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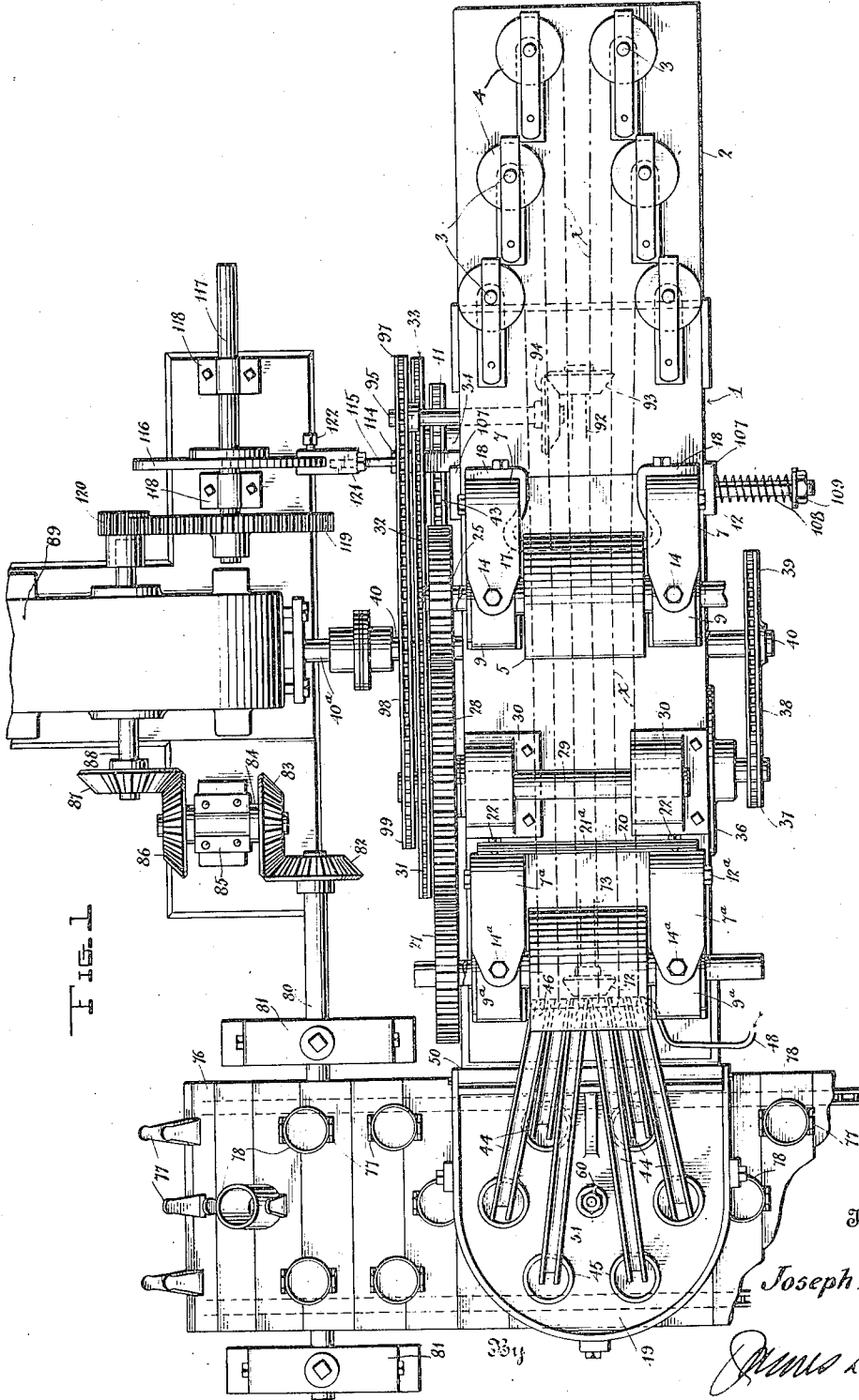
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J. A. WOLLE

