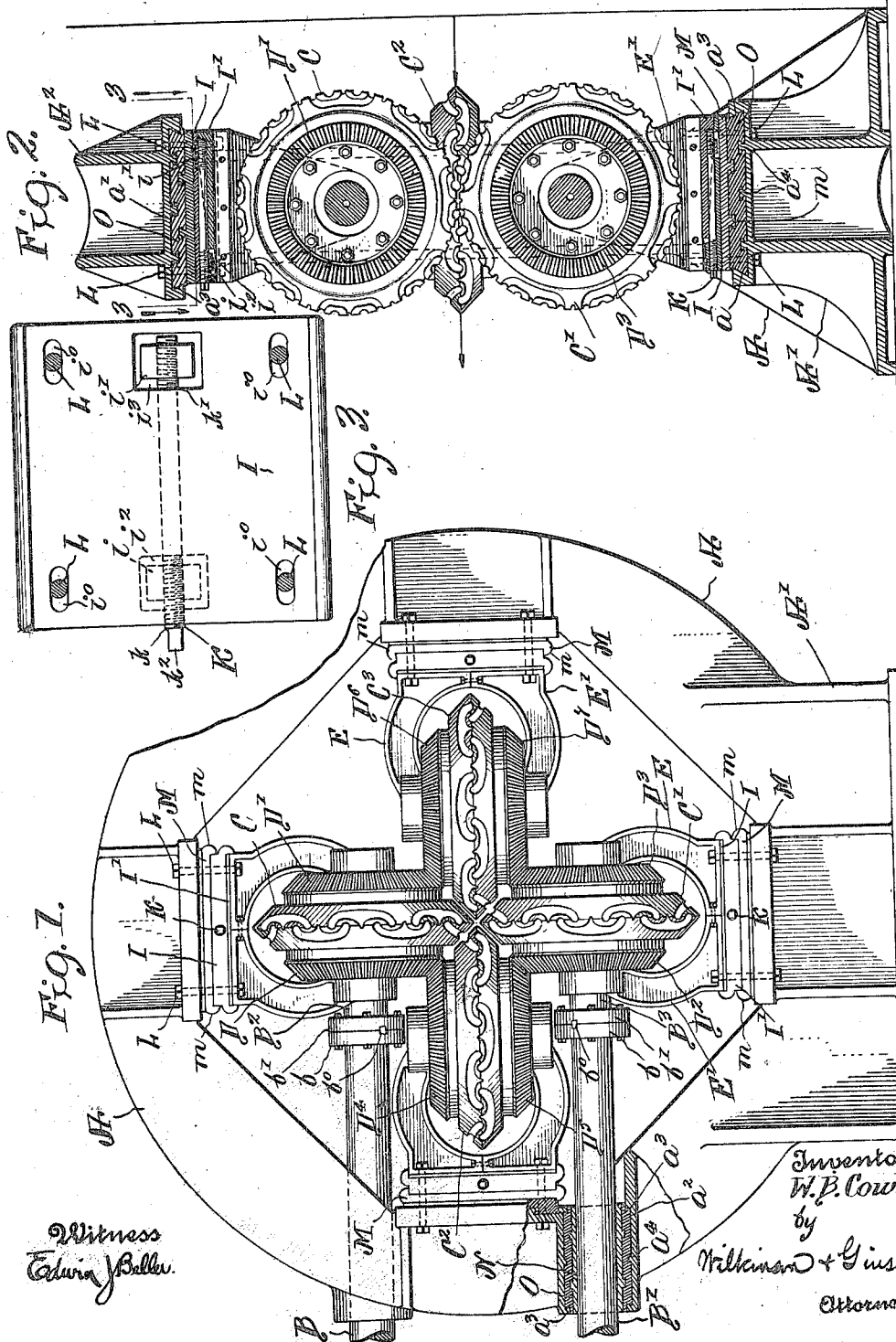


W. B. COWLES.
DIE ROLLING MILL FOR THE MANUFACTURE OF WELDLESS CHAIN.
APPLICATION FILED JULY 15, 1918.

1,431,443.

Patented Oct. 10, 1922.

