G. W. GOODRIDGE & W. J. GAGNON.

MACHINE FOR MAKING BEAD CHAINS.

APPLICATION FILED MAY 31, 1913.

1,087,876.

Patented Feb. 17, 1914.

4 SHEETS—SHEET 1.

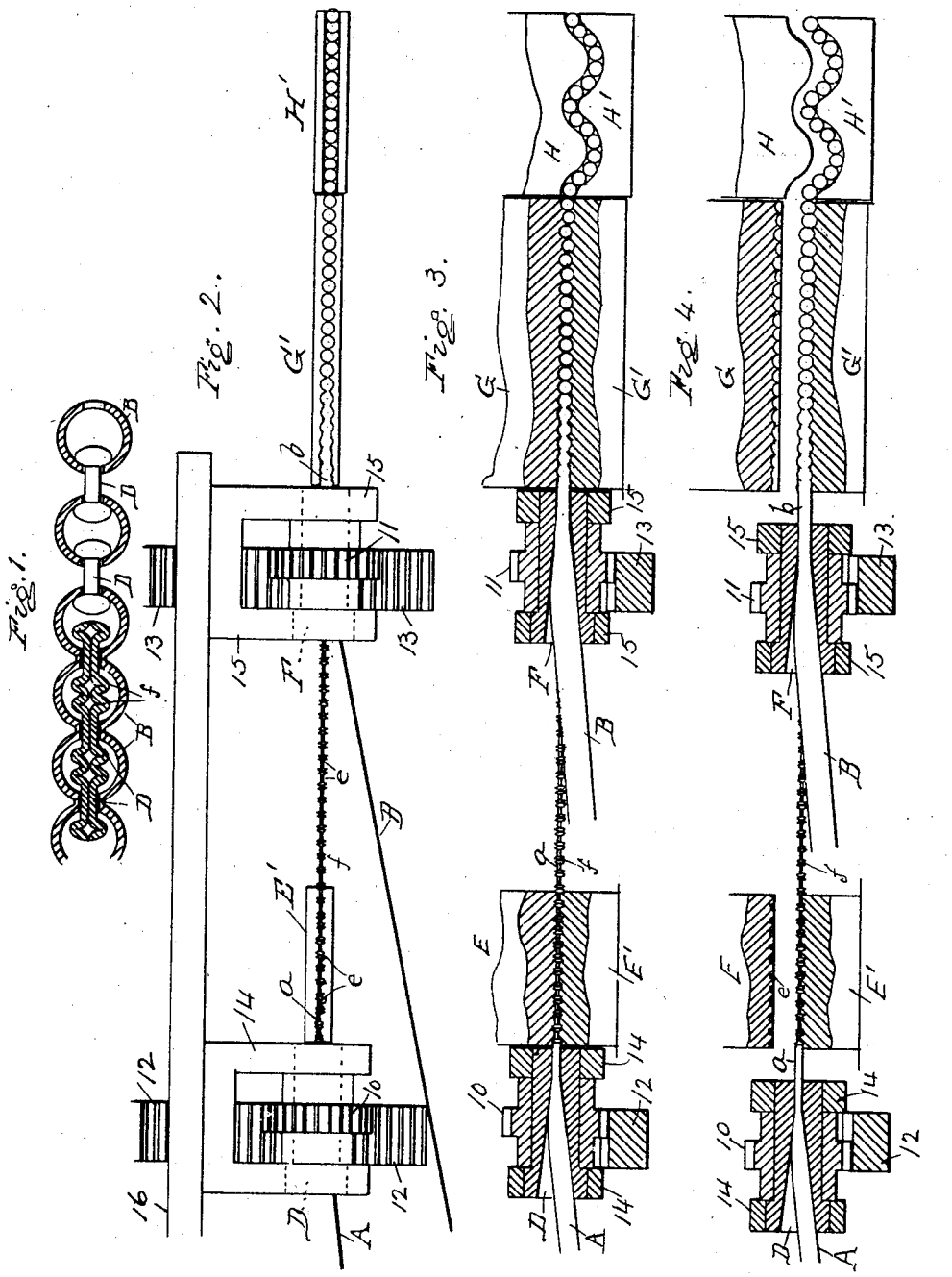

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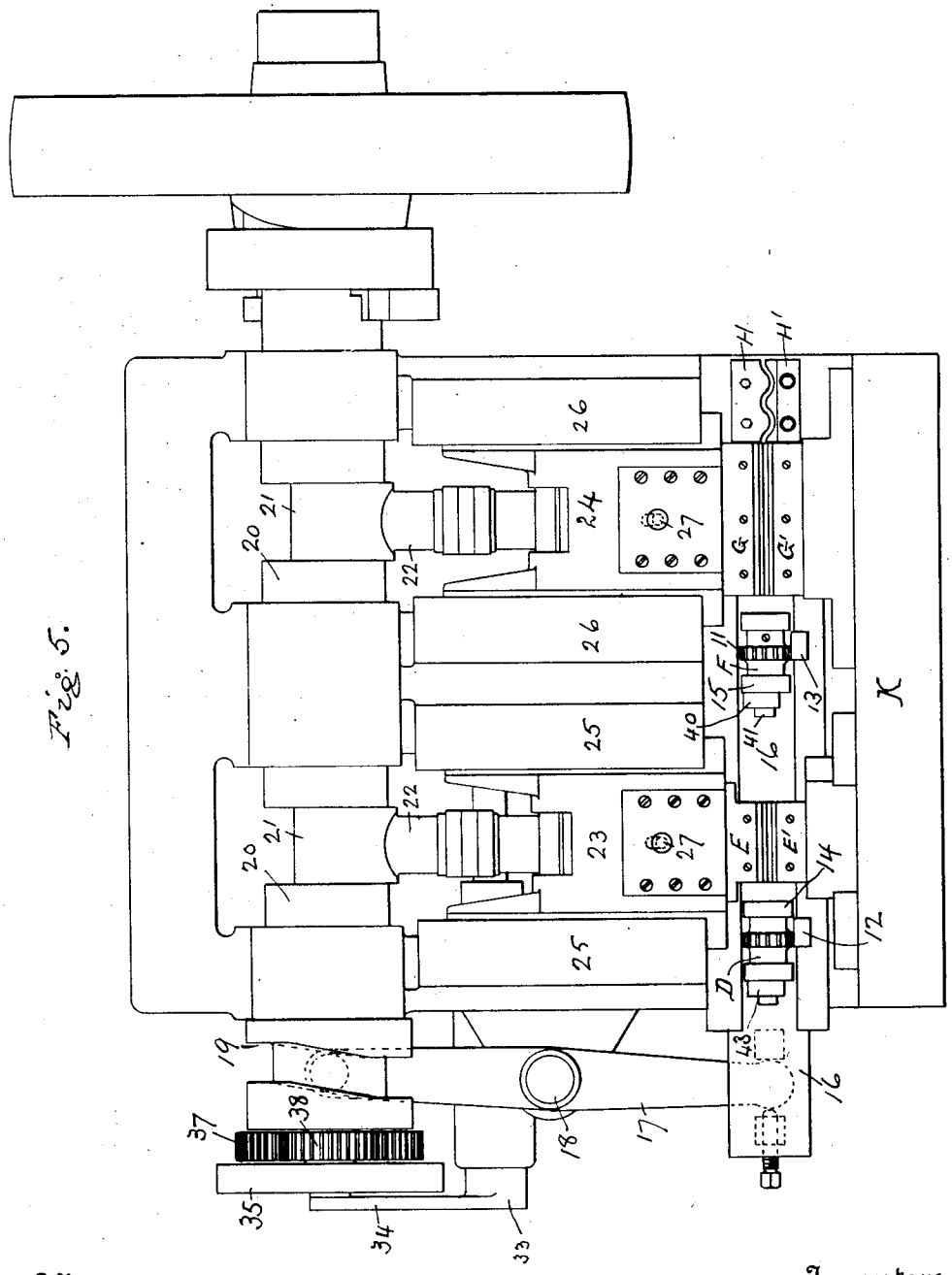
Fig. 5.



