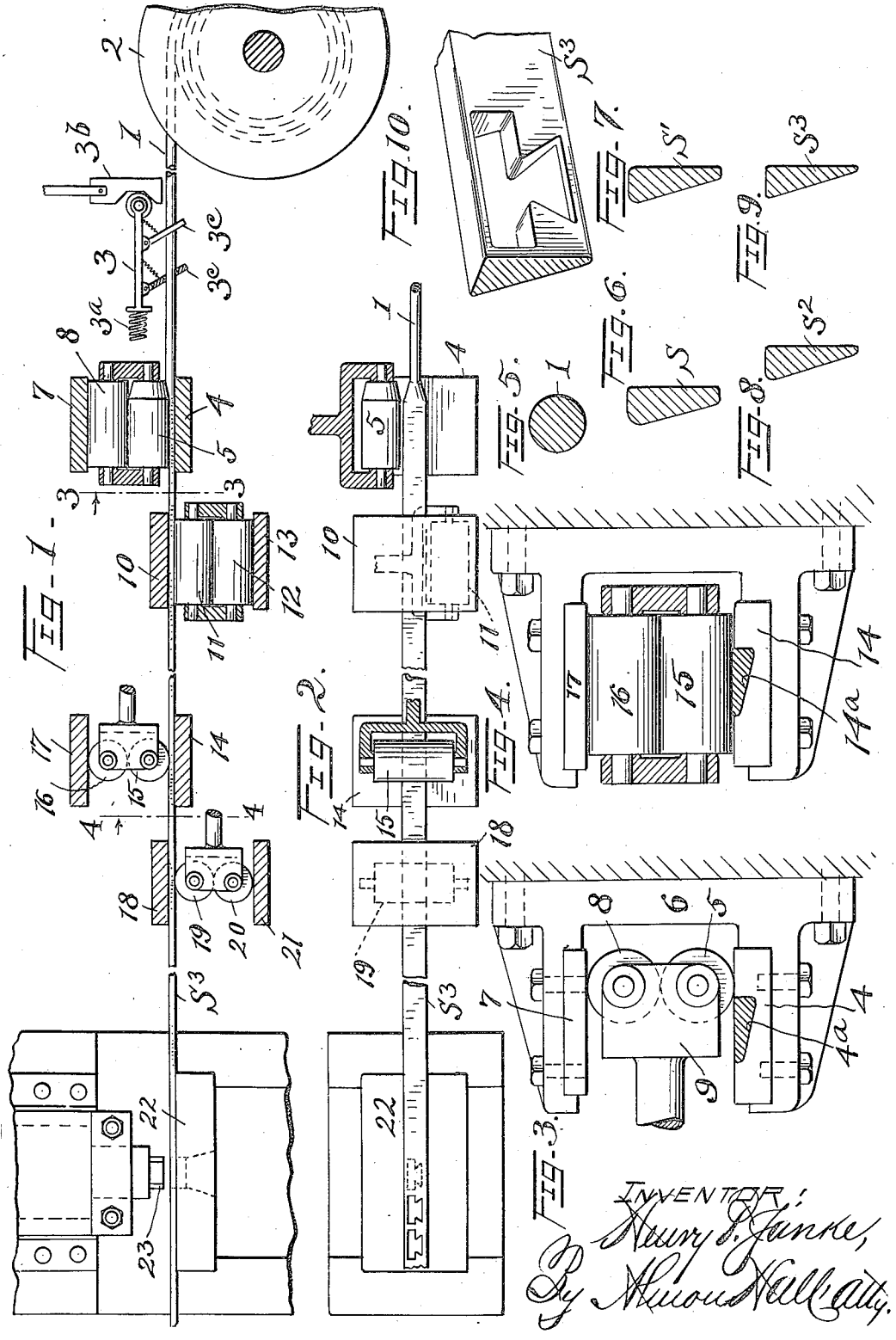
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COMMUTATOR SEGMENTS MANUFACTURE.

