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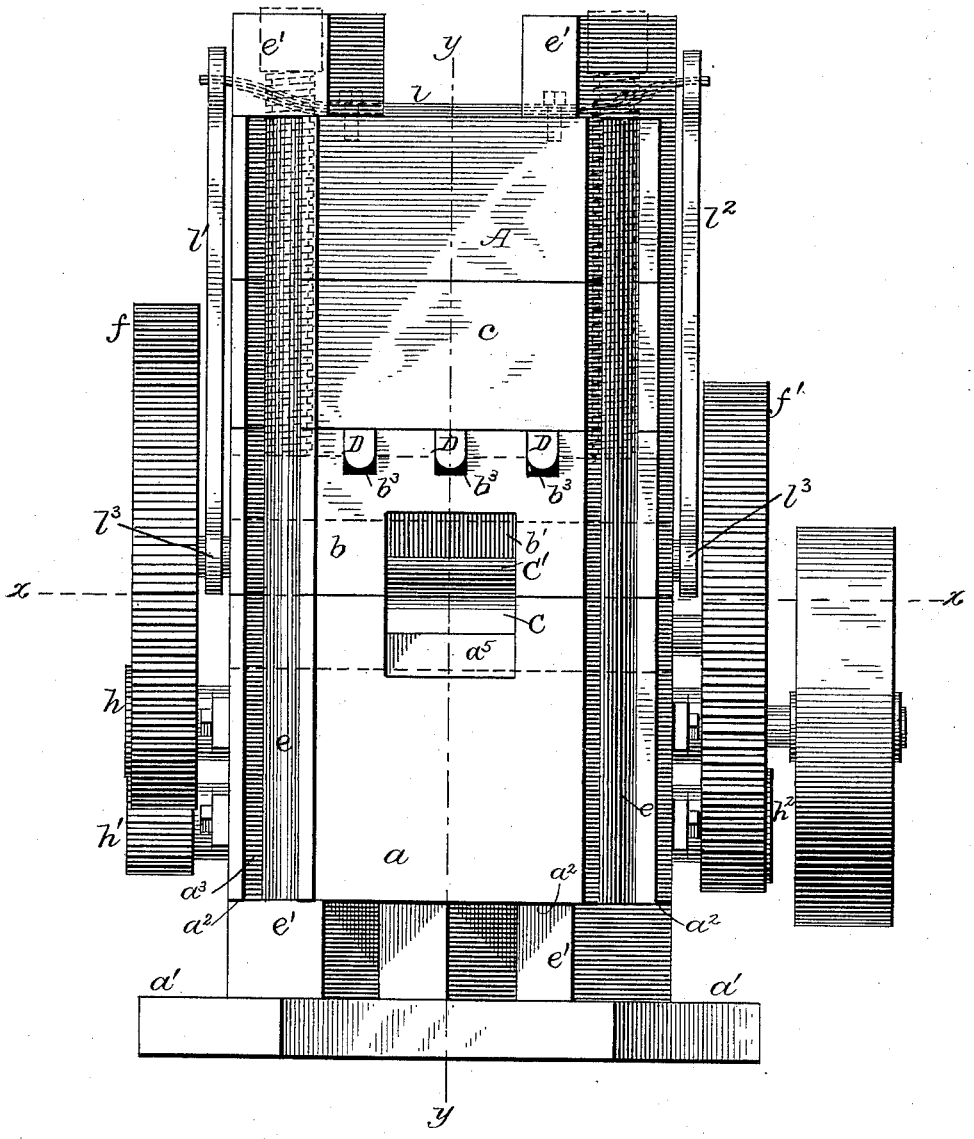
S. W. BALDWIN.

METAL WORKING ROLLING MILL.

No. 385,437. Patented July 3, 1888.

Fig. 1.



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S. W. BALDWIN.

METAL WORKING ROLLING MILL.

