March 15, 1932. D. D. MYERS 1,850,029

PRONG MAKING MACHINE

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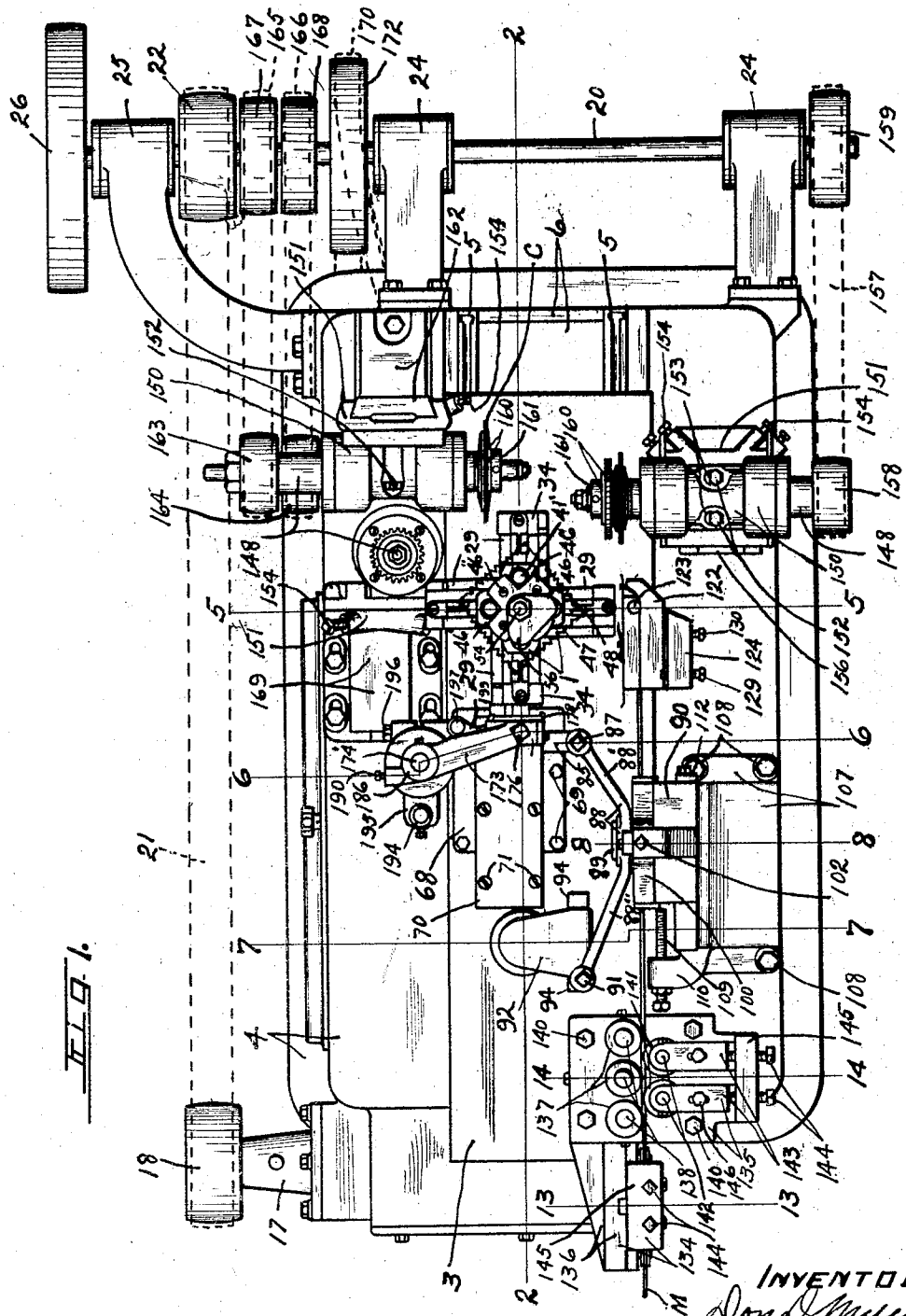


FIG. 1.