METHOD OF AND APPARATUS FOR MAKING CURLED WIRE

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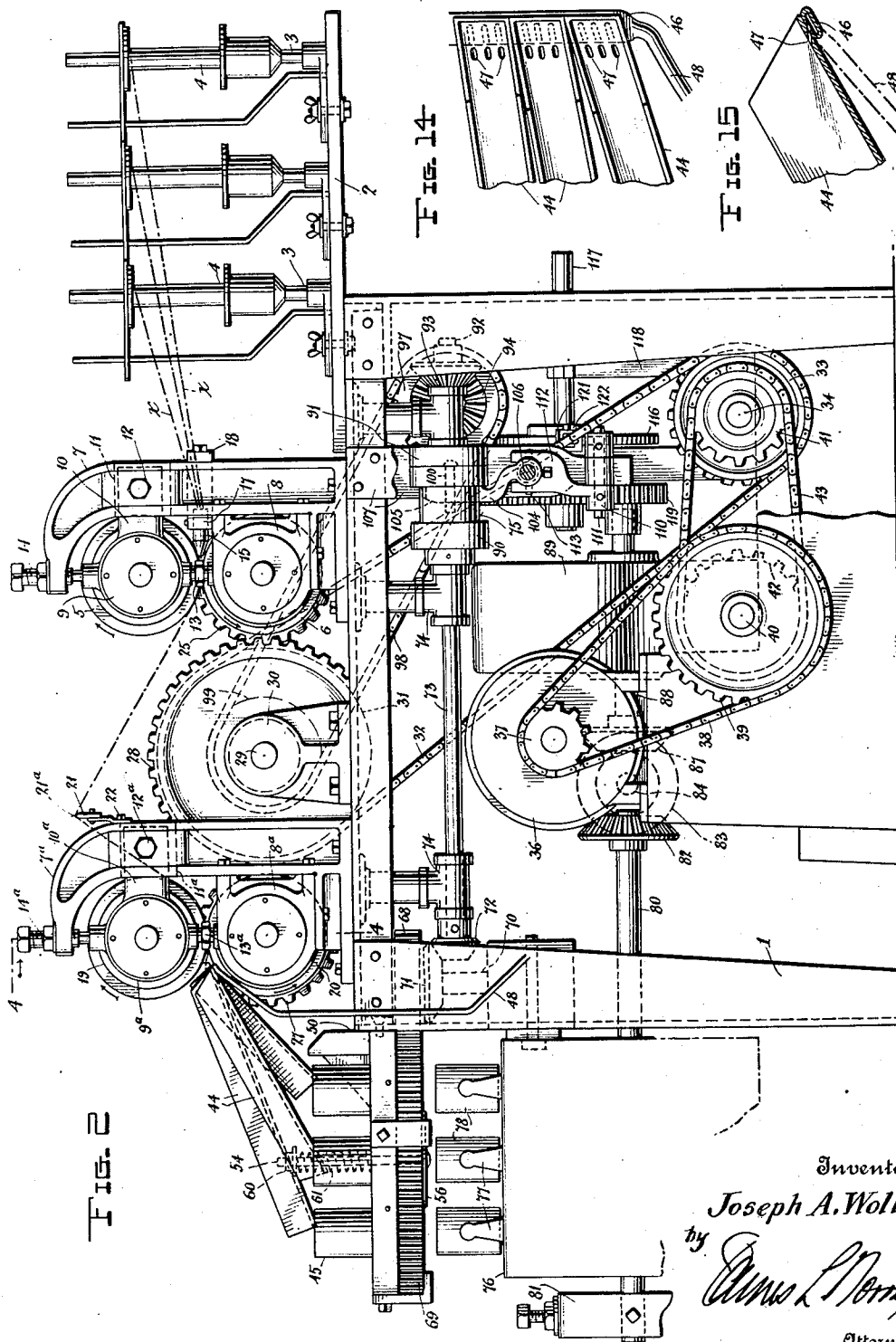
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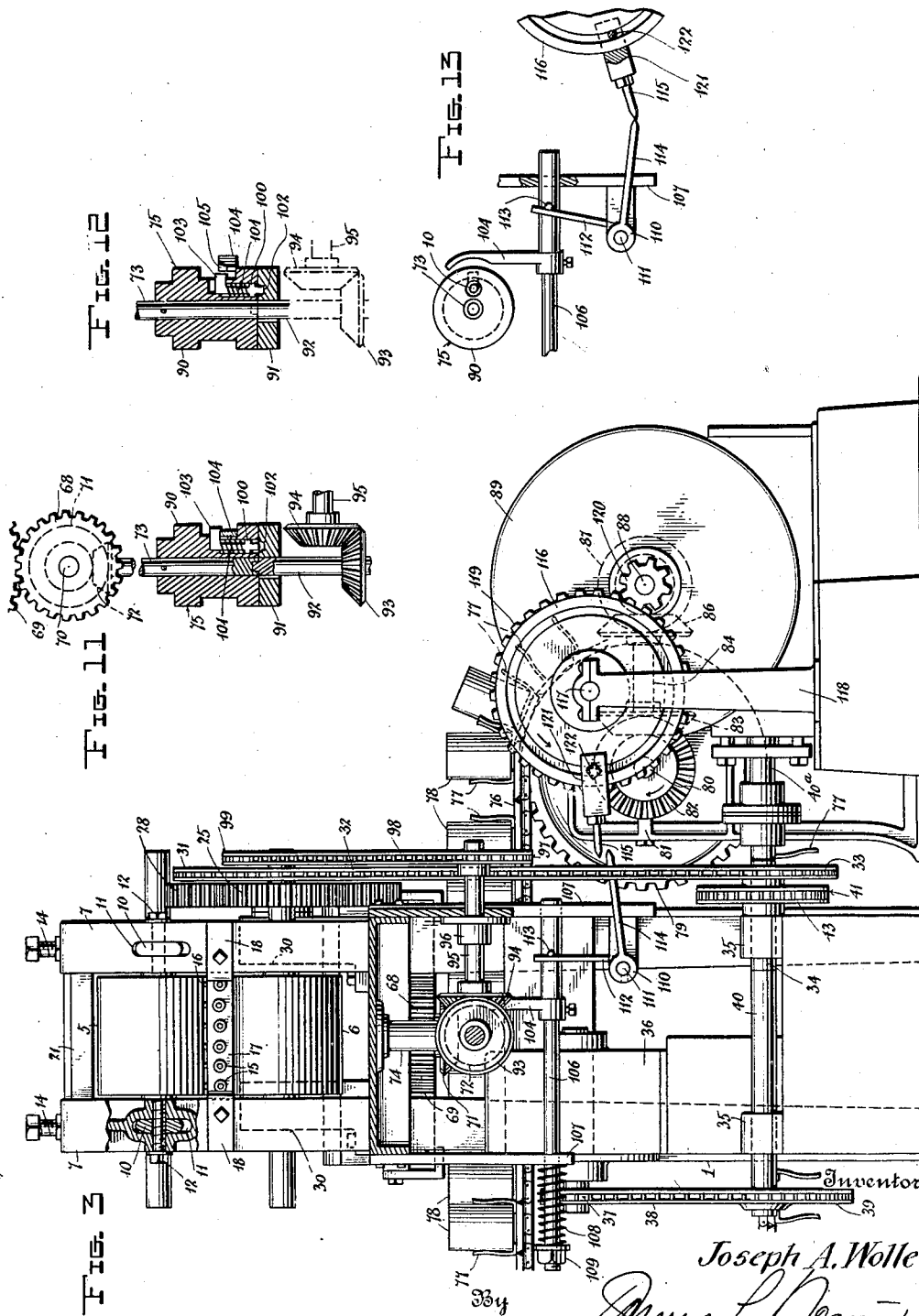
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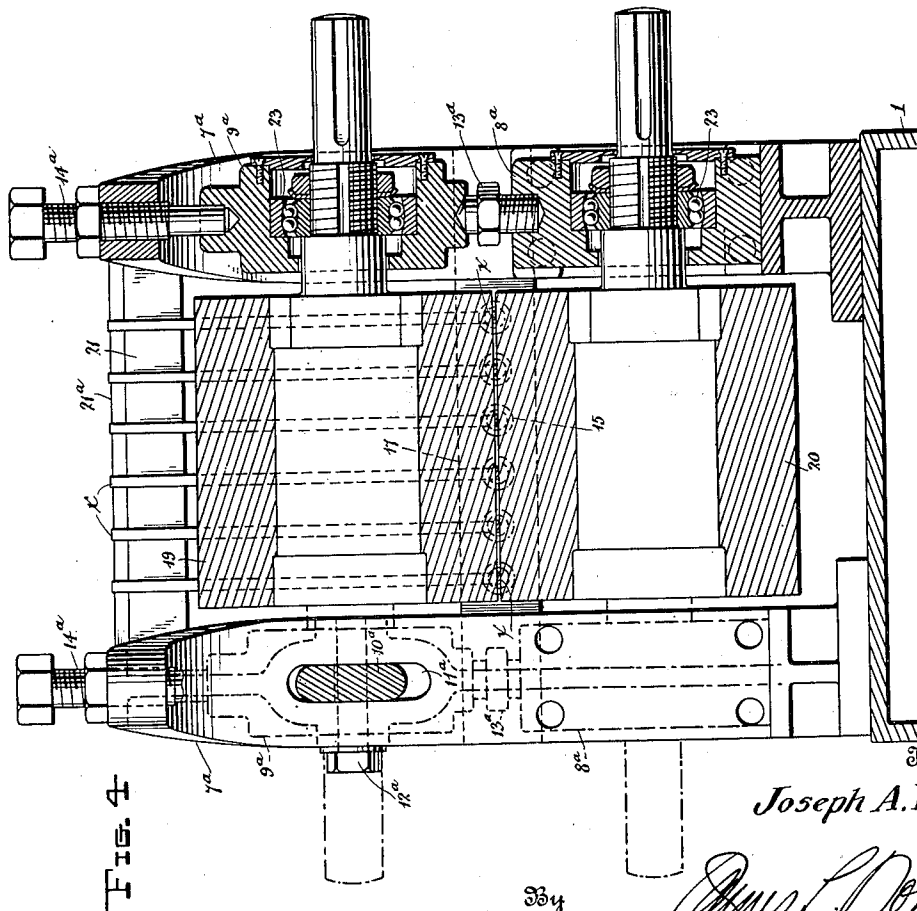
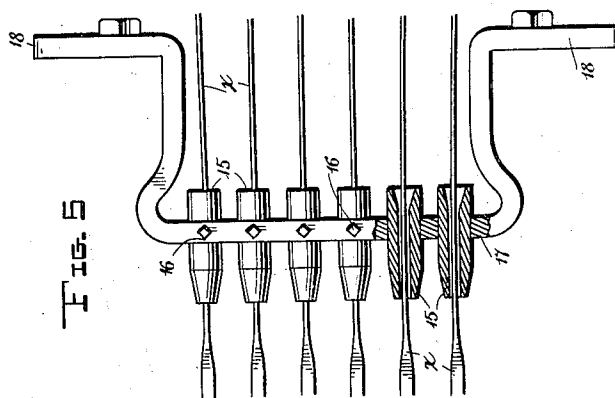
