F. H. RICHARDS.

ROLLING MECHANISM.

APPLICATION FILED APR. 30, 1902.

958,010.

Patented May 17, 1910.

2 SHEETS—SHEET 1.

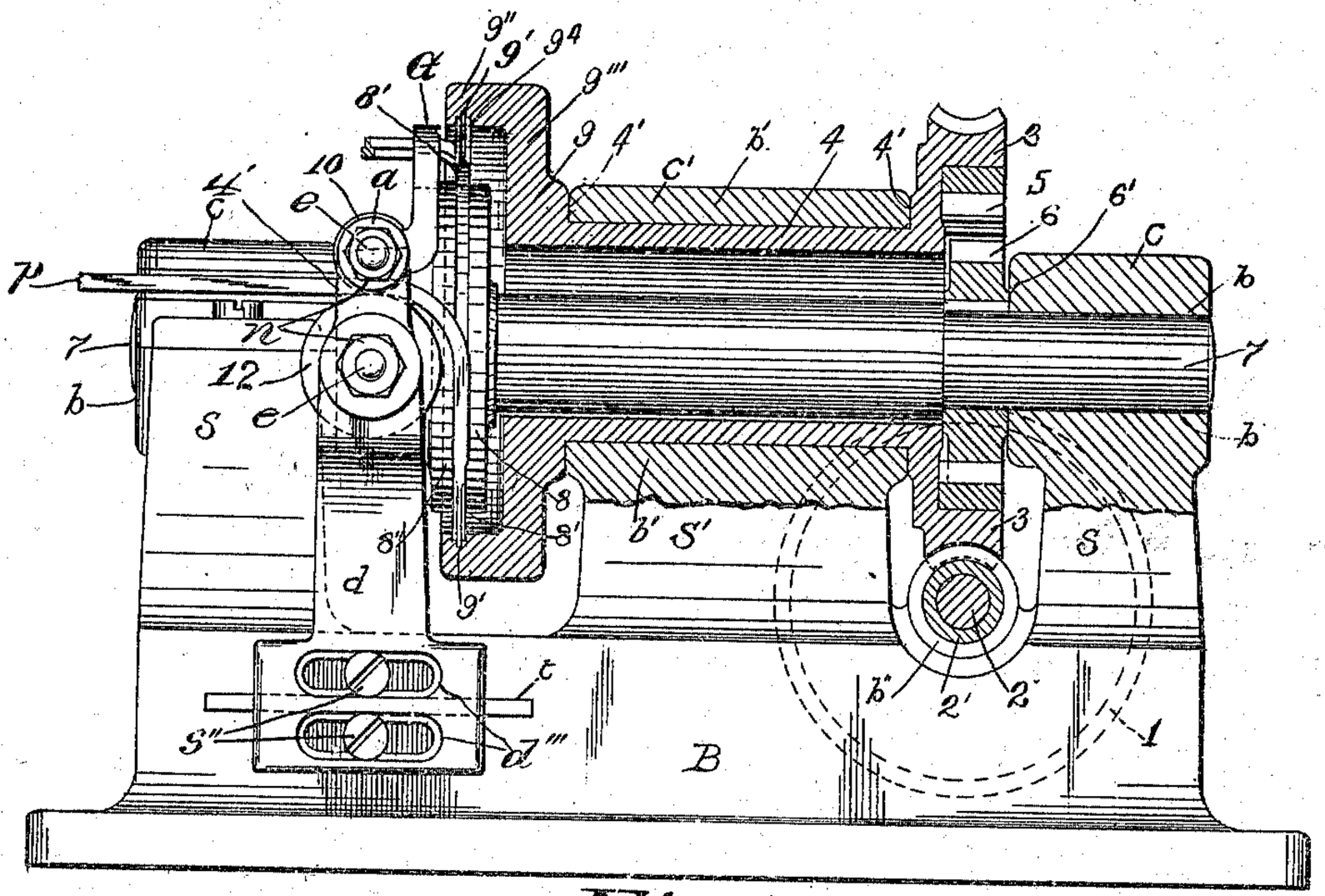

Fig. 1

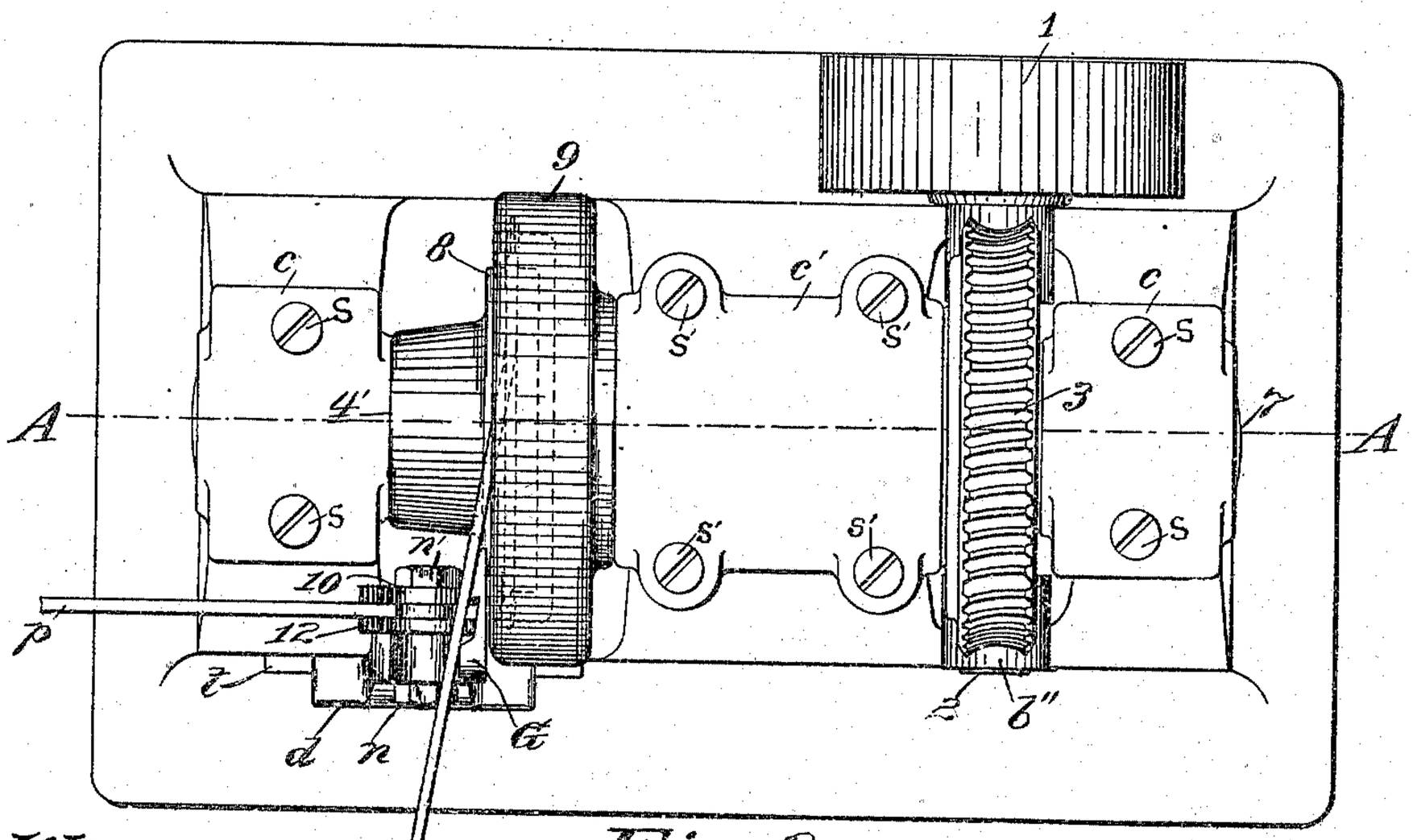

Fig. 2.