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PRONG MAKING MACHINE

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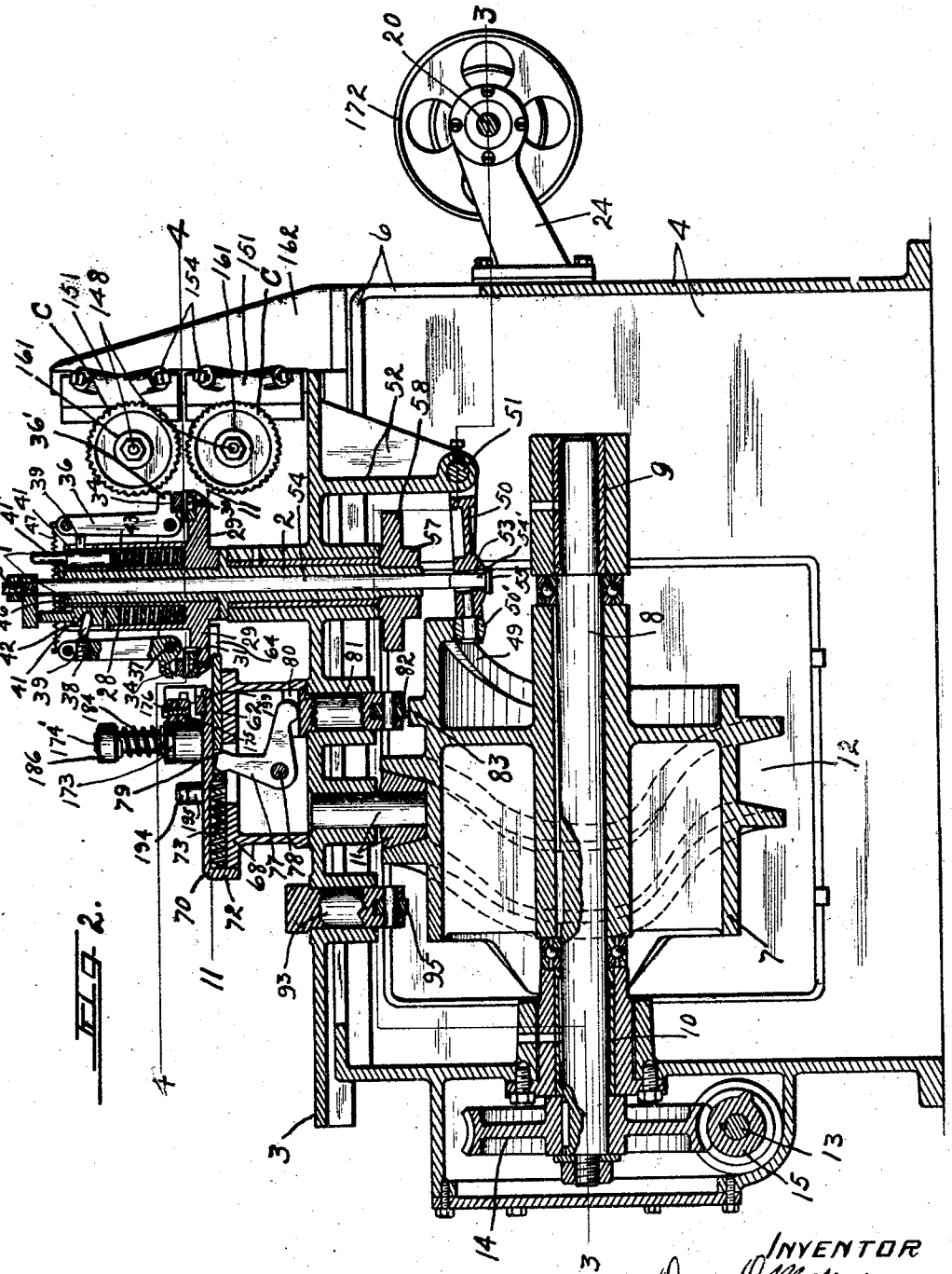


FIG. 2.