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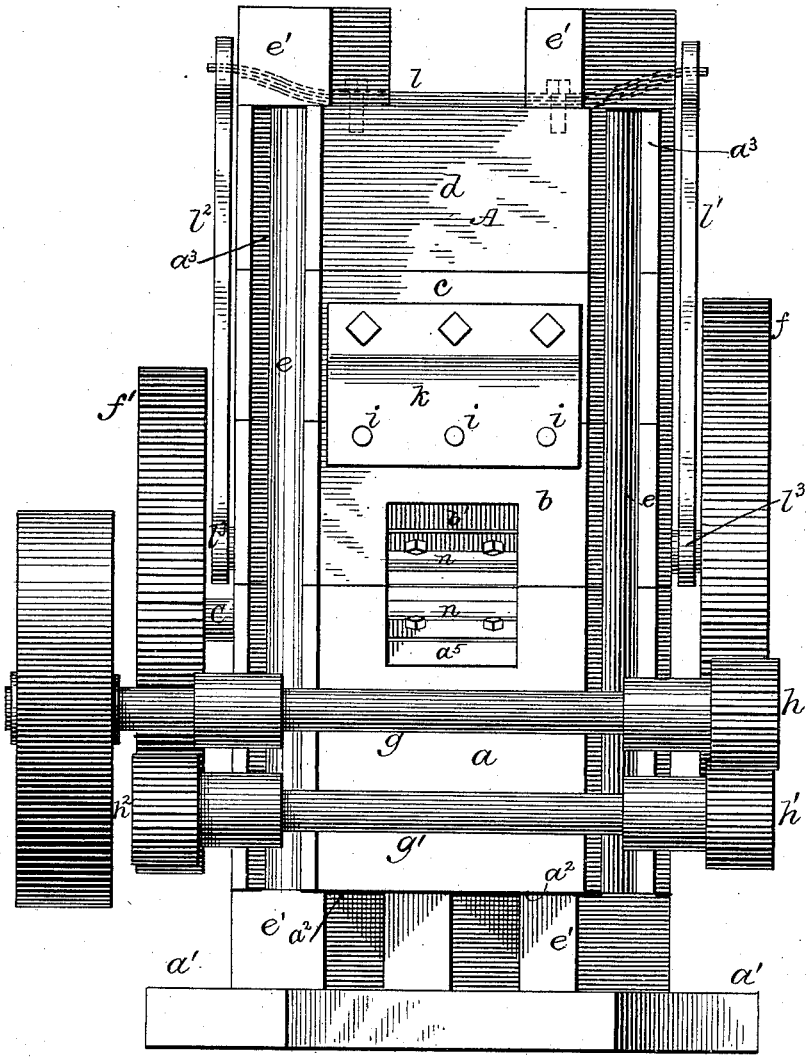
Fig. 2.



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METAL WORKING ROLLING MILL.

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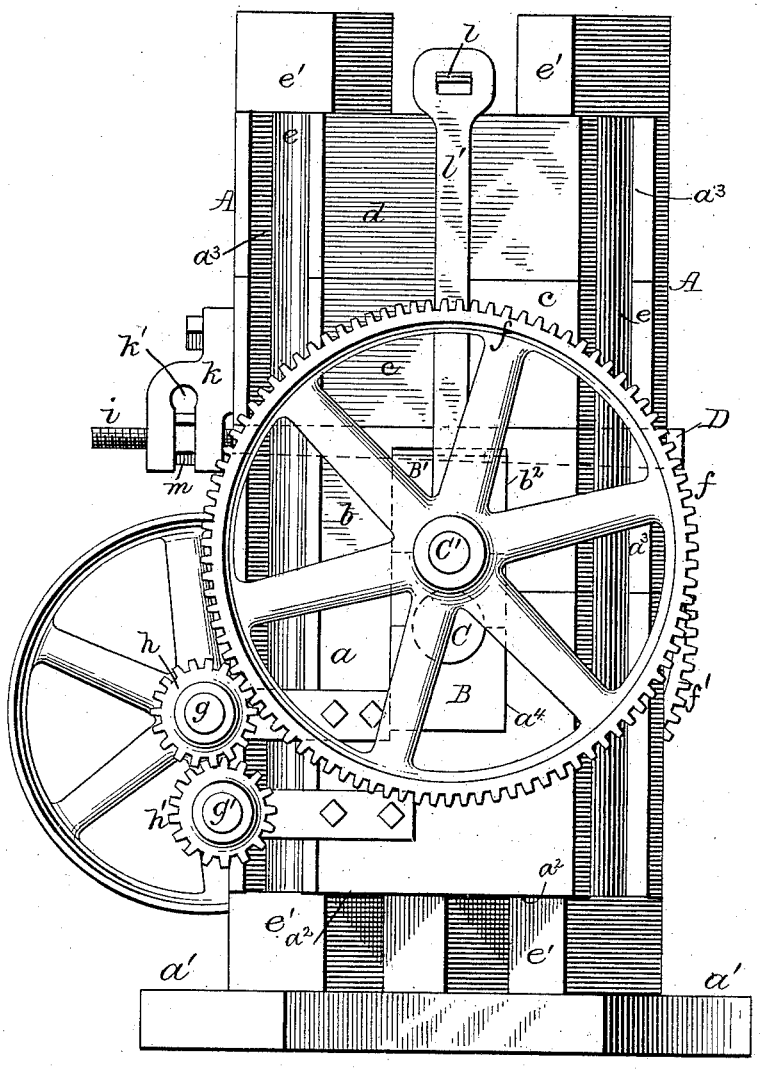
Fig. 3.