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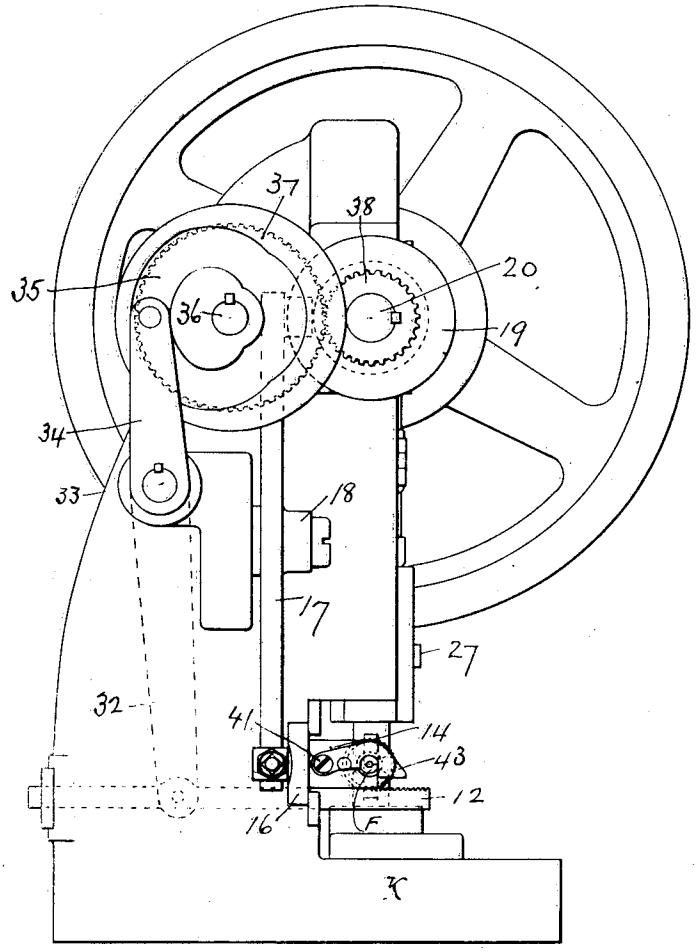
4 SHEETS—SHEET 3.

Fig. 6.



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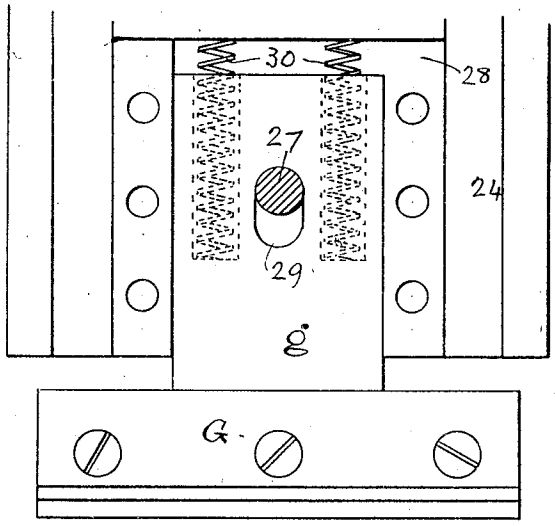


Fig. 7.

Fig. 8.