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PRONG MAKING MACHINE

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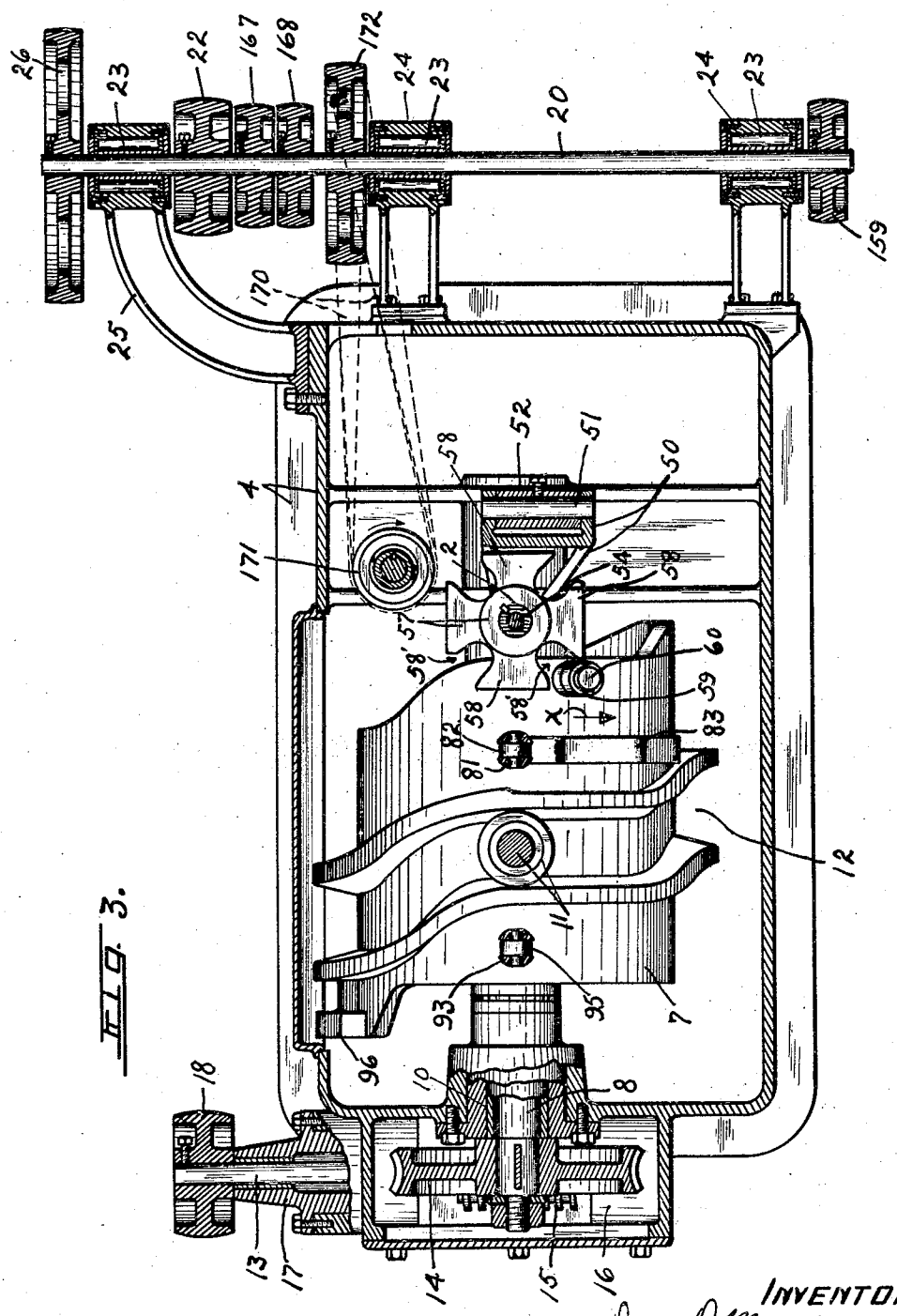


FIG. 3.