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UNITED STATES PATENT OFFICE.

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COMMUTATOR-SEGMENTS MANUFACTURE.

Application filed June 24, 1918. Serial No. 241,455.

To all whom it may concern:

Be it known that I, HENRY P. JANKE, a citizen of the United States, residing at Toledo, in the county of Lucas and State of Ohio, have invented certain new and useful Improvements in Commutator-Segments Manufacture; and I do 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, reference being had to the accompanying drawings and to the letters and figures of reference marked thereon, which form a part of this specification.

In the manufacture of the radial segmental copper pieces which are designed to be disposed in cylindrical form and which enter into the construction of commutators for electric generators and electric motors, the usual method heretofore employed in the production of these segments is as follows: Copper ingots are, by passing them between successive pairs of rolls, reduced to strips having the cross-section of the desired article, or by the employment of extruding dies or drawing dies or both, strips of the required cross-section are formed. Next by means of a punch the segment is punched from such strip. This method of producing these copper strips requires machinery so heavy, cumbersome and expensive as to be prohibitive to the small manufacturer. If fabricated bars formed by this method are purchased for special sizes of segments, the price of such bars, due to necessary changes in rolls and dies, is excessive, and in any case, a quantity purchased from the large mills in a single purchase must be so large as to justify the outlay for rolls and dies, and for changes, such purchase requiring an investment in stocks of bars not easily carried by or usually within the reach of small manufacturers.

My invention relates to, and its object is to provide a method and an apparatus for manufacturing the strips such as those here referred to, which shall overcome the difficulties and objections here indicated, and, more particularly, to furnish means by which a copper wire,—usuallly readily obtainable of any required gauge, in any desired quantity and at a comparatively cheap price,—is taken from a coil on a reel, and is continuously, rapidly, accurately and economically converted into a strip of the required cross-section, and by means of which a wire of a given gauge may be so used in the production of several of the kind of strips referred to, each having a different cross-sectional area.

A further object is to provide a method of forming articles such as commutators segments, of predetermined shape, from wire such as round wire, the process including the steps of preliminarily treating the wire by rolling, preferably transverse and longitudinal rolling, to convert the wire to a strip of the desired width and the desired thickness, together with the step of cutting or punching from the strip the articles which are to be formed, all the steps of the process including the conversion of the wire into the strip and the step of actually forming the articles being preferably carried out continuously, and preferably by a single feeding mechanism which feeds the wire and strip successively to the several instrumentalities which operate on the wire or strip to attain the desired end.

The invention may be further briefly summarized as consisting in certain novel steps of the improved method, and combinations and arrangements of parts of the apparatus which will be described in the specification and set forth in the appended claims.

In carrying out my invention, portions of the steps and mechanisms will be so well understood as to require no illustrative drawings, while other portions of the steps will be more readily understood by reference to the illustrations found in the accompanying drawings wherein I have illustrated my invention applied to the manufacture of commutators segments, although it may possibly be used for forming other articles.

Fig. 1 is a side elevation partly in vertical section of apparatus adapted to carry out my improved method as employed in the production of commutator segments from round wire; Fig. 2 is a plan view of the major portion of the apparatus shown in Fig. 1, some parts being omitted, and some being shown in section; Fig. 3 is a sectional view substantially along the line 3—3 of Fig. 1, looking in the direction indicated by the arrow and showing on an enlarged scale the first transverse rolling unit including a die and a set of rollers by which the round wire is rolled transversely to widen it; Fig. 4 is a similar

view substantially along the line 4—4 of Fig. 1, showing the first longitudinal rolling unit including the die and set of rollers by which the strip is rolled longitudinally to elongate it and thereby decrease its thickness; Figs. 5 to 9 are cross-sectional views through the metal being treated, the same being shown on an enlarged scale, Fig. 5 showing the round wire before the first rolling operation, Fig. 6 showing the shape of the strip after the first rolling operation, Fig. 7 showing the shape of the strip after the second rolling operation, Fig. 8 showing the shape of the strip after the third rolling operation, and Fig. 9 showing the shape of the strip after the fourth and final operation; and Fig. 10 is a perspective view of a portion of the tapered strip as eventually formed, and showing a segment punched therefrom.

