Dec. 27, 1932. G. C. BURD ET AL 1,892,501

MACHINE FOR PRODUCING COIL WIRE STRUCTURES

Filed March 6, 1931 2 Sheets-Sheet 1

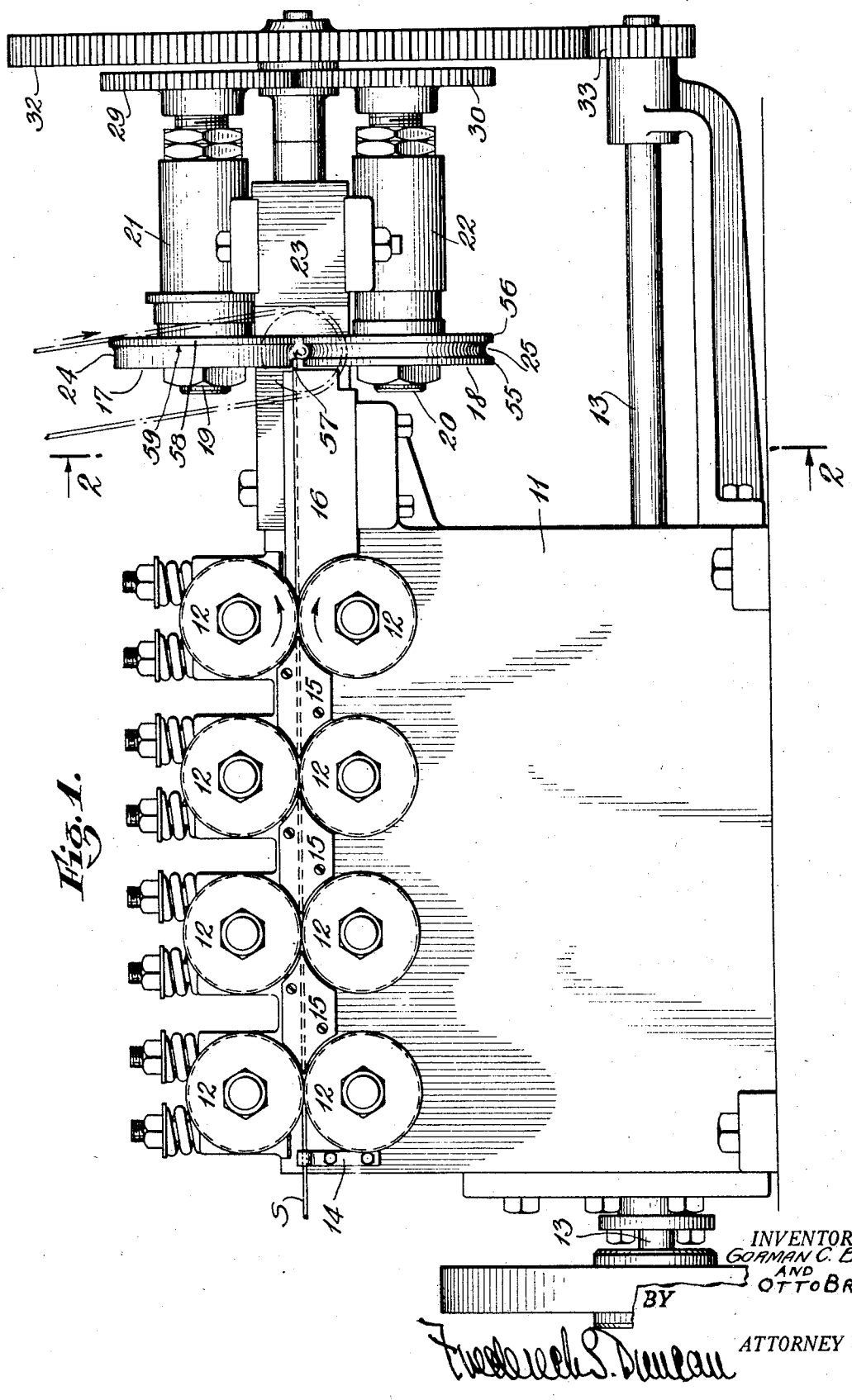


Fig. 1.

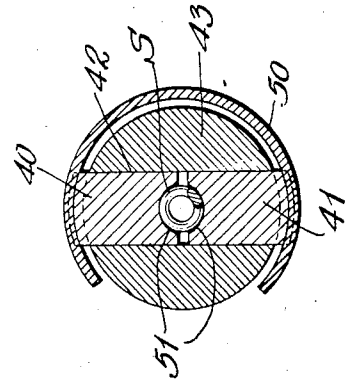
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Fig. 3.