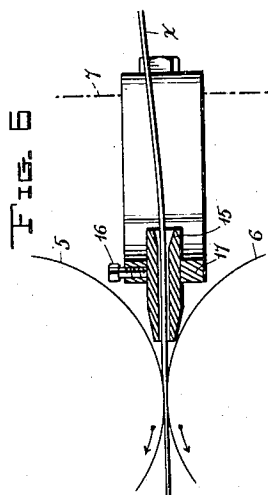
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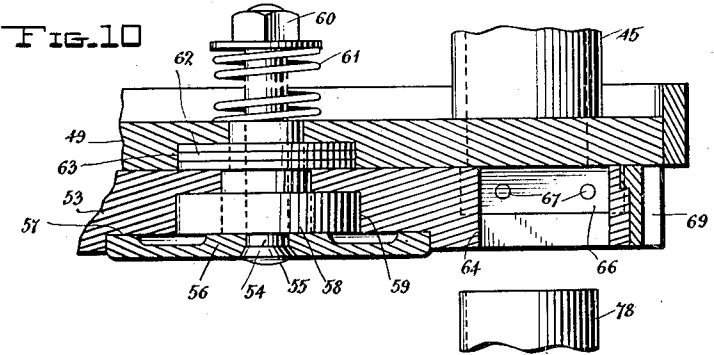
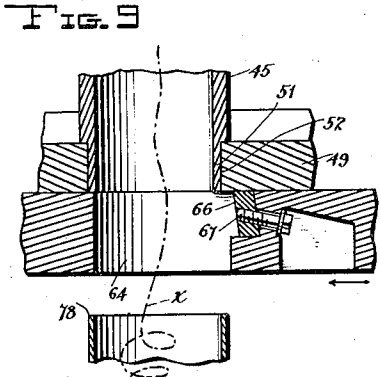
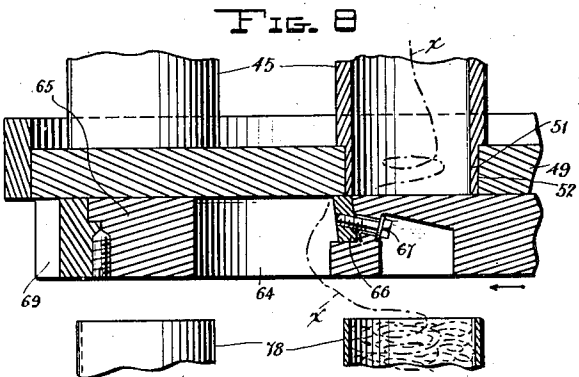
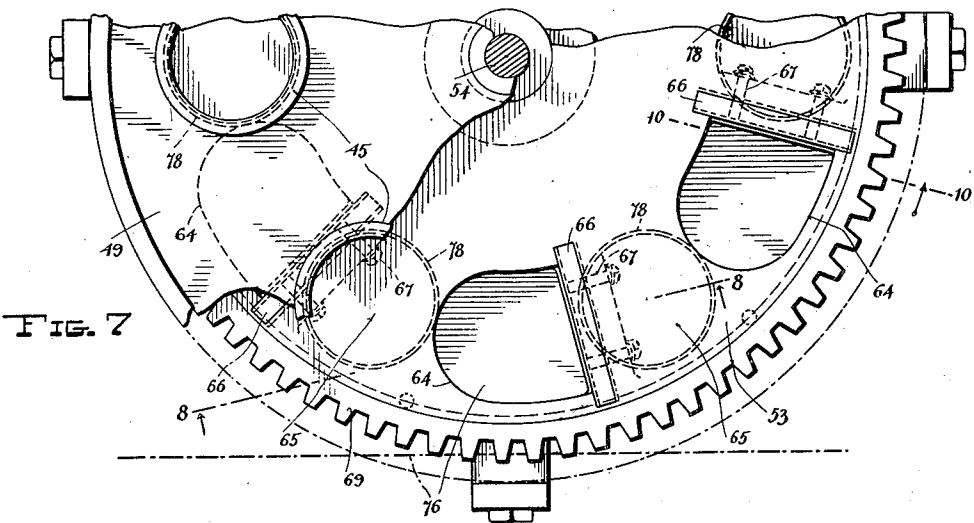
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5 Sheets-Sheet 5