Like numerals of reference indicate like parts in the several views.

In carrying out my invention I avail myself of the fact, not heretofore utilized, that in rolling a wire lengthwise it is, while flattened but little, if any, increased in width, and that when rolled transversely it is broadened, but is little, if any, increased in length. For this reason it has heretofore been the practice, when rolling a wire or rod to obtain a flat strip of metal, to employ a rod or wire of substantially the width of the required strip. This usually necessitates the use of rod or wire too heavy to unwind conveniently from a reel. I have found that by rolling a wire transversely, any required width, within limits, may be obtained, and that by rolling the wire longitudinally the strip may be reduced to the desired thickness without further widening it. Thus it will be seen that by the combination of the transverse and longitudinal rollings and by their relative separate adjustments as circumstances require, a variety of sizes may be produced from a single gauge of wire, and that a wire of small enough gauge to conveniently run from a reel may be employed.

In the drawings, 1 is a copper wire of suitable gauge for the commutator segments to be formed, and which is taken from a coil upon a reel 2, and which is fed, step by step between the strokes of the rollers, hereinafter referred to, through the several dies, and preferably also through the cutting machine or punch press hereinafter referred to. While I prefer to use a single feeding device or mechanism to feed the wire and strip formed therefrom to the various devices or machines which operate on the wire or strip from the time it is unrolled from the reel until the completed article is formed, and while it is desired that the feeding take place before each stroke of the rollers in each direction, any desired feeding mechanism which will answer the requirements and produce the desired results may be employed. In this case I have shown for the purpose of feeding the wire, and strip formed therefrom, a reciprocating feeder bar 3, adapted to be moved in one direction by a spring 3^a, and in the reverse direction by a cam plunger 3^b, and carrying pivoted grippers 3^c which grip the wire and feed the same forwardly when the bar 3 is moved to the left, as shown in Fig. 1, but slide freely over the wire when the bar is moved to the right by the action of the spring 3^a. If necessary, any suitable means may be employed to prevent reverse feed or movement of the wire during the return strokes of the feeder bar.

After leaving the reel, and in this case, after passing beyond the feeding mechanism (it being understood that the feeder may be located at some other point with respect to the devices which operate on the wire or strip) the wire is rolled transversely, and I use for this purpose a die 4 and a roller 5 which is reciprocated across and in contact with, or close to the face of the die by any suitable mechanism, as for instance, the plunger of a punch press. Across the face of the die is a groove 4^a (see Fig. 3) through which the wire is fed, this groove being in cross-section as wide approximately as the strip of metal from which the segment is to be punched, and preferably its bottom is inclined at an angle to the face of the die, as clearly shown in Fig. 3.

Without confining myself to the specific mechanism here shown, I prefer to employ a die and roller unit substantially as shown in Fig. 3 and including a casting 6, carrying the die, as well as a thrust plate 7 disposed a suitable distance from, but parallel to the face of the die, and I prefer to transmit the heavy thrust from the roller 5 which rolls the metal into the groove of the die to the thrust plate by an idler roller 8, both rollers being preferably mounted in a yoke or equivalent device 9, which is reciprocated. I might say that this same construction is preferably employed also with each of the succeeding die and roller units, the idler roller being utilized in each instance to transmit the pressure to the thrust plate to relieve the bearings of the rollers of all material stresses. One end of the roller 5 is tapered as shown in Fig. 1, but this tapered feature need not be utilized with the other rollers.

As the wire leaves the first die and roller unit it has been flattened and widened, and the strip thus formed has assumed a shape in cross-section approximately as illustrated at S in Fig. 6.