2 SHEETS—SHEET 1.



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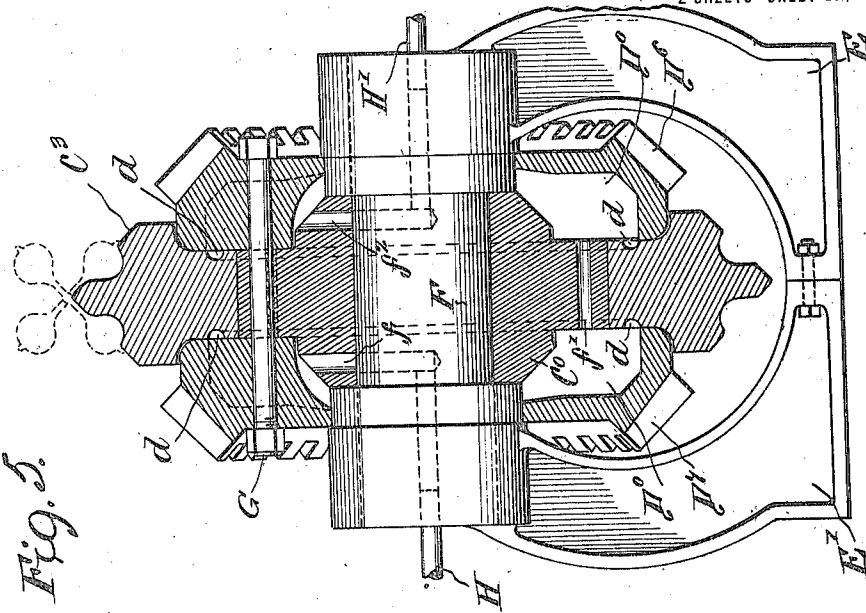


Fig. 5.

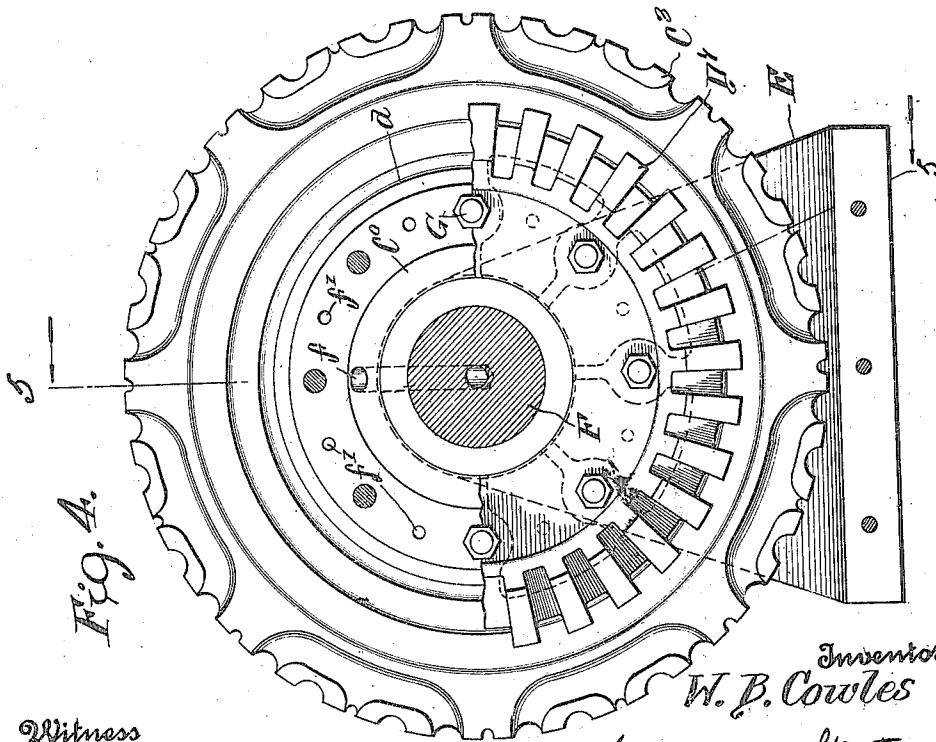


Fig. 4.