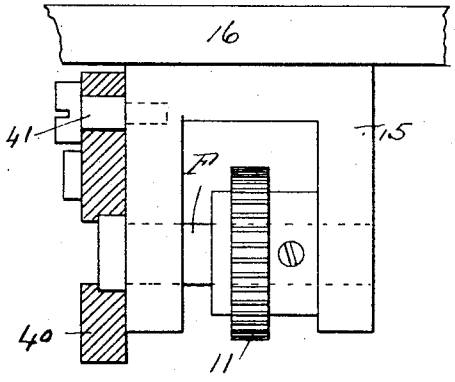
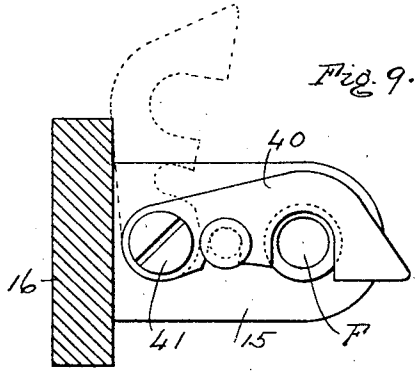


Fig. 9.



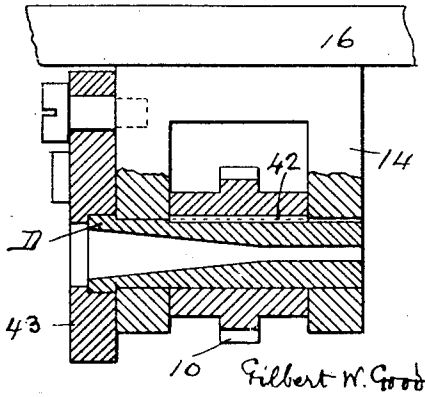


Fig. 10.

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UNITED STATES PATENT OFFICE.

GILBERT W. GOODRIDGE AND WILLIAM J. GAGNON, OF BRIDGEPORT, CONNECTICUT, ASSIGNORS TO THE BRYANT ELECTRIC COMPANY, OF BRIDGEPORT, CONNECTICUT, A CORPORATION OF CONNECTICUT.

MACHINE FOR MAKING BEAD CHAINS.

1,087,876. Specification of Letters Patent. Patented Feb. 17, 1914.

Application filed May 31, 1913. Serial No. 770,941.

To all whom it may concern:

Be it known that we, GILBERT W. GOODRIDGE and WILLIAM J. GAGNON, both citizens of the United States of America, and residing in the city of Bridgeport, county of Fairfield, and State of Connecticut, have invented certain new and useful Improvements in Machines for Making Bead Chains, of which the following is a specification.

Our invention relates to means for the manufacture of chains of that class which are known as bead chains, and in which hollow balls are united together by links of a dumb-bell shape, the heads of each dumb-bell being inclosed within the hollows of adjacent balls.

Stated generally, the main objects of our invention are to increase the speed of production, to reduce the cost of manufacture and to improve the product.

The accomplishment of these objects is secured by the means hereinafter described.

In the accompanying drawing, Figure 1 is an enlarged sctional view of part of a bead chain such as may be produced by the aid of our invention; Fig. 2 is a diagrammatic plan view illustrating in simple form some of the principal operating parts of our mechanism for the manufacture of the chain; Fig. 3 is a corresponding sectional elevation; Fig. 4 is a similar view with the parts in other positions; Fig. 5 is a front elevation of the complete machine; Fig. 6 is a side elevation; Fig. 7 is a view of one of the movable die parts; Figs. 8, 9 and 10 are views of modifications.

Our invention is especially useful for the manufacture of bead chains, in which the connecting dumb-bell links are formed of tubular material, as described and claimed in the Gagnon Patent No. 1,078,494, dated November 11, 1913, and we will describe our improvements with particular reference to the production of a bead chain of that construction, although our invention or many features of it, may be employed in the manufacture of other forms of bead chains.

The Gagnon construction of bead chain is illustrated in Fig. 1, and comprises a series of balls B, B, united by dumb-bell links D, D of hollow material, instead of solid wire, as was previously the common practice.