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METHOD OF AND APPARATUS FOR MAKING CURLED WIRE.

Application filed October 1, 1926. Serial No. 138,909.

The present invention relates to the art of making metal sponge or similar products composed of flat wires or filaments which are curled or convoluted, and the primary object 5 of the invention is to provide a novel and improved method of and apparatus for making such metal sponge or similar product whereby the same may be produced rapidly and inexpensively from stock wire.

10 A further object of the invention is to provide a machine for measuring and packaging the metal sponge or similar product whereby predetermined amounts of the product may be measured uniformly and automatically introduced into receptacles or containers suitable for shipment and sale, the measuring and packaging operations being performed rapidly and automatically, thus enabling the machine to produce, measure and package a 20 relatively large amount of the product.

In the accompanying drawings which illustrate a machine for carrying out the invention,

25 Figure 1 is a top plan view of a machine for making curled wire suitable for use as a metal sponge or similar article, the machine embodying means for measuring the curled wire to form uniform charges of predetermined amount, and means for introducing 30 such charges into suitable receptacles.

Figure 2 is a side elevation of the machine shown in Figure 1.

35 Figure 3 is an end elevation of the machine shown in Figures 1 and 2 as viewed from the right in those figures.

Figure 4 represents on an enlarged scale a vertical cross section through a portion of the machine taken on the line 4—4 of Figure 2.

40 Figure 5 is a top plan view of the eyes which guide the wires as they pass to the wire flattening rolls.

45 Figure 6 represents diagrammatically a vertical section through one of the wire guiding eyes and the adjacent flattening rolls between which the wire is directed by the eye.

50 Figure 7 represents on an enlarged scale and a portion broken away part of the head which supports the measuring receptacles and the member beneath it which controls the delivery of the measured charges of material from the measuring receptacles into the containers and severs the wires.

Figure 8 represents a vertical section taken along the line 8—8 of Figure 7, the 55 parts being in the relative position shown in Figure 7.

Figure 9 is a view similar to Figure 8, the controlling member however being shown in the position in which the measured charges 60 of the product are transferred from the measuring receptacles to the containers.

Figure 10 represents a vertical section on the line 10—10 of Figure 7.

65 Figure 11 is a detail view of the driving gearing for the member which controls the delivery of the measured charges to the containers and severs the wires, the parts being shown in their normal inactive position.

70 Figure 12 is a detail view of part of the driving mechanism shown in engaged position.

Figure 13 is a detail view of the clutch-controlling mechanism, such mechanism being shown actuated to engage the clutch as 75 shown in Figure 12.

Figure 14 is a top plan view, on an enlarged scale, of some of the delivery troughs, showing the air blast orifices therein; and

80 Figure 15 represents a vertical section through the upper end of one of the troughs and the air blast orifices therein.

Similar parts are designated by the same reference characters in the several figures.

85 The present invention is applicable generally to the production of curled wire or filaments suitable for metal sponge such as that used extensively for cleaning, polishing and similar purposes or for other uses where a product of that kind is suitable. The invention 90 is preferably carried out with the aid of a machine such as that shown in the accompanying drawings and hereinafter described in detail, but it is to be understood that the invention is not restricted to a machine of the precise construction shown as 95 equivalent structures are contemplated and will be included within the scope of the claims.

100 A machine as shown in the present instance comprises a main frame 1 which is preferably composed of metal and is in substantially the form of a table, the operative mechanism of the machine being supported on the top of the table and the driving and controlling means 105 therefor being accommodated beneath the ta-

ble. According to the present invention, wire which may be of the ordinary round form and composed of a suitable metal or alloy is fed to rolls which flatten the wire into very thin ribbons. For this purpose an extension 2 may be mounted at one end of the main frame and provided with a suitable number of spindles 3 to receive spools 4 of wire. The spool-receiving spindles are preferably staggered, substantially as is shown in Figure 1 so that the wires, designated by x unwinding from the wire-containing spools will be suitably spaced to enter the machine. The spools of wire may be applied to and the empty spools removed from the upper ends of the spindles. The wire-flattening rolls 5 and 6 are arranged to receive the wires from the different spools, and these rolls are preferably arranged one above the other in the preferred construction, these rolls being supported by bearings which are held in a pair of end frames 7. The bearing at each end of the lower roll 6 is mounted in a bearing block 8 which rests on the base of the frame 7 and is immovably bolted or secured thereto, and the bearings for the upper roll 5 are fitted in bearing blocks 9 which have tongues or extensions 10 thereon which extend into slots 11 formed in the frames 7 and are retained therein by bolts 12. The tongues 10 are capable of rocking or tilting within the slots 11 to permit adjustment of the upper roll 5 relatively to the lower roll 6 to enable the thickness of the flat ribbons produced from the wires to be gaged. Suitable means is provided for immovably retaining the upper roll 5 at different set distances from the lower roll 6. Preferably, screws 13 are threaded in the lower bearing blocks 8 and have conical ends which engage in seats formed in the under sides of the upper bearing blocks 9, the screws having wrench-receiving portions thereon as shown. With this arrangement, rotation of the screws 13 acts to adjust the upper roll 5 vertically, the adjusting motion taking place about the bolts 12, and this vertical adjustment of the upper roll enables the spacing between the upper and lower rolls to be varied, thereby varying the thickness of the flat ribbons into which the wires are rolled by these rolls. The screws 13 may be adjusted individually as well as in unison, thereby enabling parallelism between the surfaces of these rollers to be attained and maintained. The upper bearing blocks 9 are held slidably against the adjacent screws 13 by locking screws 14 which may be threaded into overhanging portions of the frames 7 so that they will bear down upon the upper bearing blocks 9, and these locking screws will also sustain reaction against the upper roll 5 due to the passage of the wires between the rolls.

In order to direct the wires in appropriate parallel paths while passing between the flattening rolls, a series of eyes 15 is preferably employed, each eye having a bore through

which the respective wire is threaded. The series of eyes may be secured as by set screws 16 in a rigid bar 17 and the ends 18 of this bar may be bolted or otherwise secured to the frames 7. The wire guiding eyes are located at the side of the rolls 5 and 6 to which the wires are fed from the wire-containing spools and the eyes are located substantially in the plane of the space between the rolls and through which the wire passes. These eyes facilitate the threading of the wires between the rolls 5 and 6 as they will direct the ends of the wires into the space between these rolls, and during the operation of the machine these eyes will maintain the wires in properly spaced relation as they enter between the flattening rolls, thereby avoiding crossing or tangling of the wires.

The flattened wires delivered from the rolls 5 and 6 are according to the present invention, subjected to a curling treatment which gives them a tendency to curl, but the wires are prevented from curling until after they are ready for curling and delivery. For this purpose, the machine is provided with a pair of tensioning and feeding rolls 19 and 20 which may be rubber covered or otherwise suitably surfaced to enable them to grip the thin flat wires between them and to maintain a tension upon the wires which draws or feeds them through the machine. The rolls 19 and 20 may be supported by a frame 7^a which is a duplicate of the frame 7 and they may have bearing blocks 8^a and 9^a similar to the bearing blocks 8 and 9 previously described in connection with the wire-flattening rolls. The bearing blocks for the upper roll 19 is also preferably provided with tongues or extensions 10^a which fit into slots 11^a in the frames 7^a and they may be capable of pivoting about the bolts 12^a. Also the bearing blocks of the upper and lower rolls may be provided with screws 13^a similar to the screws 13 previously described whereby the rolls 19 and 20 may be relatively adjusted to insure firm gripping of the wire ribbons to maintain uniform tension thereon. Screws 14^a may be employed to lock the upper roll 19 in different adjusted relation with the lower roll.