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UNITED STATES PATENT OFFICE.

WILLIAM BARNUM COWLES, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO
WELDLESS CHAIN CORPORATION, OF DOVER, DELAWARE, A CORPORATION OF
DELAWARE.

DIE ROLLING MILL FOR THE MANUFACTURE OF WELDLESS CHAIN.

Application filed July 15, 1918. Serial No. 245,057.

To all whom it may concern:

Be it known that I, WILLIAM B. COWLES, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Improved Die Rolling Mills for the Manufacture of Weldless Chains; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My present invention relates to improvements in die rolling mills for roll forgings in general, but more especially for rolling weldless chain from a single homogeneous bar of cruciform cross section.

Incident to the operation of the herein described apparatus this bar is presumed to be rolled into cruciform cross section from a single billet into the desired length. In making heavy chain cables such a bar should be long enough to make a chain cable shot of 15 fathoms, or since the bar is elongated somewhat in the process of rolling, the bar should preferably be about 65 feet more or less in length; but obviously the length of the bar would determine the length of the corresponding chain produced therefrom.

According to my present invention this cruciform bar is fed while hot between the faces of a set of four die rolls placed at right angles to each other, and the requisite contour is imparted to the bar as it is drawn through the die rolls themselves.

This leaves the bar with the chain links outlined therein, the adjacent links being at right angles to each other, but the bar after passing through the die rolls is left with protruding fins and extruded metal, exterior to the links, and with a web on the interior of the links, which fins, web and extruded metal are removed later on, as fully described in my application entitled Automatic trimming press for manufacturing weldless chain, Serial No. 245,926, filed July 20, 1918, the final product being shown in my other application entitled Weldless stud-link ship-cable shot, Serial No. 245,056, filed July 15, 1918.

The present invention relates only to the operation of roll-forging the cruciform bar into a chain-bar, and the invention relates

particularly to improved apparatus for accomplishing this result.

This apparatus will be more fully understood after reference to the accompanying drawings, in which similar parts are indicated by similar reference symbols throughout the several views, and in which:—

Figure 1 is a front elevation, partly in section, showing the complete set of die rolls journaled in their yokes and housing, together with the power shafts for driving the same.

Figure 2 shows a central vertical section through Fig. 1, parts being shown in elevation.

Figure 3 is a detail showing a plan of one of the adjustable wedges, the fastening bolts being shown in section along the line 3—3 of Fig. 2 and looking in the direction of the arrows.

Figure 4 is an enlarged side view of one of the die rolls, the upper half of the figure being shown with the bevel gear removed and the bolts for same being shown in section; and

Figure 5 shows a section along the broken line 5—5 of Fig. 4, and looking in the direction of the arrows.

A represents the housing which is preferably in the form of a substantially circular casting mounted on the pedestal A'.

B and B' represent the two power shafts which are driven with the same speed, and in reverse directions, by any suitable gearing from any suitable source of power, not shown.

The power shaft B is provided with a coupling flange *b* which is rigidly attached to the coupling flange *b'* on the short shaft B², on which the hub of the die roll C and the bevel gears D and D' are rigidly mounted.

In a similar way the power shaft B' has its flange *b* attached to the flanged end *b'* of the short shaft B³ on which the hub of the die roll C' and of the bevel gears D² and D³ are mounted.

The bevel gears D and D' mesh with bevel gears D⁴ and D⁶, respectively, which are secured on the same hubs with the die rolls C² and C³. Fast on the same hubs are the bevel gears D⁵ and D⁷, meshing, respectively, with the bevel gears D² and D³ on the power shaft B', so that the die rolls C and C' are

secured, respectively, on prolongations of the corresponding power shafts B and B'; while the die rolls C² and C³ are driven from both sides by the bevel gearing already referred to.

By this balanced construction just referred to, any spring in the apparatus to one side or the other as the bar goes through the mill is obviated or equalized, thus preventing any distortion in the form of the chain bar, and permitting the rolling of a series of links of identically the same construction.