Our means for making the chain will be best understood by reference to Figs. 2, 3, 4 and 5, these latter showing in diagram the operations as carried out by the principal operative parts of our machine.

We supply to the machine from two separate reels or other suitable means two ribbons A and B, (Figs. 2, 3 and 4), of the metal or metals to be used in making the chain, the ribbon A being of a width sufficient when drawn up longitudinally into tubular shape to form a tube less than the diameter of the desired dumb-bell heads. The ribbon B is wider, being of a width sufficient when drawn up into tubular shape to form a tube of the diameter of the hollow balls of the chain to be made. The strip B is preferably of somewhat thicker material than the strip A. The strip A enters and passes through the conical opening in the drawing or tube-forming die D, and thence passes between swaging dies E, E^1, in which are a succession of recesses *e* of gradually increasing depth in the direction of the feed movement of the material being operated upon, so as to gradually reduce the diameter of the parts of the tube, while leaving enlargements or dumb-bell heads *f* in closely adjacent pairs, as seen on a larger scale at the left of Fig. 1. Preferably one of these dies E^1 is stationary, while the other E is caused to reciprocate toward and from the die E^1. From these dies E, E^1, the tubular strip *a* of united dumb-bells passes into and through the conical drawing die F, which acts to draw into tubular form *b* around the tubular strip *a* the ribbon of metal B. The two tubes *a* and *b*, thus inclosed one within the other, thence pass to the swaging dies G and G^1, whose adjacent faces are formed with cup-shaped depressions of gradually increasing depth, to gradually form the outer tube *b* into hollow balls, as the material is intermittently fed forward. The semi-spherical depressions in the faces of these dies, G, G^1, toward the exit end,—say the last six depressions,—are slightly offset alternately, first in one direction and then in the other, thereby causing the dies to break the balls apart from each other. These last depressions in the dies may also be spaced apart slightly more than

are the preceding depressions, to aid in breaking the balls apart.

To complete the separation of the balls with certainty and also to break the dumb-bell sections within the balls, the thus formed chain passes from the dies G, G^1 into a sinuous path, which may be provided by jaws H, H^1, with wave-like faces, the lower jaw H^1 being fixed and the upper jaw movable with the movable swaging dies, or otherwise. The movable jaw is caused to approach the fixed jaw H^1 sufficiently close to bend the chain backward and forward without nipping it, as indicated in Fig. 3.

The two tubes are simultaneously fed through the swaging dies intermittently, the drawing dies themselves being availed of as the feeding means. For this purpose, these drawing dies D and F are mounted in brackets 14 and 15 respectively, and these brackets in turn are mounted upon one and the same horizontal slide 16, so that the two dies D and F always bear a definite relation to each other, and by suitable means at the proper time the slide 16 is moved to the left or to the right a distance proportional to the size of the balls of the chain. By preference this movement, which is the feed movement, is made equal to the diameter of two balls.

The cycle of operations is as follows:— The drawing dies D and F being in the position shown in Figs 2 and 3, closely adjacent to the respective pairs of swaging dies, the upper swaging dies E and G, working in unison, are simultaneously caused to approach their respective lower dies E^1 and G^1 to act upon the tubular core *a* and the tube *b* for the balls. Then while these pairs of swaging dies still hold the tubes between them, the slide 16 is moved to the left carrying the drawing dies D and F a distance equal to the diameter of two chain balls, thereby drawing the ribbons A and B into tubular form for a corresponding length. Then the swaging dies being opened, the drawing dies D and F are fed forward to the right a distance equal to the diameters of two balls for a new action of the swaging dies upon the tubes.