After the wire or strip passes through the die 4, it is preferably subjected to a similar transverse rolling operation, there being used for this purpose a die and roller unit similar to that first described, and including

a grooved die 10, rollers 11 and 12, and thrust plate 13, but the die 10 and roller 11 are reversely positioned with respect to the die 4 and roller 5 of the first unit, so that the face of the metal which in the first unit was engaged by the roller is now pressed into the base of the groove of the die, and the face of the metal which engaged the base of the die is now engaged by the roller. This second transverse rolling operation further widens the metal very slightly and presses the metal more closely into the die, and further slightly reduces its thickness, producing the shape substantially as shown at S′ in Fig. 7. The chief function, however, of this second rolling operation is to make both faces of the strip substantially the same with the corners at both faces substantially similarly filled out.

After passing through the second die and roller unit including die 10 and roller 11, the strip is fed through a third die and roller unit including a die 14 which has across its face a groove 14^a (see Fig. 4) similar to the groove of the preceding dies, but of less depth, and therefore of less area in cross-section. Across the face of this die a roller 15 is reciprocated longitudinally of the strip, the thrust on this roller being preferably transmitted through an idler roller 16 to a thrust plate 17 as in the preceding instances, and the rollers being mounted and reciprocated as previously described. This rolling operation lengthens and reduces the thickness of the strip substantially as shown at S^2 in Fig. 8, but does not change its width at least to any material extent.

From the die 14 and roller 15 the strip passes through a fourth rolling unit similar to that last described, but with the die and rollers reversely positioned with respect to those in the preceding unit, and with the rollers mounted to be reciprocated longitudinally of the strip. This unit includes a similarly grooved die 18 with an associated roller 19, idler roller 20 and thrust plate 21. This fourth rolling unit like the second rolling unit renders both sides of the strip substantially the same, and slightly decreases the thickness of the strip as indicated at S^3 in Fig. 9.

The strip in cross-section has now assumed a segmental form of the required thickness, width and cross-sectional area for the segments to be produced, this strip being shown and designated S^3 in Fig. 10.

For the production of the commutator segments from the strip S^3, the strip next passes to the punch press composed of a suitably shaped die 22 and a suitably shaped punch 23, and the segments thus produced are ready to be assembled with suitable insulating material to form the usual cylindrical commutator.

Thus in the process, from the beginning to the end thereof, the steps of which are carried out in a substantially continuous manner, the wire is fed from the reel, is flattened and thus widened, lengthened and thus reduced in thickness, and in fact, converted to a strip of the proper shape and cross-sectional dimensions, and finally the segments are punched from this strip, all the mechanism working harmoniously and in synchronism or predetermined timed relationship, and in the end producing the properly formed articles. All the steps of the process are carried on without requiring the assistance or attention of an operator after once the wire is started through the apparatus. This is a decided advantage over the old process wherein the segments are punched from previously formed rolled or drawn bars of comparatively short lengths.

I have previously mentioned the desirability of feeding the wire prior to the rolling strokes of the rollers in each direction, i. e. assuming that the rollers are moved simultaneously, it is desirable that the wire be fed prior to the forward strokes, and prior to the reverse or backward strokes of the plungers actuating the rollers. This has several advantages. By feeding before each stroke, not only are the rollers working on each stroke so that the machines are working at substantially maximum efficiency, but the rolled strip is kept straight and properly fills out the die grooves, being brought up against the shoulders along both edges of each groove, and there is prevented what may be termed flashing over the face of the die, as might result if the metal were all rolled toward one edge of the die.