A convenient form of arrangement for journaling the dies rolls C² and C³ is shown in Figs. 4 and 5, in which E and E' are two halves of a yoke, bolted together to form journal bearings for the short shaft F. On this shaft the hub C⁰ of the die roll is rigidly held, and secured on this hub is a die roll indicated in Figure 5 as C³, and also secured to this hub, as by means of the bolts G, are the corresponding bevel gears, such as D⁶ and D⁷.

The interior of these bevel gear wheels is hollowed, as at D⁰, to form a water chamber surrounding the hub of the die roll, and suitable connecting passages and grooves are provided for the complete circulation of water, so that water is admitted through the pipe H, see Figure 5, enters the bore f in the hub C⁰, enters the water chamber D⁰, passes through the opening f' in the hub, and escapes through the opening f² in the hub and through the outlet pipe H', all as shown in Figure 5. Complete circulation throughout the water chamber is facilitated by the annular grooves d, shown in Figs. 4 and 5.

In order to assemble the various die rolls into the set, and to remove the individual rolls whenever desired, as for purposes of repairs, or where it is desired to change the die rolls for making other sizes of chain, I provide means for removing each yoke with the corresponding die roll and bevel gears. These means also comprise means for varying within narrow limits the relative distances apart of the die rolls. These means comprise two oppositely-disposed wedges, shown in section in Fig. 2 and in enlarged plan in Fig. 3, in which I represents the outer wedge and I' the inner wedge, each wedge being provided with lugs i and i', respectively, projecting into sockets i² and i³, respectively, in the opposite wedge, see Fig 3.

These lugs are internally screw-threaded, but with the screw threads in reverse directions to engage the right and left screw threads k and k' on the adjusting screw K, which has a squared head k² adapted to be turned by a wrench, and by setting up or easing off on the adjusting screw K, each individual die roll may be moved slightly towards or away from the centre of the mill.

The bolts L pass through the base flange of the yoke members E and E', and also

through slots i⁰ in the wedges I and I', and thus firmly hold the yoke to the housing of the mill, but at the same time allow slight play to the wedges.

In order to adjust the wedges, it is necessary to ease up on the bolts L, set the wedges in the desired position and then lock the bolts tight.

In order to remove the die roll, take out the bolts L, then take out the wedges, and then back out and remove the yoke with its die roll and bevel gears complete.

The foregoing applies more especially to the die rolls C² and C³, and the accompanying bevel gears; and in order to remove the die rolls C and C' the additional step will be required of disengaging the flanges b and b' by disengaging the short shafts B² and B³ from the power shafts B and B', which may be accomplished by removing the bolts holding the flanges b and b' together, and also removing the keys b⁰.

The operative parts of a machine of this character have to be constructed with great precision, and it is difficult and expensive to effect the machining in such large parts as constitute the various bearing surfaces in the housing A. In order to avoid such machining I provide recesses a, a' and a² in the housing, each recess having beveled side walls a³ and projecting lugs a⁴ for holding type metal or similar neutral composition of metal O.

I further provide bearing plates M, machined to bear on one face against the outer wedges I, and on the reverse face having projecting lugs m to hold said plates in the type metal O.

These bearing plates are then set accurately in their proper position in relation to the housing, each in wake of its recess in the housing. Melted type metal O is then poured into the recesses, fixing these plates permanently and accurately in their desired position.

The plates M are provided with guide ribs m on each side thereof to guide the wedges, and the wedges are also provided with similar guide ribs to guide the corresponding yokes, as shown most clearly in Figs. 1 and 3.

In a similar manner I provide bushings N with their bearings machined on the inside accurately to fit the power shafts B and B'. These bushings are placed accurately in their permanent position in wake of the annular recesses in the bearing bosses at the left side of the housing A, as shown in Fig. 1, and melted type metal O is poured into the recess between the bushing and housing, fixing these bushings permanently and accurately in their desired position.

The form of die rolls and the method of making the same is illustrated and described in my application executed of even date herewith, and entitled Automatic die routing du-

plicator for die rolls, filed July 26, 1918, Ser. No. 246,912.

It will be obvious that in handling the heavy weights herein described, suitable cranes or other lifting devices should be provided; but these are not a part of my present invention and will not be described herein.