In order to prevent the formation of fins and to improve the appearance of the product, the tubes *a* and *b* should be turned between swaging operations. It will suffice to turn them about 90° between swaging actions. This may be conveniently accomplished by mounting these drawing dies D and F so as to be free to turn or oscillate in the brackets 14 and 15, and by securing to the exterior of the dies pinions 10 and 11 meshing with racks 12 and 13 respectively, and by reciprocating these racks simultaneously to give the desired quarter turns backward and forward to the dies D and F and consequently to the tubes, between the swaging actions. The result is the production of a bead chain such as illustrated in Fig. 1, with the headed links formed of tubes. One advantage due to the use of tubing for the links is that more perfect dumb-bells without fins can be formed than by the use of solid wire, and this without having to turn the tube more than by oscillating it 90°. Furthermore, by making both tubes and dumb-bells and balls at the same time, we can use long coils of metal ribbons, and thus lessen the expense. The simultaneous feeding insures perfect location of the dumb-bells in the ball tube and liability to get broken pieces of chain during the operation is prevented. This is further aided by the simultaneous swaging operations upon the two tubes, and also by the simultaneous drawing of the two ribbons into tubes.

In Figs. 5 and 6, illustrating the complete apparatus, we have not shown either the reels of ribbon or the ribbons or the chain in formation, because of the smallness of the scale of these views, but the essential parts of the mechanism will be readily identified from the foregoing description. Thus the slide 16, carrying the two drawing dies D and F, is mounted to reciprocate in horizontal guide ways in the frame K of the machine, being actuated at the proper times by a lever 17, pivoted at 18 to the frame and operated by a grooved cam 19 on the main driving and crank shaft 20 of the machine.

The rack bars 12 and 13 for oscillating the drawing dies D, F, are guided horizontally in the lower part of the frame at right angles to the slide 16, and are acted upon by arms 32 (indicated in dotted lines in Fig. 6) fixed upon a horizontal shaft 33, which carries at its outer end (at the left of the machine, Fig. 5) an arm 34. This arm has an antifriction roller running in a cam groove 35 on a shaft 36, which also carries a gear wheel 37 meshing into a pinion 38 on the end of the shaft 20 (Figs. 5 and 6). This gearing and the cams are such as to give the timing of movements hereinbefore described with relation to Figs. 2 to 4.

The lower swaging dies E^1 and G^1 (Fig. 5) are fixedly mounted upon the base of the frame K, while the corresponding upper dies E and G are reciprocated at appropriate times and simultaneously by cranks 21 on the shaft 20 acting through connecting rods 22 joined to the die gates or slides 23, 24, guided in vertical guide ways 25, 26 in the upright portion of the frame K. These upper dies are connected to their respective slides or gates 23 (24) with a lost motion, as illustrated in Fig. 7, which shows, on a larger scale than Figs. 5 and 6, a face view of the die G in its slide 24, with the cover plate detached. The flat stem *g* of the die carrier is guided vertically in a pocket 28

in the slide 24, but its extent of freedom of movement therein is limited by a removable pin 27 passing through a slot 29 in the stem *g*. Springs 30 tend to press the die G downwardly so far as the pin 27 will permit, when the slide 24 rises. This construction is for the double purpose, first, of enabling the upper dies E, G, to stay down and hold the material against the leftward or drawing movement, (Figs 4 and 5) of the drawing dies D and F, during the beginning of the rising movement of the slides or gates 23 and 24, and second, of permitting the dies E, G to come down again easily onto the material being operated on, after each feed movement, so that the material may the better find its correct position between the dies, before the actual swaging action.