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PRONG MAKING MACHINE

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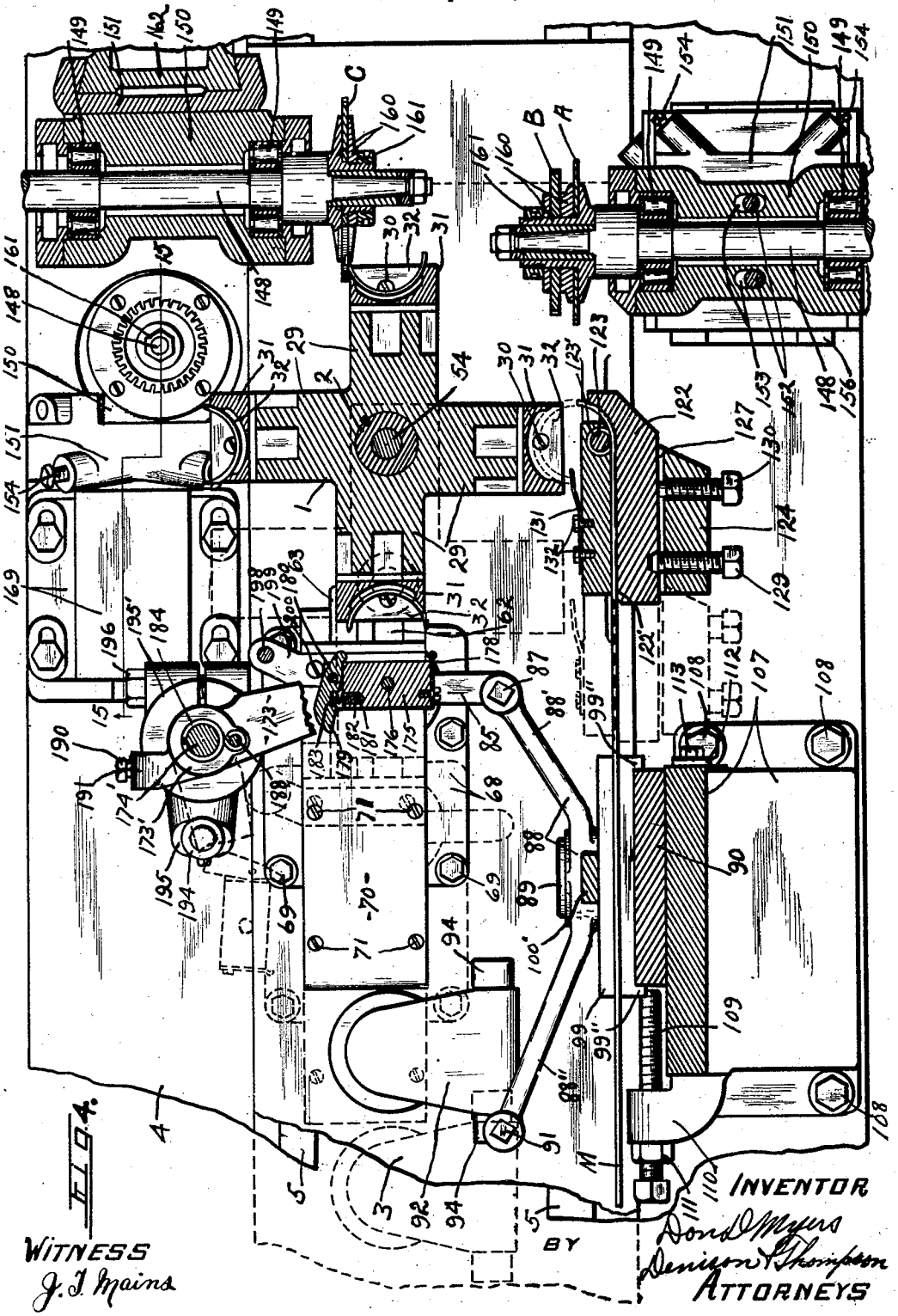


FIG. 4.

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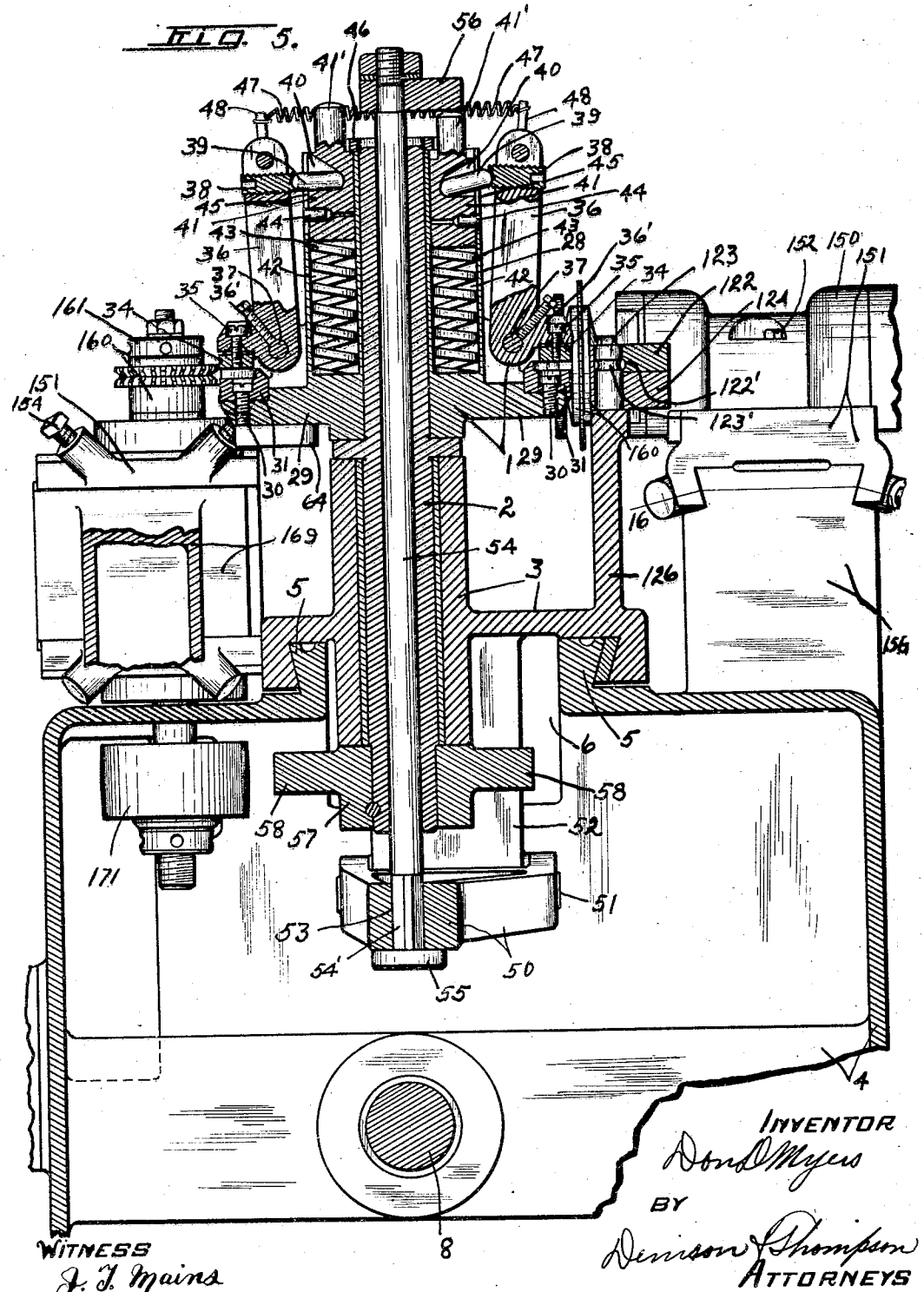
INVENTOR
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PRONG MAKING MACHINE

