of a billet supported by said cradle and the adjacent portion of the periphery of said abrasive drum during the longitudinal movement of said cradle, said contact extending entirely across the face of the billet.

5. A billet grinding machine including a base member, a grinding drum mounted thereon and spaced therefrom, a carriage movable longitudinally of said base member, a beam extending longitudinally of said carriage and pivotally supported intermediate its ends by means carried by said carriage and adjacent one end thereof, and means for controlling the movement of said beam about its axis, said last named means including a fluid pressure actuated plunger engaging the under-surface of said beam adjacent one end and a movable counterpoise positioned adjacent the opposite end of said beam.

6. A billet grinding machine comprising a base member, bearing means positioned on opposite sides of said base member, a rotatable abrasive drum having its shaft mounted in said bearing means, means for maintaining the center of the shaft against movement relative to said base, a carriage movable longitudinally of said base member, gimbal means carried by said carriage and adapted to support a billet, and fluid pressure means carried by one of said elements of said gimbal for regulating the pressure between said drum and a billet supported by said gimbal means during the longitudinal movement of said gimbal means with reference to said drum.

7. A billet grinding machine comprising a longitudinally extending base member, bearing members positioned intermediate the ends of said base, a rotatable abrasive drum mounted in said bearing members, the lower face of said drum being spaced from the upper face of said base, a carriage movable longitudinally of said base and interposed between the base and the lower face of said drum, gimbal means carried by said carriage, said means being adapted to receive and support a billet, means for moving said carriage longitudinally of said base member, said movement being adapted to cause the lower face of said drum to have a line contact with the upper face of said billet normal to the longitudinal axis thereof, and means for rockably supporting said gimbal means on said carriage.

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