Instead of mounting the two drawing dies in the simple forms illustrated in Figs. 2 to 6, we prefer to employ the constructions illustrated in Figs. 8 to 10, in order to facilitate reloading the machine with ribbon material when the supply of one or other of the ribbons has run out. Thus when the supply of ribbon for the dumb-bell core has run out, it is desirable to be able to operate the machine temporarily without feeding the tubing for the balls. For this purpose, we prefer to construct the pinion 11 which is pinned to the die F with a short hub on the left, as shown in Fig. 8, and to normally hold the die F in its bearings in the bracket 15 by a latch 40 hinged at 41 to the outside of the bracket, the latch in its closed position shown in the Fig. 8, and by full lines in Fig. 9, lying over the head of the die and holding it in place. When it is desired to stop the drawing and feeding of the tubing in the die F, the latch 40 is thrown up to a position such as shown by dotted lines in Fig. 9, whereupon at each back and forth movement of the slide 16 the die F will simply slip back and forth a distance equal to the movement of the slide 16. In order to more surely keep the ball tube in place during this time, the pin 27 which secures the upper die G in the slide 24 may be withdrawn, and the upper die dropped upon the lower die. On the other hand, when the supply of ribbon for the ball tubing gives out, it is desirable to withdraw the dumb-bell core. To do this, we provide for the withdrawal of the die D with the dumb-bell core material carried by it. Accordingly, as shown in Fig. 10, the drawing die D is connected to its pinion 10 by means of a key and keyway 42, so that when the retaining latch 43, which is similar to the latch 40, is turned to a position such as indicated by dotted lines in Fig. 9, the die D will be freed and can be withdrawn endwise with the tubing contained in it, and thereafter reinserted, when the ribbon supply for the balls has been renewed.

We claim as our invention:

1. A machine for making bead chains, comprising means for shaping a tube into a series of connected dumb-bells, in combination with means for forming a tube around said dumb-bell shapes, means for shaping said outer tube into the form of connected hollow balls over the dumb-bells, and devices for actuating said two shaping means in unison.

2. A machine for making bead chains, comprising means for forming a series of connected dumb-bell shapes in combination with means for forming a tube around said dumb-bell shapes, means for shaping said outer tube into the form of connected hollow balls over the dumb bells, devices for actuating said two shaping means in unison and intermittent feeding devices operating on the dumb-bell shapes and the outer tube simultaneously.

3. A machine for making bead chains, comprising means for shaping a tube into a series of connected dumb-bells in combination with means for forming a tube around said dumb-bell shapes, means for shaping said outer tube into the form of connected hollow balls over the dumb-bells, devices for actuating said two shaping means in unison and intermittent feeding devices operating on the dumb-bell shapes and outer tube simultaneously.

4. A machine for making bead chains, comprising means for drawing a ribbon into a tube, and means for shaping said tube into a series of connected dumb-bells in combination with means for forming a tube around said dumb-bell shapes, means for shaping said outer tube into the form of connected hollow balls over the dumb-bells and devices for actuating said two shaping means in unison.

5. A machine for making bead chains, comprising means for drawing a ribbon into a tube, and means for shaping said tube into a series of connected dum-bells, in combination with means for forming a tube into hollow balls over said dumb-bell shapes, devices for actuating said two shaping means in unison and means whereby the two tubes are fed together intermittently.

6. A machine for making bead chains, comprising reciprocating swaging dies to shape a tube into a series of connected dumb-bells in combination with reciprocating swaging dies to shape another tube into hollow balls over said dumb-bells, devices for actuating said two sets of swaging dies in unison and means for feeding the two tubes together intermittently.

7. A machine for making bead chains, comprising dies for drawing ribbons into two tubes, swaging dies to shape said two tubes, one into connected dumb-bells and the other into connected hollow balls over said

dumb-bells, means for actuating said two swaging means in unison with each other, and means whereby the tubes are fed together intermittently.

8. A machine for making bead chains, comprising dies for drawing ribbons into two tubes, sets of dies to shape said two tubes, one into connected dumb-bells and the other into connected hollow balls over said dumb-bells, means for actuating said two sets of shaping dies in unison and means for reciprocating the drawing dies together in one direction to draw the ribbons into tubes and in the other direction to feed the tubes through the shaping dies.