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FIG. 5.



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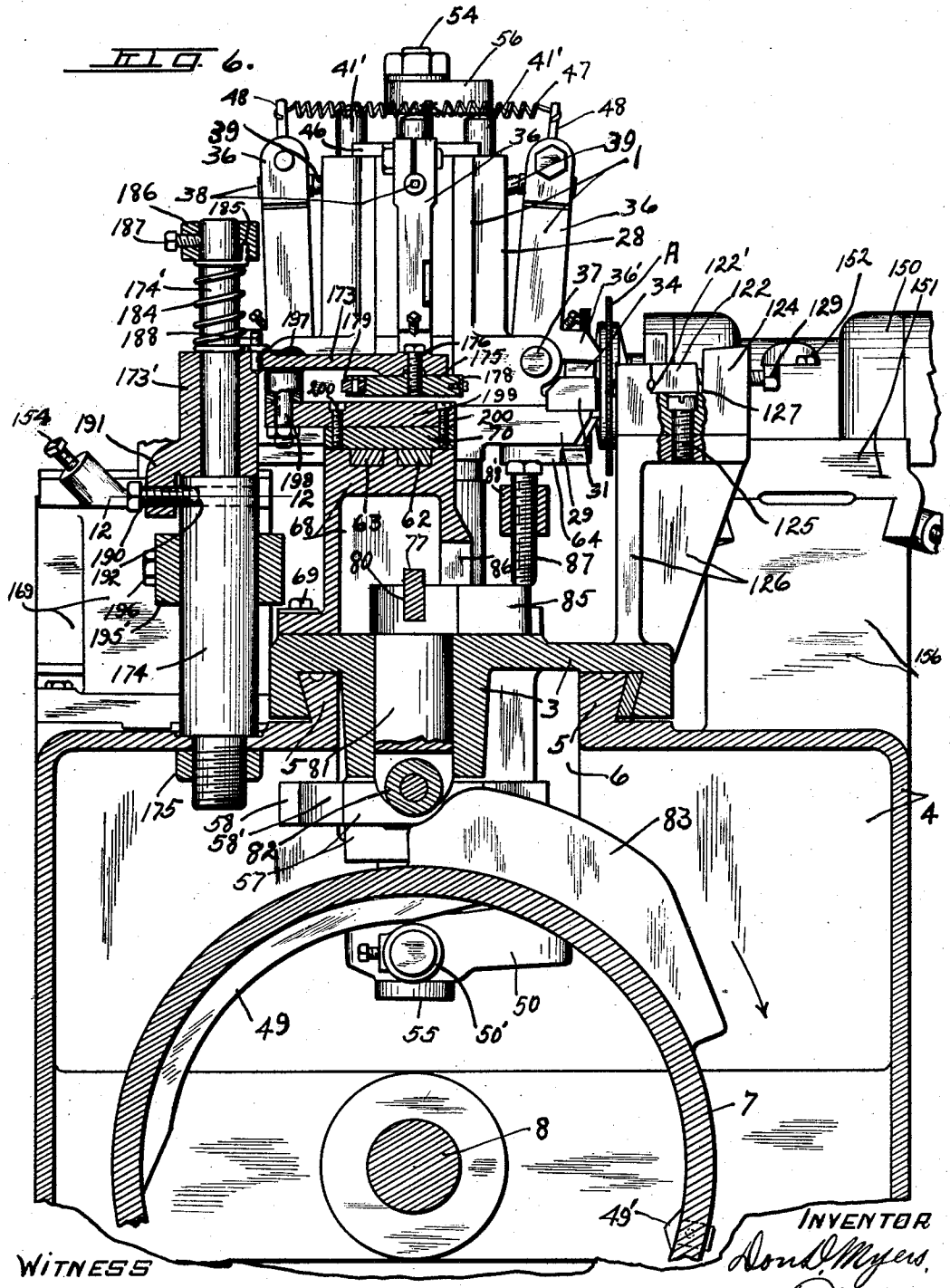
WITNESS
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PRONG MAKING MACHINE