The flat wires or ribbons, while passing between the flattening rolls 5 and 6 and the tensioning rolls 19 and 20 are drawn over the edge of a curling blade 21 which may be extended across the rear of the frames 7^a and secured thereto by screws 22 or other suitable means. The edge 21^a of this blade is sharp, and the drawing of the flat wires or ribbons over this edge while the wires or ribbons are under tension produces a curling tendency in the flat wires or ribbons. The curling tendency thus produced would cause the flat wires or ribbons to immediately curl up if the wires or ribbons were free of tension. The rolls 19 and 20, however, are continuously driven at such a speed relatively to the speed

of the rolls 5 and 6 as to maintain tension upon the wires and hence the wires are maintained in uncurled flat form, which facilitates their feeding between the rolls 19 and 20.

5 The flattening rolls 5 and 6 are cylindrical and their faces are composed of metal of sufficient hardness and ground to sufficient accuracy to produce a regular or uniform flattening of the wire as it passes between these rollers. The rolls 5 and 6 and also the rolls 19
10 and 20 are suitably journaled in their respective frames, self-aligning ball bearings 23 as shown in Figure 4 being preferably used.

The rolls 5 and 6 are arranged to revolve at
15 equal peripheral speed but in reverse directions and are driven by a gear which is keyed or otherwise fixed to the shaft of the roll 6 and the rolls 19 and 20 are arranged to revolve at equal peripheral speed but in reverse direc-
20 tions and are driven by a gear 27 which is keyed or otherwise fixed on the shaft of the roll 20. The pair of rolls 5 and 6 and the pair of rolls 19 and 20 are driven continuously at suitable speed by an intermediate gear 28
25 which is mounted on a shaft 29 supported in bearings 30 on the main frame 1, the intermediate gear 28 being located between and meshing with the gears 25 and 27 which are fixed to the lower rolls 6 and 20. By this arrangement
30 the rolls 6 and 20 will be driven at the appropriate speed and in the same direction to feed the wires past them, and the upper rolls 5 and 19 will be driven at the same peripheral speed from the respective lower rolls.

35 The shaft 29 may be driven by a sprocket wheel 31 fixed thereon, this sprocket wheel receiving a chain 32 which receives its motion from a sprocket wheel 33 on a shaft 34, the latter being mounted in bearings 35 in the lower portion of the frame 1. The shaft
40 34 may be driven from an electric motor or other suitable source of power through a variable or other suitable kind of transmission. In the present instance an electric motor 36
45 is provided for driving the machine, having a sprocket 37 on its shaft which drives a chain 38 and the latter cooperates with a sprocket wheel 39 on a transmission shaft 40. The transmission shaft 40 and the shaft 34
50 may be connected in any suitable way to drive the machine at the desired speed, the shafts 34 and 40 in the present instances having sprockets 41 and 42 thereon and a chain 43 connecting the sprockets.

55 The continuous running of the wire flattening rolls 5 and 6 and the tensioning and feeding rolls 19 and 20 causes the wires to be delivered continuously from the rolls 19 and 20, and immediately upon the exit of the
60 wires from the rolls 19 and 20, the wires curl, due to the release of the tension which was maintained upon them while passing from the curler 21 to the rollers 19 and 20. The curled wires thus delivered by the rolls 19
65 and 20 are received respectively by trough

or chutes 44 which preferably slope downwardly from the points of delivery and are arranged to distribute the individual curled wires to separate measuring receptacles 45. In order to insure the feed of the curled wires
70 along the troughs or chutes 44, and thereby assist gravity to effect the prompt delivery of the curled wires to the respective measuring receptacles, means is provided for producing an air blast at the entrance end of
75 each trough, the air blast acting in the direction in which the wire feeds along the trough. As shown, an air distributing manifold 46 is applied to the under side of the entrance ends of the different troughs, the upper ends
80 of the troughs being preferably aligned as shown, and a suitable number of orifices 47 are drilled through the bottoms of the different troughs and into the manifold 46 at a downward inclination which nearly equals
85 the inclination of the bottoms of the troughs. The manifold 46 is connected to a pipe 48 which in turn is supplied with compressed air at a suitable pressure. The air thus supplied to the manifold 46 is projected through
90 the orifices 47 at a downward and forward inclination, the air jets impinging upon the curled wire contained in the respective troughs and thereby insuring continuous feed of the curled wires along the troughs and
95 into the respective measuring receptacles. Clogging of any of the troughs and the consequent interruption of the feed of wire therefrom is thereby avoided.

The receptacles 45 into which the respective troughs or chutes 44 direct the curled
100 wires are mounted on a head 49 which is bolted or otherwise secured in fixed relation with the main frame by a bracket 50. Preferably the lower ends of the receptacles 45 are reduced in diameter externally to form reduced
105 extensions 51 and these reduced extensions are fitted closely and immovably into apertures 52 formed in the head 49 and spaced equidistantly and concentrically thereof.
110 The extensions 51 on the receptacles are of sufficient length to extend to the under side of the head 49, and the under side of this head is flat, the head being formed for example of a flat circular plate, as shown.
115

Means is provided for closing the bottoms of the receptacles 45 to cause accumulation of quantities of curled wire therein and for opening the bottoms of these receptacles to permit the accumulated charges of curled
120 wire to discharge therefrom into appropriate containers, whereupon the bottoms of the receptacles are again closed so that they may receive and accumulate therein quantities of curled wire to form the succeeding charges.
125 Preferably and as shown in the present instance, such means comprises a rotatable member or plate 53 which is preferably flat at the top and fits closely against the under side of the head 49. The plate 53 is rotatable rela-
130

tively to the head and for this purpose it is preferable to connect the plate to the head by a pivot bolt 54, the head 55 of which engages a thrust plate 56 which is preferably seated in a recess 57 in the bottom of the plate 53. The bolt 54 carries a bearing 58 which is seated in a recess 59 in the plate 53, a ball bearing being preferably used, this bearing serving to accurately center the plate 53 with respect to the head 49. The bolt 54 extends upwardly through the plate 53 and the head 49 and is provided at its upper end with an adjusting nut 60 and a compression spring 61 which is interposed between the nut and the top of the head 49, this spring acting to automatically and yieldingly draw the plate 53 upwardly against the bottom of the head 49 and to maintain it in working relation therewith. Washers 62 may be interposed between the head 49 and the plate 53 to sustain more or less of the upward thrust of the plate 53 under the action of the spring 61, these washers being accommodated for example, in a recess 63 formed in the under side of the head 49 and surrounding the bolt 54.