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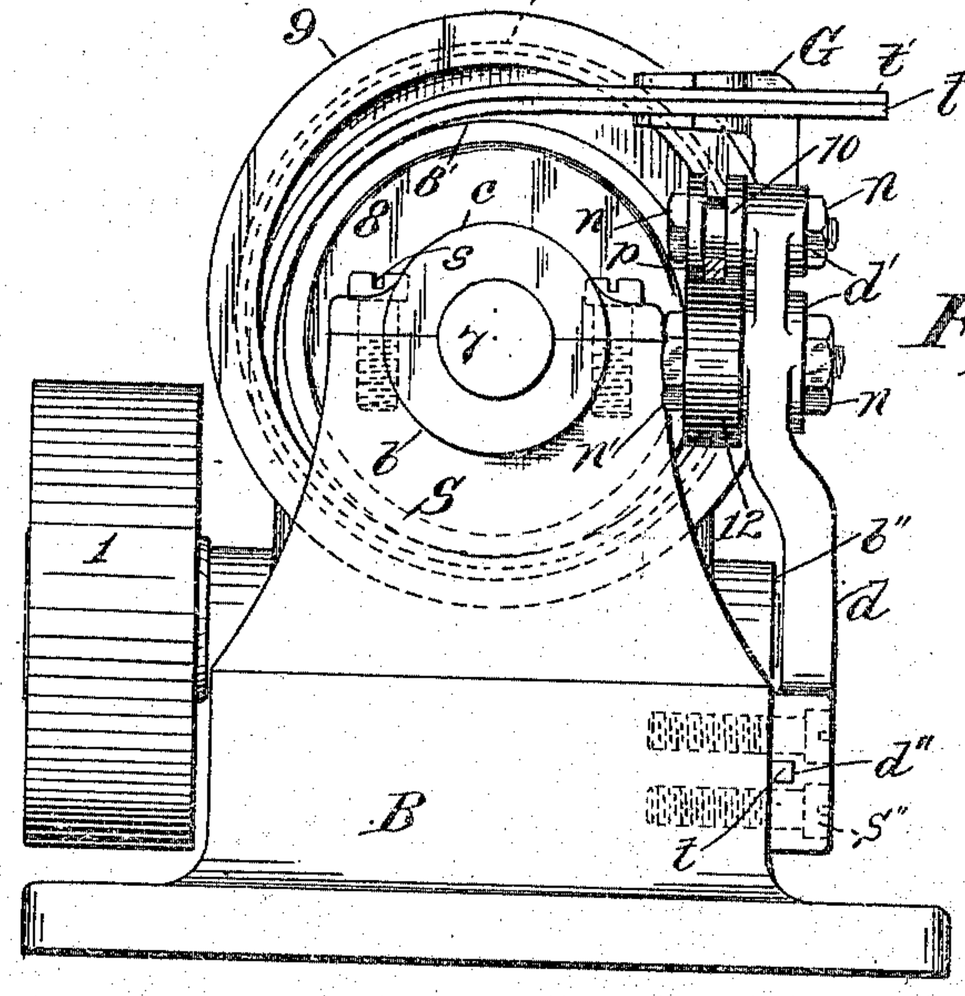


Fig. 3.

Fig. 4.

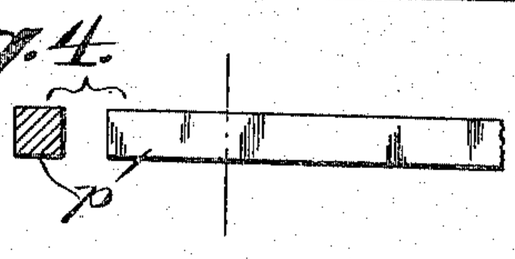


Fig. 5.

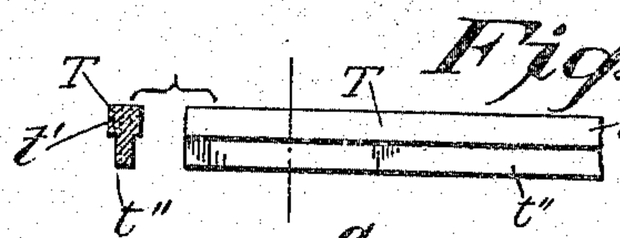


Fig. 6.