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FIG. 6.



WITNESS

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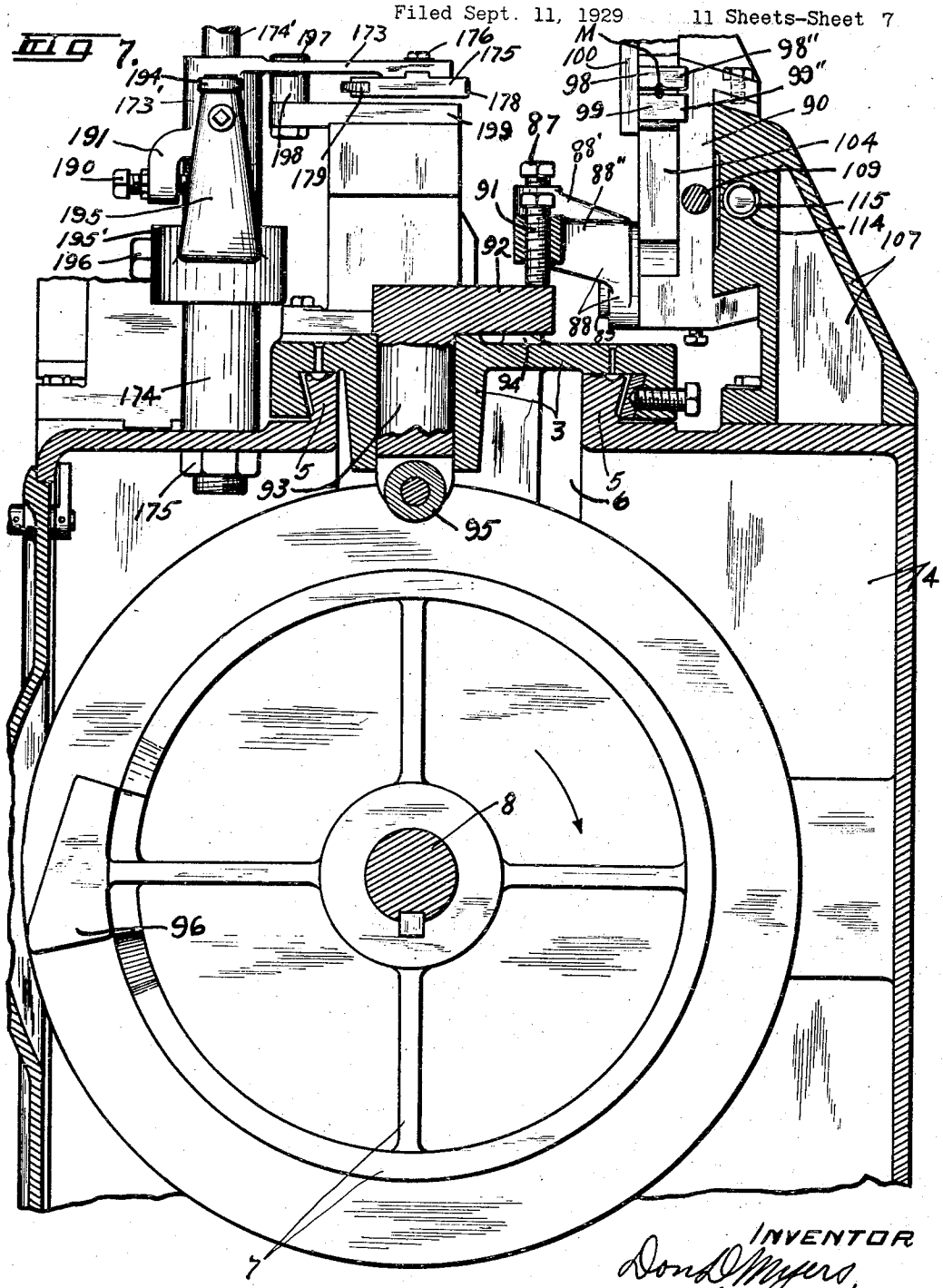
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Fig 7.