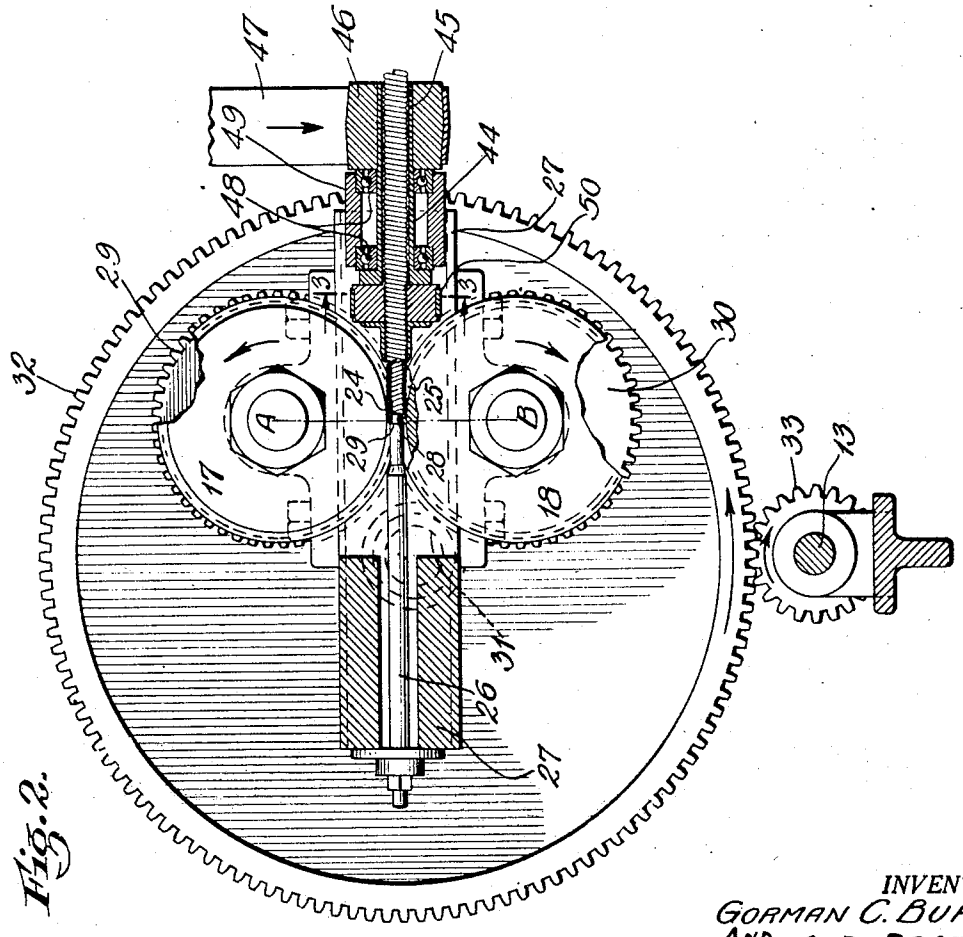


Fig. 2.

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UNITED STATES PATENT OFFICE

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MACHINE FOR PRODUCING COIL WIRE STRUCTURES

Application filed March 6, 1931. Serial No. 520,585.

This invention relates to the manufacture of coil wire structure such as helical springs, flexible shafting, and the like, and has for its primary object the provision of a machine for use in forming such coils by the deformation of wire stock into helical form, a particular object of the invention being the provision of dies of a construction and capable of a method of operation such as to distribute the wear upon them more uniformly than is characteristic of conventional means for the same purpose. Another object of the invention is to provide dies which are capable of carrying off and radiating the heat generated by the coiling operation so that the mechanism is at no time overheated.

Another object of the invention is to provide such a machine with means acting upon the helically formed coil as it emerges from the forming dies in such a manner as to exert a rotary constrictive force upon the coil, aiding in the feeding of the wire and in its formation into helical shape and also acting to release the coil from the dies.

Another object is to provide dies for use in producing coiled wire so constructed as to present an extensive die surface, only a portion of which is in operation at any instant.

Another object is to provide such a machine with dies of a particularly economical construction.

In pursuance of the invention, we provide a pair of rotatable dies taking the form of discs having curved peripheral die surfaces, which, when mounted as hereinafter described, are complemental to each other forming a die of circular cross-section and of a diameter to produce the particular size of coil that may be desired. The dies are so mounted as to be capable of acting progressively upon wire stock to deform it helically, the stock being fed into the dies in a direction substantially parallel with the axis of rotation of the dies.

The helically formed stock is then passed through a rotary gripping member which exerts a rotary drag upon it, thereby aiding in the feeding of the wire and, by reducing the diameter of the coil, helping to release it from the dies.

The above features of the invention, and others, are illustrated and described fully in the accompanying drawings and specification, and are pointed out in the claims.