While I have described the preferred form of the invention it will be obvious that various modifications might be made in the herein described construction, and in the combination and arrangement of parts which could be used without departing from the spirit of my invention, and I do mean to limit my invention to such details except as particularly pointed out in the claims.

Having thus described my invention what I claim and desire to secure by Letters Patent of the United States is:—

1. In a die-roll mill, the combination with a frame provided with a recess in its center, of a plurality of symmetrically disposed yokes each detachably connected to said frame and projecting inwardly into said recess, die-rolls journaled in said yokes, and means for rotating all of said die-rolls at the same rate of speed, substantially as described.

2. In a die-roll mill, the combination with a frame provided with a recess in its center, of a plurality of symmetrically disposed yokes, each detachably connected to said frame and projecting inwardly into said recess, reversely disposed wedges interposed between said yokes and said frame, with means for moving one wedge over the other whereby the corresponding yoke may be adjusted towards or away from the center of said frame, die-rolls journaled in said yokes, and means for rotating all of said die-rolls at the same rate of speed, substantially as described.

3. In a die-roll mill, the combination with a frame provided with a recess in its center, of a plurality of symmetrically disposed yokes, each detachably connected to said frame and projecting inwardly into said recess, reversely disposed wedges interposed between said yokes and said frame, each wedge being provided with a lug projecting into a recess in the adjacent wedge and said lugs, and said lugs being internally screw-threaded in reverse directions, with a right and left handed screw engaging said lugs, for moving one wedge over the other whereby the corresponding yoke may be adjusted towards or away from the center of said frame, die-rolls journaled in said yokes, and means for rotating all of said die-rolls at the same rate of speed, substantially as described.

4. In a die-roll mill, the combination with a frame provided with a recess in its center, of a plurality of symmetrically disposed yokes, each detachably connected to said frame and projecting inwardly into said re-

cess, each yoke being formed of two halves detachably connected to each other and to said frame, and each half yoke being provided with a journal bearing for the corresponding die-roll, die-rolls journaled in said yokes, and means for rotating all of said die-rolls at the same rate of speed, substantially as described.

5. In a die-roll mill, the combination with a frame provided with a recess in its center, of a plurality of symmetrically disposed yokes, each detachably connected to said frame and projecting inwardly into said recess, each yoke being formed of two halves detachably connected to each other and to said frame, and each half yoke being provided with a journal bearing for the corresponding die-roll, reversely disposed wedges interposed between said yokes and said frame, with means for moving one wedge over the other whereby the corresponding yoke may be adjusted towards or away from the center of said frame, die-rolls journaled in said yokes, and means for rotating all of said die-rolls at the same rate of speed, substantially as described.

6. In a die-roll mill, the combination with a frame provided with a recess in its center, of a plurality of symmetrically disposed yokes, each detachably connected to said frame and projecting inwardly into said recess, each yoke being formed of two halves detachably connected to each other and to said frame, and each half yoke being provided with a journal bearing for the corresponding die-roll, reversely disposed wedges interposed between said yokes and said frame, each wedge being provided with a lug projecting into a recess in the adjacent wedge and said lugs, and said lugs being internally screw-threaded in reverse directions, with a right and left handed screw engaging said lugs, for moving one wedge over the other whereby the corresponding yoke may be adjusted towards or away from the center of said frame, die-rolls journaled in said yokes, and means for rotating all of said die-rolls at the same rate of speed, substantially as described.

7. In a die-roll mill, the combination with a frame made of a single rough casting provided with a recess in its center, and with a plurality of cavities filled with fusible metal, with bearing plates mounted over the recesses of fusible metal contained in said cavities, of a plurality of symmetrically disposed yokes mounted over said bearing plates and each detachably connected to said frame and projecting inwardly into said recess, die-rolls journaled in said yokes, and means for rotating all of said die-rolls at the same rate of speed, substantially as described.

8. In a die-roll mill, the combination with a frame made of a single rough casting

provided with a recess in its center, and with a plurality of cavities filled with fusible metal, with bearing plates mounted over the recesses of fusible metal contained in said cavities, of a plurality of symmetrically disposed yokes mounted over said bearing plates and each detachably connected to said frame and projecting inwardly into said recess, reversely disposed wedges interposed between said yokes and said bearing plates, with means for moving one wedge over the other whereby the corresponding yoke may be adjusted towards or away from the center of said frame, die-rolls journaled in said yokes, and means for rotating all of said die-rolls at the same rate of speed, substantially as described.