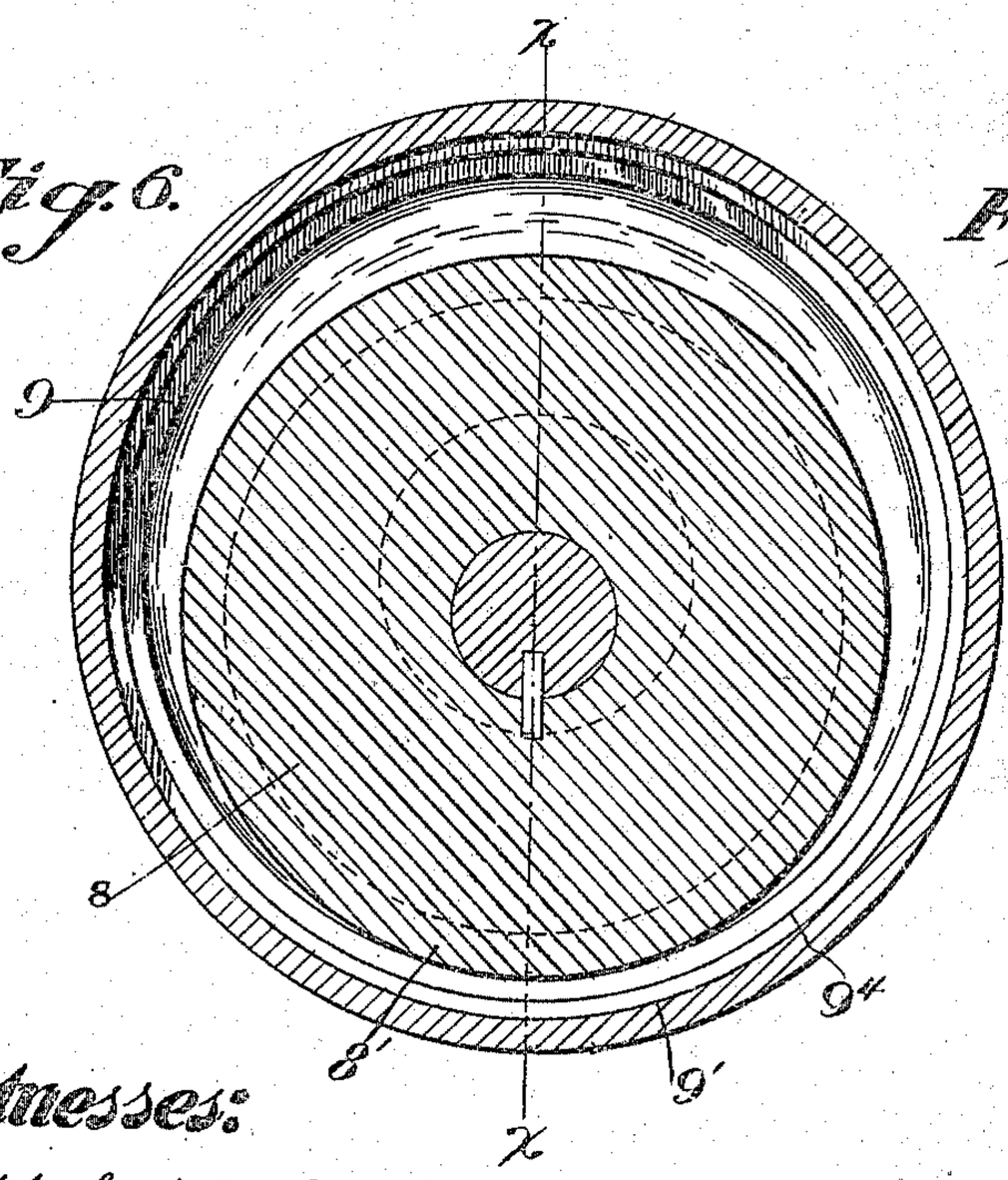
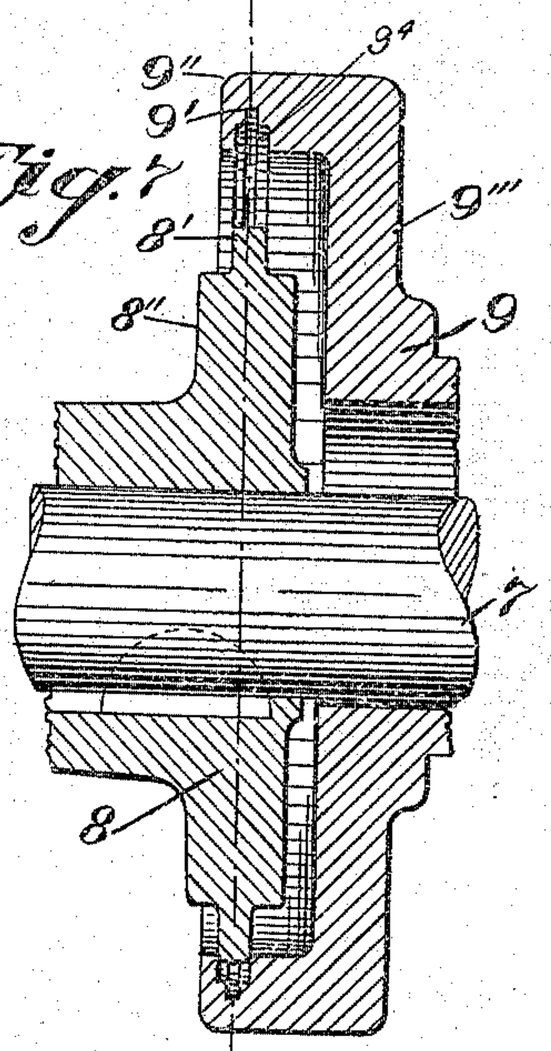