In the drawings,

Fig. 1 is a view in side elevation of a machine in the construction of which the invention has been embodied;

Fig. 2 is a view in vertical section on the line 2—2 of Fig. 1; and

Fig. 3 is a fragmentary detail view in vertical section, taken on the line 3—3 of Fig. 2, upon a larger scale.

In the now-preferred embodiment of the invention selected for illustration and description, the part designated by the reference numeral 11 is the base of a wire-coiling machine, upon which are mounted in suitable bearings a plurality of pairs of feed rolls 12, to which the wire spring stock *s* is supplied from a suitable source (not shown), these rolls being actuated by a drive-shaft 13 by means of suitable gearing contained within the base 11.

Guiding means 14 and 15 of any suitable character are provided to direct the stock into and between the pairs of rolls, and a guide 16 serves to direct the stock to the coiling dies 17 and 18, which, in their preferred form, comprise a pair of rotatable discs carried by shafts 19 and 20, mounted in bearings 21 and 22, supported by a bracket 23 extending from the side of the base 11.

The axes of rotation of these shafts are preferably substantially parallel with each other and with the line of feed of the wire stock, and the peripheries 24 and 25 of the discs, in pursuance of the invention, are of suitable contour, and are so opposed, relatively to each other, as to constitute complemental curved surfaces against which the wire stock is forced progressively by the feed rolls 12, the die-surfaces co-operating to deform the stock helically, forming a coil spring of the desired length and diameter.

If desired, a mandrel may be provided as indicated at 26, in a position substantially tangent to the peripheral die surfaces 24 and 25 at the forming point, this mandrel being supported in a suitable bracket 27 extending

transversely within the bracket 23. The mounting of the mandrel in bracket 27 may be of such a nature that the mandrel may be capable of rotation and also of a slight oscillatory motion. The free end 28 of the mandrel is preferably reduced in diameter to form a shoulder 29, which serves as an abutment to guide the stock *s*, as it enters between the die surfaces 24 and 25. The shoulder is preferably located slightly to the left (as seen in Fig. 2) of the imaginary line A—B connecting the centers of rotation of the two discs.

The discs are rotatable, as already noted, for the purpose of permitting the presentation of fresh forming surfaces constantly as the forming operation progresses, so that the wear upon the forming surfaces is uniformly distributed and, owing to the relatively large size of the discs as compared with the diameter of the coil being formed, their mass absorbs the heat of the forming operation completely and radiates it quickly to the surrounding atmosphere, preventing any overheating of the dies.

The rotation of the dies may be accomplished in any suitable manner, either by the drag produced by the forward movement of the emergent coil, which, of itself, exerts a certain amount of rotational effect frictionally upon the contacting peripheries of the dies, and this may be sufficient, under favorable conditions, to cause the rotative adjustment; or the rotative adjustment may be accomplished manually; or, and preferably, means may be provided to cause positive rotative adjustment of the dies, such means being illustrated in the drawings.

For this purpose, the shafts 19 and 20 are shown as provided with gears 29 and 30, meshing with each other, and one of which is driven by a gear 31 fast on the hub of a large gear 32 which is actuated by a small gear 33 on the main drive shaft 13, the gear ratio being suitable to cause a relatively slow rotation of the dies, sufficient, however, to distribute the wear uniformly and facilitate the radiation of heat already mentioned. The direction of rotation of the dies is preferably in the direction indicated by the arrows in Fig. 2.

The contour of the peripheral die surfaces may vary somewhat, in practice, and the form shown is merely intended to be illustrative of a contour which has proved satisfactory in use. Generally speaking, the contour of one of the peripheral die surfaces such as that of the lower die 25, may advantageously be that of an approximately semicircular groove, with side walls constituted by flanges of substantially equal height, or with a flange 55 slightly larger in radius than the flange 56, in order to continue the coiling action up to the region at which the wire stock *s* is fed between the dies, leaving room only for clearing the lip 57 which is preferably provided to support the stock at the region of delivery to the dies. This larger radius of the flange 55 is not so shown in the drawings, nor is such showing necessary. The complemental peripheral die surface of the other rotatable die 24 may have as a boundary a single flange 58, its concave inner wall 59 serving to initiate the helix-forming operation, and to direct the partly coiled wire into the groove of die 25 for completion of the helix.