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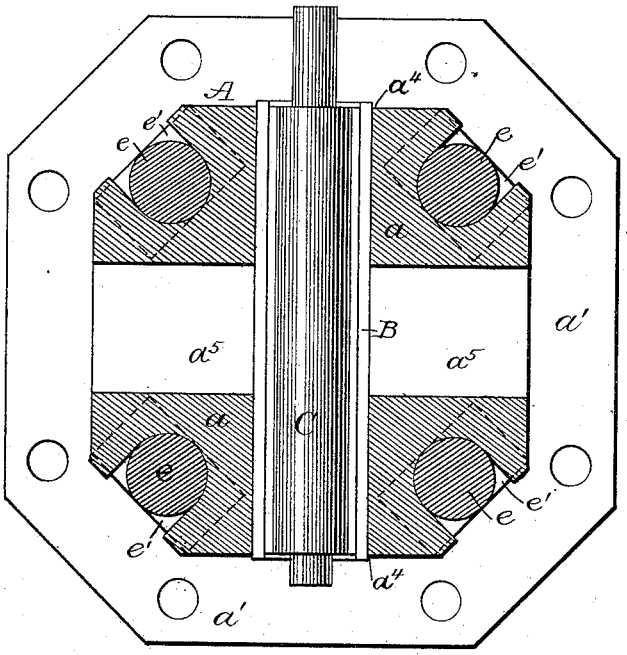
METAL WORKING ROLLING MILL.

No. 385,437. Patented July 3, 1888.

Fig. 4.



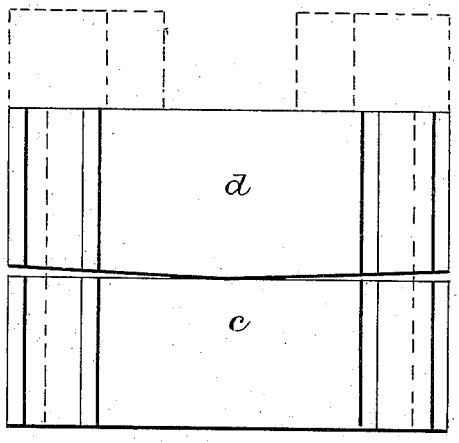


Fig. 6.

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(No Model.) 6 Sheets—Sheet 5.

S. W. BALDWIN.

METAL WORKING ROLLING MILL.