Fig. 7.



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ROLLING MECHANISM.

958,010. Specification of Letters Patent. **Patented May 17, 1910.**

Application filed April 30, 1902. Serial No. 105,273.

To all whom it may concern:

Be it known that I, FRANCIS H. RICHARDS, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Rolling Mechanism, of which the following is a specification.

This invention relates to mechanisms designed to subject material to the action of compressive forces for the purpose of compacting and condensing and thereby hardening the same, and for the purpose of giving to the material a desired cross-sectional contour or configuration.

In the working of various metals, especially alloys such as brass, and various compositions of tin with other metals, it is well known that there is a marked change in the physical characteristics of the metal when rolled, hammered or pressed.

It is one of the objects of the present improvement to furnish mechanism especially adapted for treating continuous rods or pieces of metal of suitable size and any convenient length, in order to subject the metal in an effective manner to a forcible compression.

In accordance with the present improvements, the rod of metal being fed into the compressing device is forcibly engaged between two coacting members which, in the form of the apparatus herein shown and described, consist of a pair of rolls, and in the particular organization of mechanism herein set forth these rolls are one of them provided with an external working face and the other with an internal working face, the latter roll being made larger than the former, and the rolls being disposed eccentrically with respect to each other. The difference in diameter between the two rolls not being very great, as compared with the diameter of the larger roll, brings the working faces (in the region of nearest approach of the rolls) into approximate coincidence, so that when the bar of metal is forcibly compressed by the external face of the inner roll into the suitably shaped groove or working face of the internal face of the outer roll the duration of the compressive action is considerably extended, and the particles of metal subjected to a powerful compression for a relatively protracted period as compared with the action which would take place between two ordinary rolls (as, for instance, in an ordinary rolling mill,) where both of the rolls have external working faces. The present improvement furnishes a rolling mechanism therefore, in which the "bite" of the rolls is relatively long notwithstanding the fact that the curvature of the working faces may be comparatively sharp, and thus, as has been set forth, the period of compressive action (with any given rotative speed of the rolls) is materially prolonged. An immediate effect of this peculiar organization of the mechanism is to subject the metal to a direct pressing action as the metal approaches the center of the working zone or arc, and by reason of the near approximation to concentricity of the working faces at said point and the consequent comparatively long distance throughout which the metal is subjected to compressive forces, the tendency of the metal to flow endwise of the strip in that part of the strip which is between the "bite" of the rolls is materially reduced, this reduction depending of course upon the relative curvatures and sizes of the roll faces.