The plate 53 is provided with an annular series of discharge openings 64 which correspond in number to the number of receptacles 45 on the head and the discharge openings are arranged concentrically with the receptacles 45 and are equidistantly spaced to conform with the circumferentially spacing of the receptacles 45 whereby rotation of the plate 53 will bring the discharge openings 64 into registration with the receptacles 45. For example, in the present instance six receptacles 45 are used, these receptacles being spaced equidistantly in a direction circumferentially of the head and accordingly six discharge openings 64 spaced equidistantly are provided in the plate 53. Consequently, each sixth of a revolution of the plate 53 will carry the discharge openings into the positions previously occupied by the discharge openings in advance of them and will also carry these openings past the bottoms of the receptacles 45. Blank portions 65 of sufficient area intervene between the discharge openings 64 in the plate 53 to enable the plate to close the bottoms of the receptacles 45, and these blank portions will be in position to close the bottoms of the receptacles as for example, as shown in Figures 7 and 8, when the plate 53 is in its normal position of rest and the curled wire is being fed into the receptacles 45 to make up charges therein. One-sixth of a revolution of the plate 53 will remove the blank portions of the plate 53 from beneath the receptacles, the charges of curled wire contained in the receptacles dropping by gravity from the receptacles through these openings 64 during their passage beneath the receptacles, and the remainder of the one-sixth revolution of the plate will bring the next succeeding blank portions thereof into

positions beneath the receptacles 45 thus closing them so that they may accumulate the succeeding charges of curled wire therein.

The rotatable plate 53 is utilized not only to control the discharge of the curled wire from the receptacles 45 but also for the purpose of severing the curled wires immediately after the charges thereof have been discharged from the receptacles. For this purpose the rear wall of each discharge opening 64, in the plate 53, has a severing blade 66 fitted therein, the blade being secured immovably in position, for example, by screws 67, and the upper edge of this blade, which is flush with the top of the plate 53, is adapted to co-act with the lower internal edge of the respective receptacle 45 to sever the curled wire. It will be noted that each charge of curled wire while contained in its respective receptacle 45 will be connected to the respective strand of curled wire feeding from the machine, and when the charges of curled wire discharge from the receptacles through the openings 64, such charges of wire will be connected to the respective strands of curled wire feeding from the machine but the continued rotation of the plate 53 brings the severing blade 66 into shearing relationship with the lower inner edge of the respective receptacle 45 immediately following registration of the respective discharge opening 64 with its receptacle 45 in consequence of which the curled wire steel attached to the charged wire is severed, this action being indicated diagrammatically in Figure 8. The final portion of the rotation of the plate 53 brings the blank portions 65 thereof beneath the receptacles 45 thus closing the bottoms thereof and preparing them to accumulate the next succeeding charges of curled wire therein.

The plate 53 is intermittently rotated during the operation of the machine to effect the discharge of the bunches or charges of curled wire at appropriately timed intervals by a pinion 68 which meshes with gear teeth 69 fixed to the periphery of the plate, the pinion 68 being fixed to a shaft 70, which is mounted in relatively fixed bearings in the main frame, and the shaft 70 is driven by a gear 71 which meshes with a gear or pinion 72 fixed on a shaft 73, the latter being journaled in relatively fixed bearings 74 supported on the under side of the main frame and being driven intermittently and at appropriately timed intervals through a clutch 75, the operation of which will be hereinafter described.

The charges of curled wire discharged from the receptacles 45 under the control of the plate 53 may be received in containers suitable for the packaging and shipment thereof. Preferably, a conveyer 76 is employed which has clips 77 or other means suitably placed thereon to detachably receive containers 78 and to position a set of these

containers directly beneath the set of receptacles 45 on the head, at each complete operation of the conveyer in an annular row to correspond with the annular row of receptacles 45 and the spacing thereof, so that at each operation of the conveyer one set of filled containers will be removed from beneath the receptacles 45 and another set of empty containers will be brought into registration therewith. The conveyer is preferably of the endless type, it being supported at its ends by suitable sprockets. The sprockets 79 which support the driving end of the conveyer are shown in the present instance, these sprockets being fixed to a driving shaft 80 which is journaled in suitable stationary bearings 81. The shaft 80 is driven by a gear 82 fixed to it and a cooperating gear 83 which is fixed to a shaft 84, the latter being journaled in a relatively fixed bracket 85 and having a driving gear 86 fixed on its opposite end. The gear 86 is successively rotated by interrupted gear 87 which is fixed on a shaft 88, this shaft being journaled in a housing 89 which contains a suitable reduction gearing which is driven by the shaft 40^a which is coupled to the continuously running shaft 40. The shaft 88 may be, for example, driven from the shaft 40^a through a worm on the latter shaft meshing with a worm wheel on the former shaft.

In using driving mechanism for the conveyer such as that described above each revolution of the gear 87 will cause the interrupted teeth thereon to impart a partial rotation to the gear 86 thus causing the conveyer to be advanced a step. The gearing may be so proportioned, for example, that each revolution of the gear 87 will advance the conveyer a step equal to one-quarter of its total movement at each operation so that four revolutions of the gear 87 will effect a complete advance of the conveyor which will remove a set of filled containers from beneath the filling head and will bring a set of empty containers into position beneath the head. During the period the conveyer is being advanced to remove a filled set of containers and to bring a set of empty containers to filling position, the curled wire is being fed continuously into the receptacles on the heads and hence is accumulating therein, and immediately after the set of empty containers has been brought to the filling position, the plate 53 is rotated thus causing the charges of curled wire accumulated in the receptacles on the head to discharge into the containers, the curled wires still attached to the charges of material are severed, and the bottoms of the receptacles on the head are again closed for the making up of the succeeding charges of curled wire. The present invention provides means for automatically operating the plate 53 so that it will perform its function

in proper timed relation with the advancing movements of the conveyer.

The operation of the plate 53 is controlled by the clutch 75 which is fixed on the shaft 73 which is geared to said plate. This clutch as is shown in detail in Figures 11 and 12, comprises a member 90, which is fixed to the shaft 73, and a cooperating clutch member 91 which is fixed to a shaft 92, the latter shaft being alined with but unconnected to the shaft 73 except when the clutch members 90 and 91 are in driving relation. The shaft 92 is driven by a gear 93 fixed thereon and a cooperating gear 94, the latter gear being fixed on a shaft 95 which is journaled in suitable bearings 96 mounted on the stationary main frame, and a shaft 95 has a sprocket wheel 97 fixed thereon which is connected by a chain 98 to a sprocket wheel 99 which is fixed on the shaft 29. The shaft 92 and the clutch member 91 thereon will, by this arrangement, be driven continuously during the running of the machine. The clutch 75 is of the single revolution type, that is it will normally be in released or disengaged condition and when engaged it will rotate one revolution and then automatically release. For example, as shown in the present instance, the driving clutch member 90 carries a plunger 100 which is actuated by a spring 101 in a direction to project it from the clutch member 20 into a notch or recess 102 in the continuously running driving clutch member 91. The tail 103 of this plunger is arranged to cooperate with a tripping member 104 when the latter is in one position and the plunger will be released so that it will cause engagement with the clutch when the releasing or controlling member 104 is retracted. As shown in the present instance, the controlling member 104 consists of an arm having a bevelled or inclined portion 105 on which the tail 103 of the clutch plunger is adapted to ride, this arm 104 being fixed on a bar 106 which is slidable longitudinally in bearings 107 on the stationary main frame. A compression spring 108 acts between one of the bearings 107 and a nut or abutment 109 on this bar to draw the bar toward the left in Figures 3 and 13 and to normally hold the controlling arm in such position. When the arm 104 is in this position it will be in the path of the tail 103 of the clutch plunger 100 and it will hold the plunger in retracted or non-driving position as is shown in Figure 11. When, however, the bar 106 is shifted toward the left or dotted line position, Figure 3, or the full line position, Figure 13, the arm 104 will be retracted out of the path of the tail 103, as shown diagrammatically in Figure 12, and the latter will then be free to move, under the action of its spring 101, into engagement with the notch or recess 102 in the continuously running clutch member