9. In a die-roll mill, the combination with a frame made of a single rough casting provided with a recess in its center, and with a plurality of cavities filled with fusible metal, with bearing plates mounted over the recesses of fusible metal contained in said cavities, of a plurality of symmetrically disposed yokes mounted over said bearing plates and each detachably connected to said frame and projecting inwardly into said recess, reversely disposed wedges interposed between said yokes and said bearing plates, each wedge being provided with a lug projecting into a recess in the adjacent wedge and said lugs, and said lugs being internally screw-threaded in reverse directions, with a right and left handed screw engaging said lugs, for moving one wedge over the other whereby the corresponding yoke may be adjusted towards or away from the center of said frame, die-rolls journaled in said yokes, and means for rotating all of said die-rolls at the same rate of speed, substantially as described.

10. In a die-roll mill, the combination with a frame made of a single rough casting provided with a recess in its center, and with a plurality of cavities filled with fusible metal, with bearing plates mounted over the recesses of fusible metal contained in said cavities, of a plurality of symmetrically disposed yokes mounted over said bearing plates and each detachably connected to said frame and projecting inwardly into said recess, each yoke being formed of two halves detachably connected to each other and to said frame, and each half yoke being provided with a journal bearing for the corresponding die-roll, die-rolls journaled in said yokes, and means for rotating all of said die-rolls at the same rate of speed, substantially as described.

11. In a die-roll mill, the combination with a frame made of a single rough casting provided with a recess in its center, and with a plurality of cavities filled with fusible metal, with bearing plates mounted over the recesses of fusible metal contained in

said cavities, of a plurality of symmetrically disposed yokes mounted over said bearing plates and each detachably connected to said frame and projecting inwardly into said recess, each yoke being formed of two halves detachably connected to each other and to said frame, and each half yoke being provided with a journal bearing for the corresponding die-roll, reversely disposed wedges interposed between said yokes and said frame, with means for moving one wedge over the other whereby the corresponding yoke may be adjusted towards or away from the center of said frame, die-rolls journaled in said yokes, and means for rotating all of said die-rolls at the same rate of speed, substantially as described.

12. In a die-roll mill, the combination with a frame made of a single rough casting provided with a recess in its center, and with a plurality of cavities filled with fusible metal, with bearing plates mounted over the recesses of fusible metal contained in said cavities, of a plurality of symmetrically disposed yokes mounted over said bearing plates and each detachably connected to said frame and projecting inwardly into said recess, each yoke being formed of two halves detachably connected to each other and to said frame, and each half yoke being provided with a journal bearing for the corresponding die-roll, reversely disposed wedges interposed between said yokes and said frame, each wedge being provided with a lug projecting into a recess in the adjacent wedge and said lugs, and said lugs being internally screw-threaded in reverse directions, with a right and left handed screw engaging said lugs, for moving one wedge over the other whereby the corresponding yoke may be adjusted towards or away from the center of said frame, die-rolls journaled in said yokes, and means for rotating all of said die-rolls at the same rate of speed, substantially as described.

13. In a die-roll mill, the combination with a frame provided with a recess in its center, of a plurality of symmetrically disposed yokes, each detachably connected to said frame and projecting inwardly into said recess, reversely disposed wedges interposed between said yokes and said frame, one of said wedges being provided with guide ribs engaging the other wedge and the yoke, with means for moving one wedge over the other whereby the corresponding yoke may be adjusted towards or away from the center of said frame, die-rolls journaled in said yokes, and means for rotating all of said die-rolls at the same rate of speed, substantially as described.