In the drawings which accompany this specification, Figure 1 is in part a side elevation and in part a longitudinal vertical section of a rolling mechanism embodying my present improvements, the section being taken on the plane of the median line A—A, Fig. 2. Fig. 2 is a top plan view of said mechanism. Fig. 3 is a left end elevation of said mechanism as shown in Fig. 1. Fig. 4 shows both a transverse section and a side elevation of a portion of one form of crude stock or material. Fig. 5 shows similar views of said portion as it appears after having been operated upon by said mechanism. Fig. 6 is a vertical transverse section of the rotatable compressive members, said section being taken on the plane of the line *a*—*a* in Fig. 7. Fig. 7 is a vertical longitudinal section of said members taken on the plane of the line *x*—*x* Fig. 6.

Similar marks of reference refer to similar parts throughout the several figures.

A pulley 1, adapted to be driven by a suitable belt, may be used as a power-communicating member to drive the mechanism and is shown mounted upon a driving shaft 2,

which is journaled in a bearing b'', supported by the frame or bed B, of the mechanism. On the driving shaft 2, and rotating therewith is mounted a worm-threaded member 2′, which meshes with a worm-wheel 3, and thus serves to rotate a hollow shaft 4, journaled in a bearing b', formed in this instance, partly in a standard S′, and partly in a cap c', secured to the standard S′ by screws s'. Shoulders 4′, 4′, on the hollow shaft 4, contact with opposite faces of the standard, and prevent longitudinal movement of said shaft.

An internal gear-wheel 5, is secured in an annular recess in the worm-wheel 3, and meshes with a spur gear-wheel 6, which is secured upon a shaft 7, passing through the hollow shaft 4 with its axis disposed parallel to the axis of the latter. The shaft 7 is journaled eccentrically of said shaft 4, in bearings b, b, which in this instance are formed partly in standards S, S, erected upon the bed B, and partly in caps c, c, secured to the standards by screws s. Suitable shoulders may be employed which coöperate with the contiguous faces of the standards S, S, to prevent longitudinal movement of the shaft 7, one of such shoulders being formed in the particular organization illustrated by the hub face 6′ of the gear-wheel 6.

Carried by the hollow shaft 4 is a rotatable member 9 (the two in the particular construction illustrated being integrally connected) having an inner compressive or working face 9′, the cross-sectional configuration of which varies with the similar configuration which it is desired that the finished product shall have. Mounted on the shaft 7, and thereby journaled eccentrically of the first-mentioned rotatable compressive member 9, is a second rotatable member 8, having an outer compressive or working face 8′. As constructed in this instance, the member 9, comprises a disk-like body 9‴, laterally from which extends an annulus 9″, the inner face of which is formed of the requisite contour or configuration to adapt it to give the stock a desired shape on one face. In the form of such face illustrated in the present embodiment, the face is provided with a groove 9′, centrally located at the bottom of a stock-receiving channel 9^4, thus enabling the member to produce a centrally disposed longitudinal rib, tongue or web t'' on the product, a length of which is designated by T in Fig. 5.

The member 8, in the construction thereof herein illustrated, comprises a disk-like body 8″, the peripheral or outer working face of which is so formed as to properly coöperate with the working face of the aforesaid member. As constructed in this instance, such outer working face of the member is constituted by the peripheral surface of a radially projecting flange 8′, which enters somewhat into the channel 9^4 of the member 9, at the point of nearest approach of the working faces.

For the purpose of guiding the stock in between the rolls, the following is a description of the means indicated in the present illustrated organization; from one side of the bed B, projects a member or slide t to which may be clamped an adjustable bracket d, having a groove d'', engaging with the slide. Slots d''', d''', in the bracket d, permit the passage of clamping screws s'' and s'', respectively. The bracket d is provided with perforated bosses d', d', in which are secured journal-studs e, e, by nuts n, n. On the studs e, e, are mounted rolls 10 and 12, which are retained on the studs e, e, by nuts n', n'. The opposed peripheral faces of the rollers 10 and 12, are so formed as to adapt them to properly engage the stock which is to be operated upon, and to guide it into the space between the working faces 8′ and 9′, of the respective members 8 and 9. The rolls 10 and 12, may be adjusted according to requirements, by moving the bracket d, toward or from the rolls 8 and 9, the bracket being guided by the slide t, in the groove d''.