9. A machine for making bead chains, comprising dies for drawing ribbons into two tubes, sets of swaging dies to shape said two tubes, one into connected dumb-bells and the other into connected hollow balls over said dumb-bells, and means for oscillating said drawing dies first in one direction and then in the other direction between swaging actions for the purpose set forth.

10. A machine for making bead chains, comprising dies for drawing ribbons into two tubes, sets of swaging dies to shape said two tubes, one into connected dumb-bells and the other into connected hollow balls over said dumb-bells, means for oscillating said drawing dies first in one direction and then in the other between swaging actions, and means for reciprocating said drawing dies together, in one direction to draw the ribbons into tubes and in the other direction to feed the tubes through the swaging dies.

11. A machine for making bead chains, comprising means for shaping a tube into a series of connected dumb-bells in combination with means for forming a tube around said dumb-bell shapes, means for shaping said outer tube into the form of connected hollow balls over the dumb-bells, means for turning said tubes back and forth at intervals and devices for actuating said two shaping means in unison.

12. A machine for making bead chains, comprising means for drawing ribbons into two tubes, two sets of swaging dies actuated in unison to shape said two tubes, one into connected dumb-bells and the other into connected hollow balls over said dumb-bells, and means for turning said tubes intermittently back and forth, for the purpose described.

13. A machine for making bead chains, comprising means for forming connected dumb-bells, means for passing over the dumb-bells a tube of connected balls and devices for bending the chain on leaving the ball-forming means, for the purpose described.

14. A machine for making bead chains, having dies for shaping a tube into connected balls, the depressions at the leaving end of the dies being offset, for the purpose described.

15. A machine for making bead chains, having sets of swaging dies to shape a tube into connected dumb-bells and to shape another tube into connected hollow balls over the dumb-bells, and reciprocating gates carrying the movable dies with lost motion, for the purpose described, in combination with means for intermittently feeding the tubes through the dies.

16. A machine for making bead chains, having swaging dies to shape a tube into connected balls and a reciprocating gate carrying the movable die with lost motion, in combination with means to intermittently feed the tube through the dies.

17. A machine for making bead chains, comprising dies for drawing ribbons into two tubes, sets of swaging dies to shape said two tubes, one into connected dumb-bells and the other into connected hollow balls over said dumb-bells, means for reciprocating the drawing dies together, in one direction to draw the tubes and in the other direction to feed the tubes, and means for readily disconnecting the drawing die for the outer tube to stop the drawing and feeding actions thereof.

18. A machine for making bead chains, comprising dies for drawing ribbons into two tubes, sets of swaging dies and operating slides to shape said two tubes, one into connected dumb-bells and the other into connected hollow balls over said dumb-bells, means for reciprocating the drawing dies together, in one direction to draw the tubes and in the other direction to feed the tubes, means for readily disconnecting the drawing die for the outer tube and means for readily detaching the movable swaging die for said tube from its slide, to clamp said outer tube.

19. A machine for making bead chains, comprising dies for drawing ribbons into two tubes, sets of swaging dies to shape said two tubes, one into connected dumb-bells and the other into connected hollow balls over the dumb-bells, means for reciprocating the drawing dies together, in one direction to draw the tubes and in the other direction to feed them, and means for readily withdrawing the die for the dumb-bell tube and its contained material, for the purpose described.

20. A machine for making bead chains, having a drawing die to draw a ribbon into a tube, swaging dies to shape said tube into connected balls and a reciprocating gate carrying the movable swaging die with lost motion, as and for the purpose set forth.

21. A machine for making bead chains, having two drawing dies to draw ribbons

into two tubes, sets of swaging dies to shape said two tubes, one into connected dumb bells and the other into connected hollow balls over said dumbbells, and reciprocating gates carrying the movable swaging dies with lost motion, as and for the purpose set forth.

In testimony whereof we have signed our names to this specification, in the presence of two subscribing witnesses.

GILBERT W. GOODRIDGE.
WILLIAM J. GAGNON.

Witnesses:
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