14. In a die-roll mill, the combination with a frame provided with a recess in its center, of a plurality of symmetrically disposed yokes, each detachably connected to

said frame and projecting inwardly into said recess, reversely disposed wedges interposed between said yokes and said frame, one of said wedges being provided with
 5 guide ribs engaging the other wedge and the yoke, each wedge being provided with a lug projecting into a recess in the adjacent wedge and said lugs, and said lugs being internally screw-threaded in reverse direc-
 10 tions, with a right and left handed screw engaging said lugs, for moving one wedge over the other whereby the corresponding yoke may be adjusted towards or away from the center of said frame, die-rolls journaled
 15 in said yokes, and means for rotating all of said die-rolls at the same rate of speed, substantially as described.

15. In a die-roll mill, the combination with a frame provided with a recess in its
 20 center, of a plurality of symmetrically disposed yokes, each detachably connected to said frame and projecting inwardly into said recess, each yoke being formed of two halves detachably connected to each other
 25 and to said frame, and each half yoke being provided with a journal bearing for the corresponding die-roll, reversely disposed wedges interposed between said yokes and said frame, one of said wedges being pro-
 30 vided with guide ribs engaging the other and wedge and the yoke, with means for moving one wedge over the other whereby the corresponding yoke may be adjusted to-
 35 wards or away from the center of said frame, die-rolls journaled in said yokes, and means for rotating all of said die-rolls at the same rate of speed, substantially as described.

16. In a die-roll mill, the combination
 40 with a frame provided with a recess in its center, of a plurality of symmetrically disposed yokes, each detachably connected to said frame and projecting inwardly into said recess, each yoke being formed of two
 45 halves detachably connected to each other and to said frame, and each half yoke being provided with a journal bearing for the corresponding die-roll, reversely disposed wedges interposed between said yokes and
 50 said frame, one of said wedges being provided with guide ribs engaging the other wedge and the yoke, each wedge being provided with a lug projecting into a recess in the adjacent wedge and said lugs, and said
 55 lugs being internally screw-threaded in reverse directions, with a right and left handed screw engaging said lugs, for moving one wedge over the other whereby the cor-
 60 responding yoke may be adjusted towards or away from the center of said frame, die

rolls journaled in said yokes, and means for rotating all of said die-rolls at the same rate of speed, substantially as described.

17. In a machine of the character de-
 scribed, the combination with an integral
 65 main frame made of cast metal and provided with a series of recesses filled with fusible metal, of a bearing body mounted on the face of said fusible metal, and having a
 70 smooth bearing surface, whereby a nicely adjusted bearing surface is provided for the working parts of the machine in an other-
 wise rough casting, without the necessity for special machining or other finishing
 75 processes, substantially as described.

18. In a machine of the character de-
 scribed, the combination with an integral
 main frame made of cast metal and pro-
 vided with a series of recesses filled with
 80 fusible metal, of a bearing body mounted on the face of said fusible metal, and hav-
 ing lugs projecting into said fusible metal and holding said bearing body firmly in
 place, said bearing body being provided
 with a smooth bearing surface, whereby a
 85 nicely adjusted bearing surface is provided for the working parts of the machine in an
 otherwise rough casting, without the neces-
 sity for special machining or other finish-
 ing processes, substantially as described.
 90

19. In a machine of the character de-
 scribed, the combination with an integral
 main frame made of cast metal and provid-
 ed with a series of recesses filled with fus-
 95 ible metal, of a flat bearing plate mounted on the face of said fusible metal, and hav-
 ing a smooth bearing surface, whereby a
 nicely adjusted bearing surface is provided
 for the working parts of the machine in an
 otherwise rough casting, without the neces-
 100 sity for special machining or other finish-
 ing processes, substantially as described.

20. In a machine of the character de-
 scribed, the combination with an integral
 main frame of cast metal and provided with
 105 a series of recesses filled with fusible metal, of a flat bearing plate mounted on the face
 of said fusible metal, and having lugs pro-
 jecting into said fusible metal and holding
 said bearing plate firmly in place, said bear-
 110 ing plate being provided with a smooth bearing surface, whereby a nicely adjusted bearing surface is provided for the work-
 ing parts of the machine in an otherwise
 rough casting, without the necessity for
 115 special machining or other finishing pro-
 cesses, substantially as described.

In testimony whereof, I affix my signa-
 ture.

WILLIAM BARNUM COWLES.