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FIG. 8.

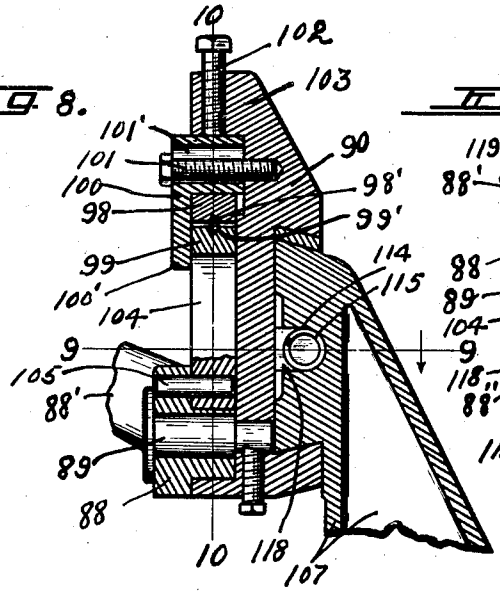


FIG. 9.

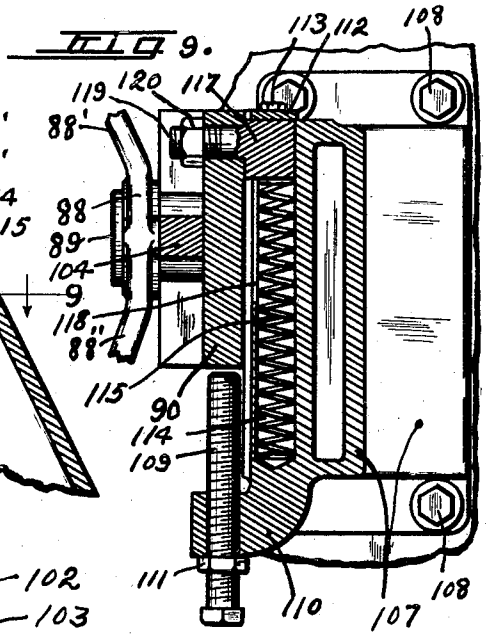
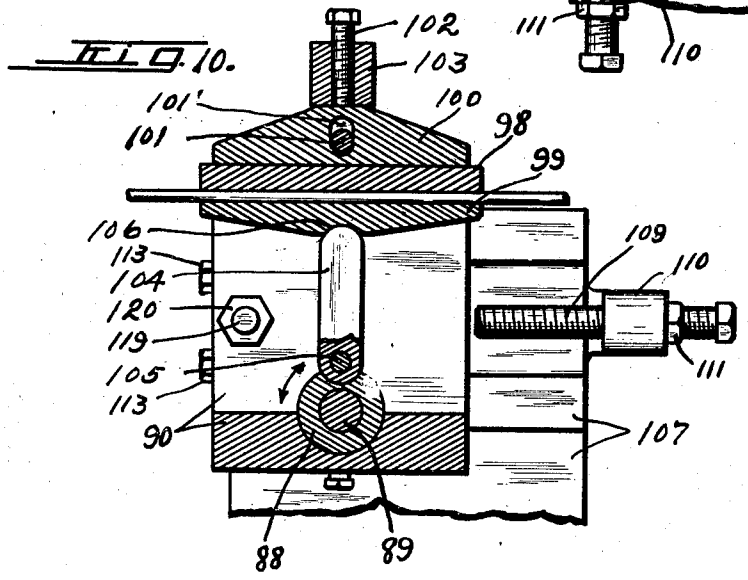


FIG. 10.