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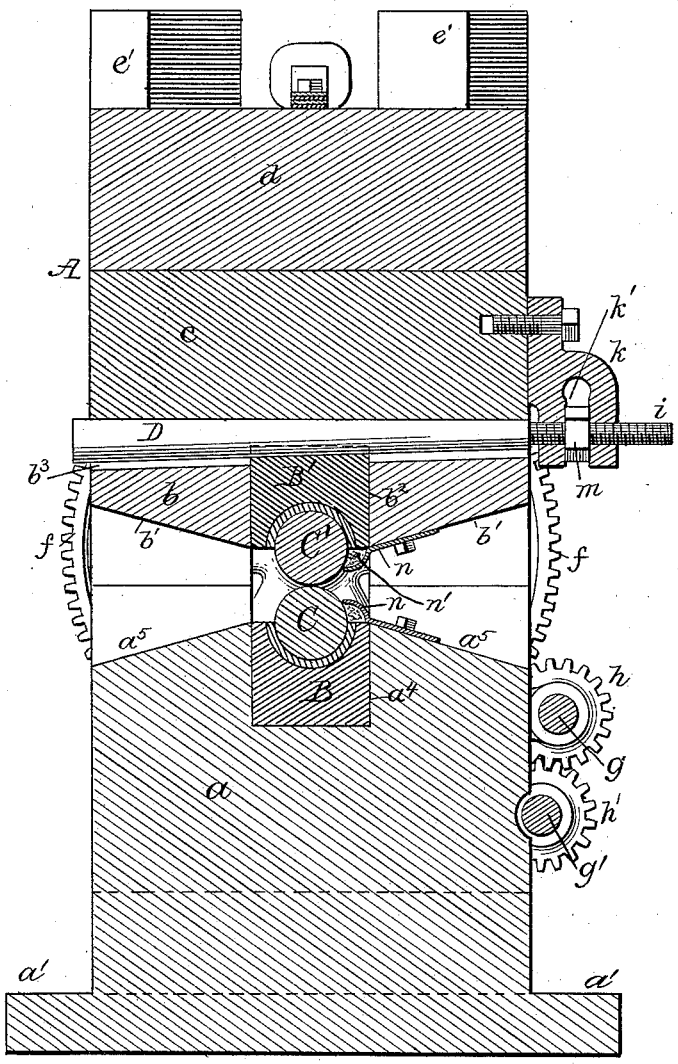
Fig. 5.



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(No Model.) 6 Sheets—Sheet 6.

S. W. BALDWIN.

METAL WORKING ROLLING MILL.

No. 385,437. Patented July 3, 1888.

Fig. 8.

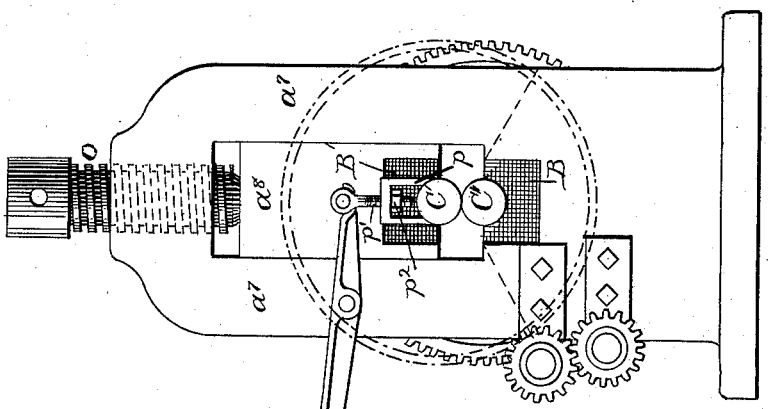
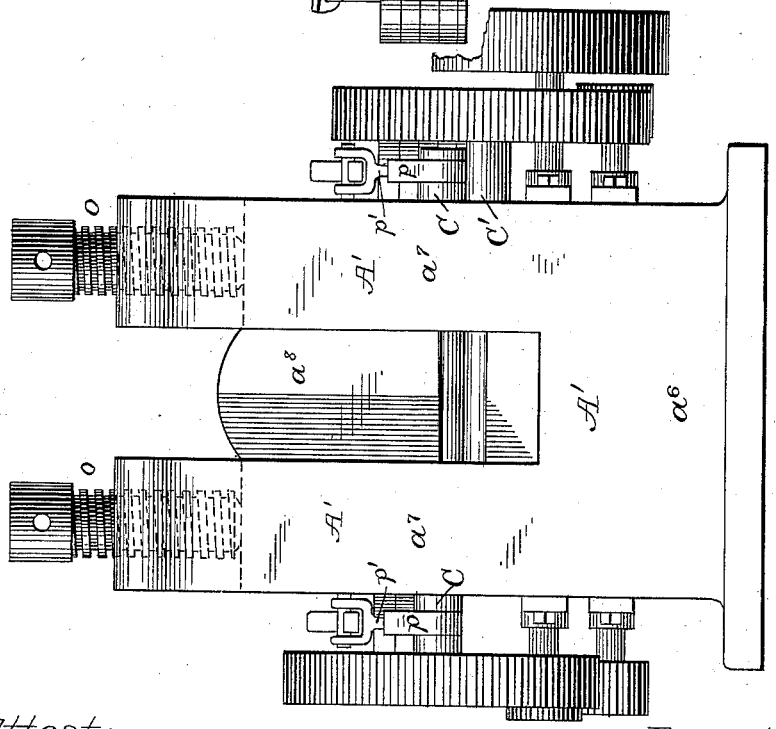


Fig. 7.