91. The driven clutch member 90 will thus be picked up by the continuously running clutch member 91 and in consequence the shaft 73 will be rotated. As the rotation of this shaft approaches a complete revolution the tail 103 of the clutch plunger will begin to ride on the bevelled or inclined portion 105 of the arm 104 which has in the mean time returned to its left hand position to the full line position shown in Figure 3, and as the rotation of the shaft 73 continues, the riding of the tail 103 of the clutch plunger on the bevelled or inclined portion 105 of the arm 104 will cause the plunger to be retracted from the notch or recess 102 in the clutch member 91, and when the disengagement of the clutch plunger from this notch or recess is complete, the clutch member 90 will be disconnected from the clutch member 91 so that the latter may continue to revolve the clutch member 91 and the shaft 73 to which is it attached, have come to rest. Thus one complete revolution of the shaft 73 will take place incident to each engagement of the clutch 75. It will be understood that the gearing between the shaft 73 and the plate 53 is such that one revolution of the shaft 73 will cause a one-sixth revolution of the plate 53 in correspondence with the number of receptacles carried by the filling head thus insuring operation of the plate 53 to uncover the bottoms of the wire containing receptacles, sever of the wires from the wire charges and reclose the bottoms of the receptacles 45.

Means is provided for automatically actuating the bar 106 to release the clutch plunger 100 and thus cause engagement of the clutch 75 immediately after the conveyer has completed the step in its operation which brings the set of empty containers thereon into filled position. As shown in the present instance, actuation of the bar 106, which will cause retraction of the arm 104, is effected by a bell-crank lever 110 which is pivoted at 111 to a part of the main frame of the machine, one arm 112 of this bell crank lever being arranged in the path of a tripping arm 115 which is fixed at an appropriate point in the circumference of a disk 116, the latter being fixed on a shaft 117 which is journaled in relatively fixed bearings 118. The shaft 117 is driven by a gear 119 which is fixed to it and meshes with a pinion 120, the latter being fixed on the shaft 88 which operates the conveyer. The position of the trip arm 115 around the disk 116 may be adjusted to effect proper timing of the tripping of the clutch by providing the tripping arm with a forked holder 121 to straddle the disk 116 and providing the holder with a set-screw 122 adapted to clamp the holder in adjusted position. The gearing 119 and 120 are so proportioned and the tripping arm 115 is so positioned on the disk 116 as to cause the arm 115 to engage the arm 114 of the bell crank lever and to de-

press this arm immediately after the conveyer has completed the last step in its operation and which brings a set of empty containers into filling position. Depression of the arm 114 of the bell crank lever by the tripping arm 115 moves the arm 112 of the bell crank lever towards the right, and this arm 112 acting against the pin 113 on the bar 106 causes the latter to shift towards the right into the dotted line position, Figure 3, or the full line position, Figure 13, the arm 104 being thus retracted from the tail 103 of the clutch plunger as shown in Figure 12, and thereby causing the clutch to be engaged and to effect the revolution of the shaft 73 and thus cause the plate 53 to perform its wire discharge and severing operation. The arm 114 is only momentarily engaged by the tripping arm 115 and immediately after the arm 115 passes the arm 114 the latter is released and the bar 106 is immediately restored to its normal position by the spring 108, the bevel 105 of the arm 104 being then positioned in the path of the tail 103 of the clutch so that as the latter nears the completion of its revolution it will be disengaged by retraction of the clutch plunger and the shaft 73 will then come to rest.

The complete operation of the machine may briefly be described as follows. Spools containing wire of a kind suitable for the production of the curled wire product are placed upon the spindles 3 and the ends of the wires are threaded through the respective eyes 15 and then are passed between the flattening rolls 5 and 6, thence over the curling blade 21 and the wires are finally passed between the feed rollers 19 and 20 so that they will be advanced into the troughs or chutes 44. Operation of the motor 36 will drive the flattening rolls 5 and 6 and feeding rolls 19 and 20 continuously and at such relative speed as to cause the portions of the wires which extend between the flattening rolls and the feeding rolls to be maintained under tension. The passage of the wires between the rolls 5 and 6 causes them to be flattened so that they will be very thin having for example, the thickness of tinsel, and the drawing of these flat wires over the sharp edge of the curling blade 21 while the wires are under tension imparts to the flat wires a tendency to curl up. Curling of the wires at this point, however, is restrained or prevented by the tension on the wires, but as the wires are delivered from the rolls 19 and 20 to the distributing troughs or chutes 44, the wires will curl, due to the release of tension thereon, and the curled wires will descend through the respective chutes into the corresponding receptacles 45. Normally the plate 53 will be stationary and the blank portions thereof will close the bottoms of the receptacles 45; hence the curled wires delivered to these receptacles will accumulate therein and form bunches or charges.

During the continuous operation of the flattening and feeding rolls the conveyer will be advancing step-by-step due to the continuous rotation of the shaft 88 and the intermittent rotation imparted to the conveyer driving shaft 80 by the interrupted gear 87. Immediately after the conveyer has been advanced through the step which brings the container thereon into filling position immediately beneath the receptacles 45, the tripping arm will have reached a position in its rotation where it depresses the arm 114 and thereby retracts the bar 106 thereby tripping the clutch plunger 100 and engaging the clutch 75, whereby the plate 53 will rotate to bring the discharge openings 64 therein beneath the wire containing receptacles 45, thereby causing the charges or bunches of wire accumulated therein to drop by gravity from the receptacles through the openings 64 and into the containers 78 which are then positioned beneath them immediately following which the severing blades 66 will sever the ends of the curled wires and the bottoms of the receptacles 45 will be closed. The tripping arm 115, quickly passes the arm 114 thus releasing the bar 106 so that it returns to its normal position as shown by full lines, Figure 3, the arm 104 being thus positioned to engage the tail of the clutch plunger 100 and to retract this plunger and thereby disconnect the clutch upon completion of one revolution thereof, the plate 53 being thereby stopped. The continued running of the flattening rolls and feed rolls causes succeeding charges of the curled wires to accumulate in the receptacles 45 and during this operation the conveyer receives successive movements which eventually remove the filled containers thereon from filling position and bring another set of empty receptacles in filling position, the cycle of operation above described being performed automatically during the operation of the machine. The empty containers 78 may be manually placed in the clips 77 on the conveyer in advance of the filling position and the filled containers may be removed from the conveyer at the delivery side of the filling head.