Some of the advantages of the method above explained, are,—1st, that by substituting the die and roll, operating on wire, for the pairs of rolls heretofore employed, lighter, cheaper, and more accurate instrumentalities are employed, and the delivery of the strips of metal in a straight line is insured, which, with pairs of rolls, is only attainable by the use of additional mechanisms, and that, instead of employing expensive pairs of rolls for each size of strip, my method requires merely the change of comparatively cheap die-blocks or plates, the rolls remaining the same; 2d, that by my method a variety of sizes of strips suitable for commutator-segments may be produced from wire of a single gauge; 3d, that wire of suitable gauge for the purpose indicated is generally easily obtainable at reasonable prices in any desired quantity; 4th, that by taking copper wire from a reel the operation is rendered practically continuous, and much more rapid and economical than when the segments are formed by the method heretofore in use; 5th, that by the use of light

easily handled wire, segment-strips of any required width may be obtained; 6th, that by the adjustment of the transverse and longitudinal rolls relatively to the face of their respective dies, or by the adjustment of the dies relative to the rolls, the width and thickness of the strips to be produced may have a wide range of variation; 7th, by such adjustments the slightest inaccuracies and wear may be corrected, and 8th, the metal is made denser, producing harder and more durable commutator segments than those produced by the old methods, and resulting in improved commutation when a commutator which is made with such segments is in use on a dynamo electric machine.

While I have shown two sets of rolls and dies for the preliminary transverse shaping of the copper wire, and have shown two sets of rolls and dies for rolling the strip longitudinally, it will be understood, of course, that the number of the rolling units may be varied as conditions may require, and that in some cases,—as when wire of exactly the required gauge is available,—a single roll and die or rolling unit for the transverse shaping of the strip will suffice, while in other cases a single roll and die or rolling unit for the longitudinal rolling of the strip may be employed. The advantage of the means for the repeated rolling of the strip transversely and longitudinally, in the order named, has however, been explained.

While the process has been explained in connection with the production of commutator segments and has particular utility when so used, it may be employed for the production of other articles without deviating from the invention in its broad aspects.

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

1. In an apparatus for forming tapered commutator segments, means for rolling copper wire into a bar or strip of wedge-like form in cross-section, from which tapered segments may be punched or cut, said apparatus comprising a reciprocable roller and a stationary die in operative relation to the roller, said die having a groove through which the stock to be rolled is fed, said groove being provided with sides which are the same distance apart during the rolling and feeding operations, and having opposite to the roller for the support of the strip or bar to be rolled, a surface inclined at an angle to the path of the roller, and means for feeding the stock through said groove.

2. In an apparatus of the character described, a die, mechanism for feeding stock through the die, a roll co-acting with the die, and means for moving the roll back and forth with a straight line movement longitudinally of the stock and in contact therewith.

3. In a device of the described character, a die having across its face a fixed groove adapted for the passage therethrough of a wire, said groove being shaped in transverse outline to correspond substantially to a cross-section of the desired product and of less depth than the thickness of such wire, and a reciprocable roll arranged to traverse the face of said die transversely to said groove with a straight line movement.

4. An apparatus for forming commutator segments comprising a pair of dies, each having a groove angular in cross-section and adapted for the passage therethrough of stock to be rolled, and a pair of rolls each co-operating with one of said dies, and means for actuating said rolls so that one roll traverses the face of the die transversely of the groove, and the other traverses the face of the die longitudinally of the groove.

5. An apparatus for forming commutator segments which includes in its construction a die having across its face a groove angular in cross-section and adapted for the passage therethrough of a wire of suitable gauge, a roll which traverses the face of such die transversely to such groove, a die having across its face a groove and arranged for the passage therethrough of a wire leading from the first mentioned die, and a roll which traverses the face of the latter die in the direction of the length of the groove.

6. An apparatus of the described character, comprising a die having across its face a groove angular in cross-section and adapted for the passage therethrough of a wire of suitable gauge, a second die having across its face a like groove but of less cross-sectional area, rolls adapted to roll such wire,—one transversely, and the other longitudinally,—and mechanism adapted and arranged to cut from the strip formed by said rolls and dies a piece having the desired outline and corresponding substantially in cross-section to a cross-section of the groove last mentioned.