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UNITED STATES PATENT OFFICE.

STEPHEN W. BALDWIN, OF YONKERS, NEW YORK.

METAL-WORKING ROLLING-MILL.

SPECIFICATION forming part of Letters Patent No. 385,437, dated July 3, 1888.

Application filed July 9, 1887. Serial No. 243,865. (No model.)

To all whom it may concern:

Be it known that I, STEPHEN W. BALDWIN, of Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Metal-Working Rolls; and I do hereby declare that the following specification, taken in connection with the drawings furnished and forming a part of the same, is a clear, true, and complete description of the several features of my invention.

My said improvements have been devised in connection with rolls for working metal into thin sheets or strips, and especially such rolls as are relied upon for producing sheets or strips in which the greatest attainable uniformity of gage or thickness is desirable.

A set of rolls embodying my improvements can be operated to advantage in working hard metals in a heated condition or soft base metals in a cold condition; but their prime value will accrue in their use in cold-working such metals as steel, iron, gold, silver, platinum, and brass.

The working strains upon rolls of this general class are well known to be exceedingly heavy, often resulting either in the separate or combined springing or yielding of the housings and the rolls, and the rolled product is consequently not only irregular in gage on comparison of one sheet or strip with another, but also as to different portions of any one sheet or strip.

The prime object of my invention is to reduce to a minimum that liability to variation in the vertical dimension of the "pass" or rolling-space between the rolls. In accomplishing this end the main feature of my invention consists in a novel combination of a strong unyielding housing and a pair of metal working-rolls which have their working-faces journaled in unyielding bearings, or, in other words, rolls which have said bearings immediately opposite or above and below the pass, so that all tendency of either roll to spring, bend, or yield at or near its working-face will be successfully resisted. By thus journaling the rolls I am enabled to have them of any desirably small diameter, and to make them absolutely reliable for the accurate and uniform rolling of thin sheets of metal to any desired gage, even when executing more abrupt or radical reductions in thickness than has, as I believe, been heretofore attempted—for instance, in cold-rolling fine sheet iron or steel. Suitable housings widely varied in construction can be employed without departure from the main portion of my invention; but in organizing rolls well suited for performing a wide range of duty I have devised a peculiar construction of the housing, involving a series of horizontal metal sections bound together into a substantially integral structure, in which the rolls can be mounted and maintained in positively-fixed relations and free from liability to derangement through the springing or yielding of the housing. As binders I use vertical double-headed rods of wrought-iron or steel, put into place in a heated condition, so that in shrinking they unite said sections under heavy binding strain in lines opposed to the working strains upon the rolls, and render it practically impossible for any yielding action to occur at either end of the housing. In lieu of the double-headed rods, large carefully-threaded bolts and heavy nuts can be used as binders with fairly good results without departure from my invention. In their best form one or both of those sections which overlie the rolls are initially provided with a bearing contact with each other only at the central portion of the housing, the coincident surfaces at each end being slightly separated, so that under the binding action of the rods said sections are sprung into uniform contact, thus increasing their capacity to resist working strains upon the central portion of the rolls, when the latter have a general bearing extended substantially throughout their length, as in accordance with another portion of my invention.

While a housing embodying my invention can be employed with good results for rolls controlled by temper-screws, whether the rolls have end bearings or general bearings, I prefer to employ a series of longitudinally-sliding wedges, as in accordance with another portion of my invention, because of the greater and more reliable solidity afforded by said wedges as compared with temper-screws, inasmuch as the variations in gage incident to the use of my rolls may well be restricted to a very limited range, because preliminary rolling can be satisfactorily performed with ordinary rolls.

Inasmuch as my wedges only afford means for forcing the upper roll toward the lower roll and unyieldingly confining it in working position, I employ separate lifting contrivances, preferably in the form of a spring or springs, so as to enable the upper roll to rise automatically whenever permitted so to do by the wedges.