The driving mechanism for the different elements of the machine, as shown in the present instance, enables the machine to be readily adjusted to accurately measure and deliver any desired amount of curled wire to each container. The regulation of the amount of wire delivered to each container depends upon the speed at which the flattening rolls and feeding rolls operate. As shown, both of these pairs of rolls are driven from the shaft 34 which may be connected by a suitable variable speed gearing to the shaft 40, while the shaft 40 drives the mechanisms, which advance the conveyor and control the tripping of the clutch 75. By varying the speed at which the shaft 34 runs with respect to the speed of the shaft 40, the speed of the rolls 5 and 6,

and 19 and 20 operate and hence the amount of wire fed into the containers during each interval elapsing between the operations of the clutch 75 may be varied as desired without disturbing the timing of the operation of the conveyer and the tripping of the clutch 75 which controls the depositing of the charges of curled wire into the containers.

The present invention provides a novel and improved method of making curled wire which enables the curled wire to be produced rapidly and directly from ordinary stock-wire as it is fed from the wire-containing spools. By rolling the wire to flatten it, the wire may be reduced accurately to any desired thickness and the strength or physical structure of the wire will not be impaired and hence the curled wire will not easily break up or disintegrate. The tendency of the flattened wires to inherently curl is imparted to the wires while they are under tension and hence the wires cannot become tangled or broken, and this tension is maintained on the wires by the feeding rolls so that the flat wires may pass flatwise between the feed rolls and thus be effectively fed by them, this enabling the wires to be fed rapidly and concurrently flattened and curled.

The invention also provides a machine which is capable of rapidly feeding, flattening and curling the wires and forming the curled wires into charges containing uniformly the desired length or amount of wire, the different wires being advanced at the same speed through the machine, and the automatic means provided for introducing the charges into containers enables the machine to be operated with facility and with minimum attention.

I claim as my invention:—

1. The method of making curled wire which comprises rolling wire to flatten it, maintaining the flattened wire while moving under tension, and causing the flattened wire while moving and under tension to pass over a curling edge which imparts to the wire an inherent tendency to curl.

2. The method of making curled wire which comprises passing wire continuously between rolls thereby flattening the wire, feeding the flattened wire continuously between feed rolls whereby the flattened wire is maintained under tension, and causing the tensioned flattened wire, while maintained under tension and moving continuously, to pass over a curling edge thereby imparting to it an inherent tendency to curl.

3. The method of making curled wire which comprises flattening wire while moving continuously, imparting to the flattened wire, while moving continuously, an inherent tendency to curl, maintaining the flattened wire under tension, thereby preventing curling thereof, and then relieving the wire of tension, thereby permitting it to curl.

4. A machine for making curled wire comprising rolls operative to flatten wire, feed rolls operative to advance the flattened wire continuously and to maintain the flattened wire under tension, and means operative on the continuously advancing flattened wire under tension to impart to it an inherent tendency to curl.

5. A machine for making curled wire comprising continuously revolving rolls operative to flatten wire, a curling edge, and means for drawing the flattened wire over said curling edge and for maintaining the wire under tension.

6. A machine for making curled wire comprising rolls adapted to receive wire between them and operative to flatten said wire, feed rolls adapted to receive the flattened wire between them and operative to advance said wire and to maintain it under tension, and means arranged to act on the tensioned wire to impart to it a tendency to curl.

7. A machine for making curled wire comprising a pair of wire flattening rolls, a pair of feed rolls adapted to draw the flattened wire between them, means for driving said pairs of rolls at a relative speed which will maintain the flattened wire under tension, and curling means arranged to act on the tensioned flattened wire.

8. A machine for making curled wire comprising a wire curling member, means for maintaining the wire under tension while being acted on by said curling member and for releasing such tension on the wire after it has passed said curling member, receptacles into which the curled wire, freed of tension, is fed, a conveyer having means for placing containers in filling position with respect to said receptacles, and means for controlling the discharge of curled wire from said receptacles into said containers.

9. A machine for making curled wire comprising a wire curling member, continuously running means for advancing the wire, means for maintaining the wire under tension while passing said curling member and for freeing it of tension after passing said curling member, and intermittently operative container-filling means for the tension-freed curled wire.

10. A machine for making curled wire comprising continuously running means for feeding and tensioning wire, means for imparting a curling tendency to the wire, means for filling the curled wire, freed of tension, into containers, and means governed by the feeding means for controlling the operation of the filling means.

11. A machine for making curled wire comprising means for continuously advancing and tensioning wire, means for imparting a curling tendency to the wire while main-

tained under tension, receptacles into which the tension-freed curled wire is fed, a member operative to discharge the curled wire from said receptacles, and means for actuating said member after a predetermined amount of wire has been fed into each receptacle.

12. A machine for making curled wire comprising means for curling and feeding wire while maintained under tension, receptacles into which the tension-freed curled wire is fed, a member operative to discharge the wire from said receptacles and to sever the wire, and means controlled according to the length of wire fed into each receptacle for actuating said member periodically.

13. A machine for making curled wire comprising wire feeding and curling means operative to maintain the wire under tension during curling thereof, receptacles to receive the tension-freed curled wire from said feeding and curling means, and a member movable relatively to said receptacles and having discharge openings therein through which charges of wire in said receptacles may discharge therefrom and having portions intervening the discharge openings for closing said receptacles, and cutter blades at the edges of the discharge openings for severing the wires connected to the charges after the latter have been discharged from the receptacles.

14. A machine of the class described comprising wire tensioning, feeding and curling means operative to maintain the wire under tension during curling thereof, container-filling means to receive the wire delivered by said feeding and curling means and free of tension, a conveyer for positioning containers to receive wire from the filling means, means for periodically operating the conveyer to bring containers thereon in filling position, and means operative while the conveyer is at rest to cause discharge of wire from the filling means into containers on the conveyer.

15. A machine of the class described comprising continuously operative wire tensioning feeding and curling means operative to maintain the wire under tension during curling and to deliver curled wire freed of tension, an intermittently operative conveyer for bringing containers into filling position, filling means to receive the tension-free curled wire from the feeding and curling means and having an intermittently operative member for discharging wire therefrom into containers on the conveyer, and means connected to the wire feeding means for actuating said member while the conveyer is at rest and after a predetermined amount of wire has been fed to the filling means.

In testimony whereof I have hereunto set my hand.

JOSEPH A. WOLLE.