In pursuance of another object of the invention, the helically coiled spring S as it emerges from the forming dies is subjected to the action of a constrictive force, preferably applied by a rotary member which tends to reduce its diameter slightly, thereby aiding to release the coiled spring from the rotary dies, and also aiding to impart to the coiled spring a uniform diameter. Any suitable device may be used for the above purpose, and as one form of such device, there is shown in the drawings a rotary device comprising jaws or dies 40 and 41 mounted in a radial slot 42 in a head 43 which is carried by a hollow shaft 44, at one end of which the head may be conveniently formed integrally, while the other end of the shaft, as shown at 45, is provided with a pulley 46 by which it may be rotated, as by a belt 47 running from any suitable source of power not shown. The shaft 44 is illustrated as mounted in ball-bearings 48 supported at 49 upon a part of the transverse bracket 27. The jaws or dies 40 and 41 are urged yieldingly by a C-shaped spring 50 inward toward the emergent coiled spring S, each of the dies preferably having a recess 51 adapted to be engaged with the coil, the recesses preferably being of slightly larger radius than that of the coil, so as to prevent any jamming of the jaws upon the coil, the action of the jaws being of an easy rubbing nature.

By this means, the jaws, which turn in the same direction as that of the formation of the helix, will constrict the latter slightly, reducing its diameter sufficiently to aid in releasing from the jaws the emergent portion of the coiled spring, the latter tending, however, to expand again slightly after passing through the rotary constricting head.

It has been found in practice that a spring-coiling machine constructed in accordance with this invention can be operated at a considerably higher speed than conventional machines for the same purpose, and will produce coiled springs of very uniform structure and superior finish.

We claim:

1. In a machine for coiling wire to form springs and the like, a pair of rotatable dies having complemental curved peripheral die surfaces arranged in opposed relation to each other and adapted to act progressively

upon wire stock to deform said stock helically, and means to feed wire stock between said dies in a direction substantially parallel with the axis of rotation of said dies.

2. A machine characterized by a pair of rotatable dies as set forth in claim 1, said machine being further characterized by means to rotate said dies to present progressively fresh forming surfaces for operation upon said stock.

3. A machine having a pair of rotatable dies characterized as in claim 1, said rotatable dies being formed as discs of relatively large diameter, as compared with the diameter of the coil formed, and adapted to absorb and radiate rapidly the heat generated by the forming operation.

4. A machine characterized by rotatable forming dies as set forth in claim 1, and further characterized by a mandrel mounted in position to extend between said die surfaces in substantially tangent relation thereto, and means to feed said wire progressively into forming relation with said mandrel and co-operating die surfaces, said feeding movement being in a direction at an angle to the length of said mandrel.

5. A machine characterized by rotatable forming dies as set forth in claim 1, and further characterized by a mandrel mounted in position to extend between said die surfaces in substantially tangent relation thereto, and means to feed said wire progressively into forming relation with said mandrel and co-operating die surfaces, said feeding movement being in a direction substantially at right angles to the length of said mandrel.

6. A machine characterized by rotatable forming dies as set forth in claim 1, and further characterized by a mandrel mounted in position to extend between said die surfaces in substantially tangent relation thereto, and means to feed said wire progressively into forming relation with said mandrel and co-operating die surfaces, said feeding movement being in a direction at an angle to the length of said mandrel, said mandrel having an abutment shoulder to guide said stock between said dies and oppose the end thrust due to formation of said coil.

7. A machine having means adapted to deform wire stock helically by a compressive force to form a coil spring, and having combined therewith a rotary gripping means mounted in position to engage the periphery of said helically formed stock as it emerges from said coiling means and wind it up sufficiently to reduce its diameter thereby to aid in releasing the helically formed stock from said coiling means.

8. A machine having means adapted to deform wire stock helically to form a coil spring, and having combined therewith a rotary gripping means mounted in position to exert a constrictive force upon said helically formed stock as it emerges from said coiling means and thereby to aid in forming said stock helically and in releasing the helically formed stock from said coiling means, said rotary gripping means comprising a head provided with radially movable jaws and means tending to urge said jaws yieldingly inward into engagement with said helically formed stock.

9. A machine having means adapted to deform wire stock helically to form a coil spring, and characterized further by a rotary gripping means mounted in position to exert a constrictive force upon said helically formed stock as it emerges from said coiling means and thereby to aid in forming said stock helically and in releasing the helically formed stock from said coiling means, said rotary gripping means comprising a head provided with radially movable jaws and a C-shaped spring tending to urge said jaws yieldingly inward into engagement with said helically formed stock.

10. A spring-coiling machine characterized as set forth in claim 1, and further characterized by the formation of one of said peripheral die surfaces as a groove of substantially semicircular form in cross-section, and by the formation of the other peripheral die surface with a single flange having a concave wall to initiate the helix-forming operation and adapted to direct the partly formed helix into said groove.

11. A machine having means to deform wire stock helically to form a coil spring, and having combined therewith a rotary means mounted in position to be engaged frictionally with said helically formed stock as it emerges from said coiling means and adapted to change the diameter of said helix sufficiently to release the helically formed stock from said coiling means.

In testimony whereof, we have signed this specification.

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