Although I can use rolls of various diametrical dimensions and sufficiently large to warrant the use of gearing by which either would be directly coupled to the other, I find that the best results accrue from the use of rolls of small diameter, and inasmuch as the driving-power required is sometimes too great to warrant the use of gears small enough to directly couple one roll with the other, I have devised gearing which enables each roll to carry a gear of large diameter, and these are respectively coupled to smaller gears on shafts which are directly geared together, and enable power to be applied to either of the shafts on which the said smaller gears are carried.

After fully describing the illustrated embodiments of my invention, the several features deemed novel will be specified in the clauses of claim hereunto annexed.

Referring to the drawings, Figures 1 and 2 respectively illustrate in front and rear elevation a set of rolls mounted in accordance with my invention. Fig. 3 is an end elevation of the same. Fig. 4 is a horizontal section on line *x*, Fig. 1. Fig. 5 is a central vertical section on line *y*, Fig. 1. Fig. 6, in front view, illustrates the top section of the housing and the next underlying section before the several sections are clamped together. Figs. 7 and 8 illustrate, respectively in front and end view, a set of rolls mounted in accordance with the main portion of my invention, but in a housing constructed unlike that shown in Fig. 1.

The body of the housing A, as here shown in Figs. 1 to 6, inclusive, is constructed in four sections. These horizontal housing-sections can of course be varied in number; but there must at least be a base-section and a top or bridge section bound together by rods or bolts. I have shown what I deem the most desirable number, and indicate parting-lines most conducive to economy in the performance of such machinery as each piece of casting ought to undergo. The base-section *a* is provided with ears or foot-flanges *a'*, having holes for receiving bolts by which the housing may be securely mounted on any suitable foundation. At each corner the base-section is laterally recessed to afford a horizontal face, as at a^2, above the foot-flange *d*, and it is also vertically recessed, as at a^3. On its upper side the base-section is longitudinally grooved centrally, as at a^4, to serve as a seat for the box or bearing B of the lower roll, C.

The section *b* rests upon the top of the base-section, the coincident faces being planed to secure uniform bearing contact, except centrally, at which point both of these sections are slotted laterally and beveled, as at *b'* and a^5, at their front and rear sides, thus affording a pass opening in the housing. This section *b* is also longitudinally grooved centrally, as at b^2, for the reception of the box or bearing B' of the upper roll, C', and at each corner this section has a vertical recess, a^3. When the sections are piled in mass, the central grooves, a^4 and b^2, are coincident with each other and form a roll-box chamber.

The section *c* rests upon the section *b*, with uniform bearing-surfaces planed to afford general contact at all points, except at three lateral grooves, b^3, provided for the reception of the wedges D. At each corner this section has a vertical recess, a^3.

The upper or bridge section, *d*, rests upon the section *c*, and in some cases the bearing-surfaces may be initially parallel with each other and in uniform contact; but for obtaining the best results the lower surface of this upper section or the upper surface of the underlying section is so formed that the initial contact of these two sections will be restricted to a central transverse line, as illustrated in Fig. 6, the lower surface of said upper section being very slightly inclined from the center toward each end. This upper section has also at each corner the vertical recess a^3, like all the underlying sections, thus forming a continuous vertical recess extending from the lateral recess at the base-section to the top of the upper section for the lateral reception of the heavy clamping-bolts *e*, provided with heavy heads *e'*, welded or integrally formed thereon.

The bolts *e* are initially proportioned in length between their heads to the height between the top of the housing and the upper surfaces of the lateral recesses a^2, so that when said rods have been longitudinally expanded by heat at a non-injurious temperature they can be driven or forced laterally into the recesses a^3 until their heads will have perfect bearings against the respective coincident surfaces of the upper and lower sections, and then the rods are properly cooled.

The enormous strains incident to the longitudinal contraction of the rods causes them to bind the several sections into a practically-integral structure, and to render the housing more rigid than would be practicable if it were formed in one casting. With the upper section constructed with the initial central bearing, as shown in Fig. 6, the binding force of the rods so springs that section as to give it a uniform bearing upon the underlying section, and deprives it of all tendency to spring upward centrally during the operation of the rolls.