7. The method of forming a tapered bar from which commutator segments may be punched or cut, which comprises feeding copper stock through a die having a fixed tapered groove or channel, and rolling the stock in said groove so as to cause the entire body thereof to assume a tapered shape.

8. The method of forming a tapered bar from which commutator segments may be punched or cut, which comprises feeding copper stock through a die having a fixed tapered groove or channel, and rolling the stock in said groove so as to cause the entire body thereof to assume a tapered shape substantially the same as the cross-sectional shape of the groove.

9. The method of forming a tapered bar from which commutator segments may be punched or cut, which comprises feeding copper stock successively through a plurality of dies having fixed tapered die grooves or channels, and rolling the stock in said grooves or channels so as to cause the entire body of the stock to gradually assume the desired tapered cross-sectional shape.

10. The method of producing a tapered bar from which commutator segments may be punched, which consists in progressively feeding stock through dies having tapered grooves approximating in varying degrees the cross-sectional outline of the bar to be formed, and rolling the stock in the dies both longitudinally and laterally.

11. The method of producing commutator segments which consists in feeding a wire through a die of substantially the cross-sectional outline of the segment to be formed, then rolling the wire transversely in said die, then feeding the wire through a die conforming in cross-section to the finished segment to be produced, then rolling the wire longitudinally in said latter die, and then punching from the strip thus produced a piece of the required outline.

12. The method of preparing a length of material from which articles of predetermined shape are to be formed, which comprises feeding the material through a die having a fixed die groove or channel and rolling the material in the die transversely of the length of the material by moving a roller over the face of the die with a straight line movement.

13. The method of preparing a length of material from which articles of predetermined shape are to be formed, which comprises intermittently feeding the material through a die and rolling the material in the die in the direction of the length of the material by moving a roller over the face of the die with a straight line movement.

14. The method of preparing material so that articles of predetermined shape may be cut therefrom, comprising rolling the material transversely and longitudinally so as to increase the width of the material, lengthen it, and decrease its thickness.

15. The method of treating wire so as to produce a strip from which articles of predetermined shape may be cut, which comprises rolling the wire in a fixed die groove by moving a roller transversely with a straight line movement back and forth across the groove, and feeding the wire before the stroke of the roller in each direction.

16. The method of treating wire to form a strip from which articles of predetermined shape may be cut, which comprises rolling the wire in the groove of a die by running the roller with a straight line movement back and forth over the die in the direction of the length of the groove and feeding the wire through the die before the stroke of the roller in each direction.

17. The method of forming tapered commutator segments which comprises in substantially a continuous operation rolling a copper wire so as to produce a dense copper strip having substantially parallel edges and a varying depth from one edge to the other, and punching the tapered segments from the strip.

18. The method of forming commutator segments from a wire, which comprises in substantially a continuous operation passing the wire through grooves of dies and rolling the same in the grooves by transverse and longitudinal rolling action so as to form a strip of predetermined width and thickness, and punching the segments from the strip.

19. The method of treating a wire to form a strip from which articles of predetermined shape may be formed, which comprises feeding the wire successively through grooves of dies and passing rollers over the die faces so as to roll the wire in the grooves with the rollers of the two rolling units engaging opposite faces of the material.

20. The method of preparing material for the production of commutator segments which comprises rolling a copper wire transversely and longitudinally so as to provide a strip of predetermined cross-sectional shape with opposite faces relatively inclined and of such width that tapered segments of the desired size may be punched or cut therefrom.

21. The method of making tapered commutator segments which comprises rolling copper wire transversely and longitudinally so as to form a tapered strip approximating the cross-sectional shape of the segments to be formed, and punching segments from said strip.

22. The method of making commutator segments which comprises rolling a copper wire transversely and longitudinally so as to convert it to a tapered strip, and in the same continuous operation punching the segments from the strip.

In testimony whereof I affix my signature in presence of two witnesses.

HARRY P. JANKE.

Witnesses:
S. N. SLOAN,
M. KRAMER.