In the practical use of the mechanism, a length of stock will be passed endwise between the rolls 10 and 12, and curved around the latter within the space between the working faces 8′ and 9′, of the members 8 and 9, and in the direction in which such faces approach each other. The stock after being gripped by the working faces will be passed between said faces, and after having passed out from between the faces may be caught by a suitable deflector G, and guided diagonally out of the line of the encircling annulus 9″, and received on or by proper means, not shown.

It is obvious that the members aforesaid as well as the guides and deflector illustrated and herein described may be variously modified as to form in order to more effectually accomplish the proper ingress of the stock and the egress of the product.

The working face 8′, may be given a different velocity from that of the working face 9′, by suitably proportioning the gear-wheels 5 and 6, thus causing the rolls 8 and 9 not only to shape and compact the material by their rolling action, but also to apply a certain amount of forging action thereto, thus effecting a peculiar combination of treatments that operate most thoroughly to compress and flow the material into all parts of the forming grooves and channels, and to thoroughly close and condense the substance thereof.

By subjecting bars or rods of stock such as that indicated in a conventional way in Fig. 4 and designated by P, and having a

metallic composition of the kind sometimes employed in the manufacture of typebars and the like, to a treatment that may be carried out by means of the mechanism herein described, the strips of metal will be given a very uniform and solid texture, the effect corresponding to a considerable extent with the "hammer hardening" to which brass and analogous alloys are frequently subjected for the purpose of hardening and stiffening the same.

A finished product made of the proper material and having the configuration set forth in Fig. 5 in which the bar comprises a body portion t', from which projects the aforesaid rib or tongue t'' is particularly adapted for use in connection with certain improvements disclosed in United States Letters Patent No. 535,777, issued to R. H. St. John, September 2, 1890, for type-bar.

By examining the cross-sectional view showing how the two rolls fit together in Figs. 1 and 7, it will be seen that the projecting working part of the middle roll is arranged to fit closely between the side walls of the space in the outer roll, so that in the cross-sectional view, as shown for instance in the lower part of Fig. 7, the space for the metal is in the nature of a closed die. This arrangement is adapted for the purpose of preventing relatively fluid metal, such as brass or other alloys workable by pressure without much heat, from flowing up between the two dies and thus escaping before the metal has been subjected to a sufficient condensation, or densification, through the peculiar action of the two rolls, these having, as already explained, a relatively slight deviation in curvature. The effect of this arrangement of the rolls, when the metal is confined in such a positive manner, is to apply a very high pressure to the metal without permitting this to escape by flowage, as it would do for instance if run between rolls having their co-acting faces at the working point arranged with the curvatures in opposite directions respectively; this latter arrangement of roll being, as is well known, particularly effective for making the metal flow lengthwise of the rod during the compression of the same. The present arrangement of the roll, on the contrary, is especially adapted, by reason of the adhesion and of the molecular resistance of the metal, and of the small angle between the diverging surfaces while the metal is under pressure, to hold the metal in place and thus tend to prevent a degree of flowage which would under other conditions be a normal result of the treatment. It is by means of these features of the present improvement that the object is carried out of applying to the metal, (while in the process of rolling,) an intense condensation, whereby to give the metal a high degree of stability due to the effect of the "roll hardening", which corresponds to the well known process of "hammer hardening" as applied to the stiffening of sheets of relatively soft brass or analogous alloys where it is desired to render them more rigid. The rib of the roll enters the groove at the arc of contact to a sufficient radial distance to maintain the engagement between these members throughout a considerable portion of their circumference to the end that pressure will be applied to the stock on all its sides at each side of the point of nearest approach of the rolls for preventing elongation of the strip due to its cross sectional compression, at such point of nearest approach. By having the working face of one of the rolls an internal face the angle between the working faces of a pair of rolls at the working pass is made much smaller than in cases where the working faces both are on the outside of the rolls. This is useful in causing the rolls to pinch the strip or bar being acted upon and compact rather than to elongate it. A wide angle reduces the bar by elongation as distinguished from the compression and compaction of a narrow angle as in the present improvement.

Having described my invention, I claim—

1. A rolling mechanism, comprising two rotating members located one within the other and whose axes of rotation are eccentric one to the other, each of said members being provided with a continuous circumferential working face, said faces forming a working pass at their arc of nearest approach one to the other, and means at the respective sides of said working pass for guiding strip material longitudinally through said pass in the direction of rotation of the rolls.