It will now be understood that the roll-boxes B and B' are snugly fitted to their respective grooves or chambers a^4 and b^2, and so that they may be longitudinally entered and removed therefrom.

Each box is preferably composite, the body being of cast-iron or steel and chambered to receive a suitable lining, preferably of phosphor-bronze, highly finished to afford a per-

fect bearing for its roll throughout the main portion of its length. The upper roll-box on its upper side is transversely scored or grooved, the bottom of each score or groove being inclined, to correspond with the inclined surface of the lower side of the round top wedge, D, which occupies the groove. The rolls C and C′ are practically counterparts of suitable metal, sometimes of chilled cast-iron, sometimes hardened steel, and in all cases having highly-finished surfaces.

I prefer to use rolls about four or four and one-half inches in diameter; but larger or even smaller rolls may be employed, the housing and the boxes being properly proportioned thereto.

The ends of the rolls project beyond the ends of the housing for receiving their gearing. It will be seen, in view of the great driving strains sometimes involved, that the two rolls could not be safely coupled by means of gears on both rolls meshing directly with each other, and hence each roll is provided with a large driving-gear, the upper roll having its gear *f* at one end of the housing, and the lower roll its gear *f′* at the opposite end. There is at the rear side of the housing a pair of parallel shafts, *g g′*, mounted in rearwardly-projecting hangers or brackets, preferably adjustable, and these shafts are coupled together by the gears *h h′*. Power is applied to the shaft *g*, which communicates power to the upper roll by way of the gears *h* and *f*, and the shaft *g′* communicates with the lower roll by way of the gears h^2 and *f′*. The extent of the separation of the rolls is generally so slight that the gearing will not require adjustment; but the hangers for the shafts *g* and *g′* being adjustable on the housing, as by means of enlarged bolt-holes in the hangers, the gears can be readily adjusted, if need be.

The wedges D may be moved longitudinally and held in their positions of adjustment by means of a variety of well-known devices without departure from my invention; but I prefer that each be provided with a long screw-threaded tail-piece, *i*, extending loosely through holes in a hanger, K, having a transverse slot, K′, for the snug reception of a hand-nut, *m*, on said tail-piece, thus enabling the wedges to be easily moved in both directions by rotating the hand-nuts.

The upper roll and its box are supported by means of a suitable double spring, *l*, on top of the housing, and the links $l' l^2$, suspended from the ends of said spring and provided at their lower ends with straps or loops l^3, in which the upper roll is carried. In lieu of having the wedges above the upper roll-box, the latter may be solidly backed and the wedges placed beneath the lower roll-box without departure from my invention.

The roll-bearings can in some cases be successfully lubricated with running water; but, as a rule, heavier lubricants will be desirable, and they can be applied by way of suitable oil-ducts in the boxes, or when the rolls are in motion and not at work oil can be applied to both rolls at the pass, and thereby freely distributed along the bearings.

The importance of maintaining a good surface finish on the rolls is obviously apparent, and hence care should be taken to prevent grit and dirt from entering the bearings, at least adjacent to the central or working portion of the rolls. As a special precaution against defacement, I apply at the rear side of the rolls clearers *n*, which are adjustable with relation to the working-faces of the rolls, to enable the latter to be kept clean and free from abrasive matter. These clearers can be variously constructed and applied, and be composed of metal or hard wood, and preferably accompanied with a body of felt, *n′*, or other fibrous material, to operate as a cleansing-brush.

While I prefer to employ in one machine all of my features of invention, substantially as shown and thus far described, certain features can be profitably employed independently of others—as, for instance, if the wedges be dispensed with and long heavy temper-screws employed in lieu thereof, as indicated in dotted lines in Fig. 1, so as to bear at proper points upon the upper roll-box, the advantages incident to the improvements in the housing would largely accrue, as well as those incident to the extensive roll-bearings. It will be obvious that the two middle sections of the frame may be in one piece, and that the rolls may be provided with anti-friction rollers without departure from my invention.

In the organization shown in Figs. 7 and 8 the housing A′ consists of a base, a^6, and two standards, a^7, and it may be in one integral casting, as shown; or the three parts may be separately constructed if so locked together and secured by bolts as to render the housing practically integral and incapable of yielding under the parting strains borne by the rolls when at work.

The rolls C C′ and their boxes B B are similar to those before described, and gearing is applied thereto, as in Fig. 1. The journal box or bearing B of the lower roll, C′, is well fitted to a longitudinal groove or seat on a central upward projection of the base a^6. The journal box or bearing B of the upper roll, C, occupies a longitudinal groove or seat in the under side of a heavy movable block, a^8, which may be properly termed a portion of the housing. This block a^8 at its ends occupies vertical guide-slots in the standards a^7, and in the latter are heavy temper-screws *o*, which bear upon said block for adjusting and maintaining the upper roll in desired working position. These boxes B differ from those previously described in that their length is only equal to or a little greater than the width of the pass, instead of being extended each way toward the ends of the rolls. The upper roll is coupled to the block a^8 at each end by means of a strap, *p*, pendent bolt *p′*, and adjusting-nut p^2, thus maintaining the journaled portion of the roll in proper contact with its box, and

keeping the latter in close contact with its seat. The block a^3 and the upper roll and its box or bearing are so provided with levers q and weights q' that the latter may lift them when permitted so to do by the screws o.

In some cases the boxes or bearings are spirally scored or grooved, so that while the working-faces will be evenly subjected to wear in the boxes the scores or grooves will serve to retain any abrasive matters which may enter the bearing, and also facilitate lubrication.

A set of rolls organized as shown in Figs. 7 and 8 will be found well suited for rolling soft-metal foil and for light work on harder metals; but when organized as in Fig. 1 they will be found to be equally well adapted to perform such duty, as well as the heaviest duty required in this line of metal-rolling. In the use of my rolls, when extra-heavy reductions are to be made they should obviously be supplemented, as heretofore, by mechanism adapted to pull or draw upon the metal at the rear sides of the rolls.

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

1. The combination, substantially as hereinbefore described, of a strong unyielding housing, a pair of metal-working rolls, and unyielding bearings for both of said rolls located immediately opposite their working-faces, whereby when in service said rolls adjacent to the pass are rendered incapable of springing, bending, or yielding.

2. A housing for metal-working rolls, substantially as hereinbefore described, composed of piled horizontal metal sections bound together by vertical clamping rods or bolts and forming a practically-integral mass having central chambers for the reception of roll-boxes, and a transverse central pass-opening, whereby rolls mounted in said housing can be maintained in positively-fixed relations and the liability of derangement through springing of the housing reduced to a minimum.

3. In a housing for metal-working rolls, the combination of a horizontal base-section, a top or bridge section having its bearing-surface inclined from the center toward each end, one or more intermediate sections, and a series of rods or bolts, by which said bridge-section is strained into general contact with the next underlying section, and all of said sections bound solidly together into a practically-integral mass containing interior grooves or chambers for the reception of boxes for the rolls, and a transverse central pass-opening.

4. The combination, substantially as hereinbefore described, of a pair of metal-working rolls, boxes or bearings which serve as supports for said rolls substantially throughout their length, a housing composed of a practically-integral mass of metal centrally chambered for the reception of the rolls and their boxes, and also having a central transverse pass-opening, and a series of adjustable sliding wedges interposed between the back of one of the roll-boxes and coincident surfaces within said housing.

5. The combination, substantially as hereinbefore described, of the pair of metal working rolls, the boxes or bearings which support said rolls substantially throughout their length, a housing centrally chambered to receive said boxes, and having also a transverse central pass-opening, the springs for lifting the upper roll and its box, and a series of sliding wedges for forcing said roll downward and maintaining it in working position.

6. The combination, substantially as hereinbefore described, of a pair of metal-working rolls, each having a large driving-gear mounted directly thereon, a pair of parallel driving-shafts geared together, oppositely rotated, and geared to said roll-gears, whereby, however small the diameter of said rolls may be, they can be smoothly operated and heavy working-power applied thereto.

7. The combination of a pair of plain-surfaced metal-working rolls, boxes which afford bearings above and below the working-faces of said rolls, and clearers which engage with said working-faces for protecting the bearings against the entrance of abrasive matter, substantially as described, whereby the liability of defacing said working-faces in said bearings is reduced to a minimum.

STEPHEN W. BALDWIN.

Witnesses:

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