2. A rolling mechanism, comprising two rotary members located one within the other and whose axes of rotation are eccentric one to the other, a circumferential die upon the interior of the outer member and upon the exterior of the inner member, and feed mechanism transversely disposed with relation to said members, and located for delivering material to a point between said dies where these are separated adjacent to the working pass thereof.

3. The combination with a rotary member having an internal circularly formed die face, of a rotary member having an external circularly formed die face mounted within and eccentric to said internal die face, said die faces being in rolling working relation one to the other throughout a considerable arc of each and effective to pass work between them and in the direction of their rotation, means for rotating said members in the same direction, and means for delivering strip material to the said rotary members at the out-of-working-relation-position.

4. The combination of a hollow rotatable member having an interior forming face and an internal gear, a rotatable shaft passing therethrough and eccentric to the axis thereof, a member carried by said shaft and rotating therewith and also having a forming face concentric with said shaft and eccentric with the first mentioned member, a pinion carried by said shaft and meshing with the internal gear, and means for driving one of said members.

5. The combination of a rotatable member having a compressive inner face, a rotatable member arranged eccentrically of the first-mentioned rotatable member and having a compressive peripheral surface located within said inner face and coöperative therewith in forming a working pass, driving mechanism engaging the eccentrically arranged compressive members, and rotatable members arranged angularly of the eccentrically arranged compressive members and located for delivering material to the said working pass.

6. The combination of two circular rotary forming members located one within the other, and arranged eccetrically one to the other for forming a working pass at their region of nearest approach, means at the respective sides of said working pass for guiding a strip of material longitudinally through said pass in the plane of the path of rotation of the working faces of said members, one of the said members at the working pass presenting to the other a convex face and that other a concave face measured in the said plane.

7. A rolling mechanism, comprising two rotary members located one within the other and whose axes of rotation are eccentric one to the other, a circumferential die upon the interior of the outer member and upon the exterior of the inner member, a guide having a curved surface, and located for delivering material to a point between said dies where these are separated adjacent to the working pass thereof, and means for adjusting said guide relative to said members.

8. The combination of a rotatable member having a compressive inner face, a rotatable member arranged eccentrically thereof and having a compressive peripheral surface located within said inner face and coöperative therewith in forming a working pass, a pair of rolls arranged angularly of the eccentrically arranged compressive members and located for delivering material to the said working pass, and means for adjusting said rolls in a direction transversely of their axes and relative to said rotatable members.

9. The combination of two members located one within the other and whose axes are eccentric one to the other, a working face upon the inner portion of the outer member and a working face upon the outer portion of the inner member, the two faces coöperating together to form a pass at a point which is in line with the axes of the two members and on the side of the axes where the working surfaces of the two members are in the closest relation, the working portions of the faces which form the pass having the same relative movement with respect to the axis of one of the members, and a guiding member located in advance of the pass and at an angle to a plane which passes through and includes a circumferential element of one of the working faces.

10. The combination of two members located one within the other and whose axes are eccentric one to the other, a working face upon the inner portion of the outer member and a working face upon the outer portion of the inner member, the two faces coöperating together to form a pass at a point which is in line with the axes of the two members and on the side of the axes where the working surfaces of the two members are in the closest relation, the working portions of the faces which form the pass having the same relative movement with respect to the axis of one of the members, and means for guiding a stock rod into the said pass.

11. The combination with a pair of rolls located one within the other and in eccentric relation, means for feeding a strip of metal between said rolls at their region of approach and means for simultaneously operating the two roll-surfaces at corresponding speeds in the same direction at their coacting points, whereby to roll-finish the strip of metal and, by the bite due to such finishing action, to drive forward such strip of metal.

12. The combination with a pair of rolls located one within the other and in eccentric relation, a guide having a curved surface for changing the direction of a metal strip and directing the same into the working pass between the roll-surfaces, means for simultaneously operating the two roll-surfaces at corresponding speeds in the same direction at their coacting pass-forming points, whereby to roll-finish the strip of metal and by the bite due to such finishing action, to drive forward the said strip of metal.

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