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FIG. 11.

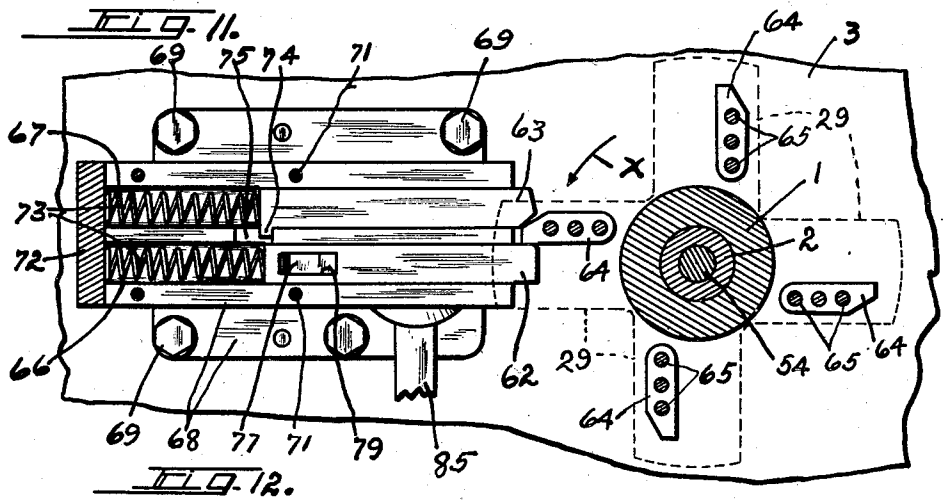


FIG. 12.

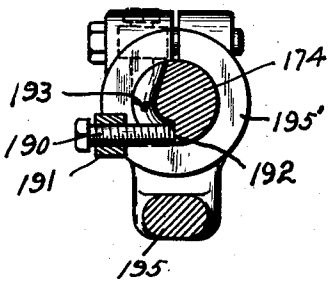


FIG. 13.

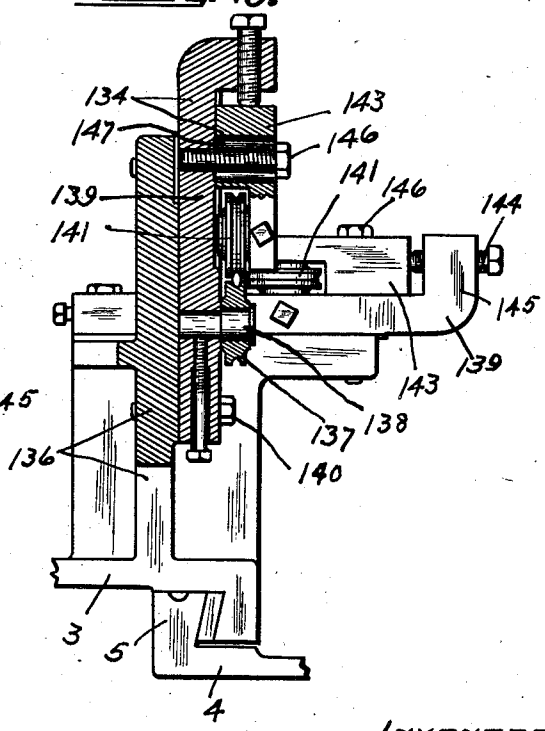
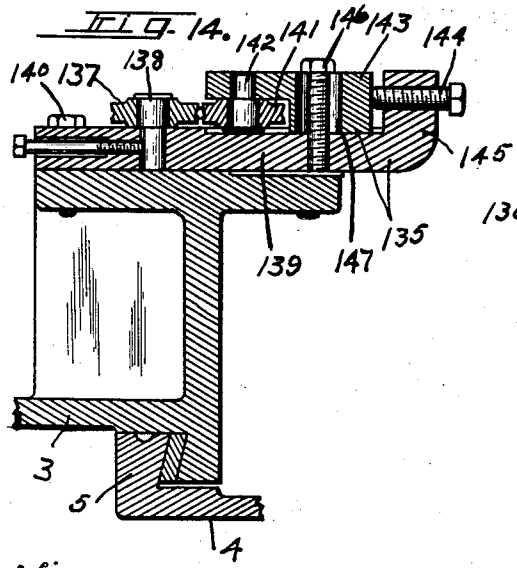


FIG. 14.



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PRONG MAKING MACHINE

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FIG. 15.

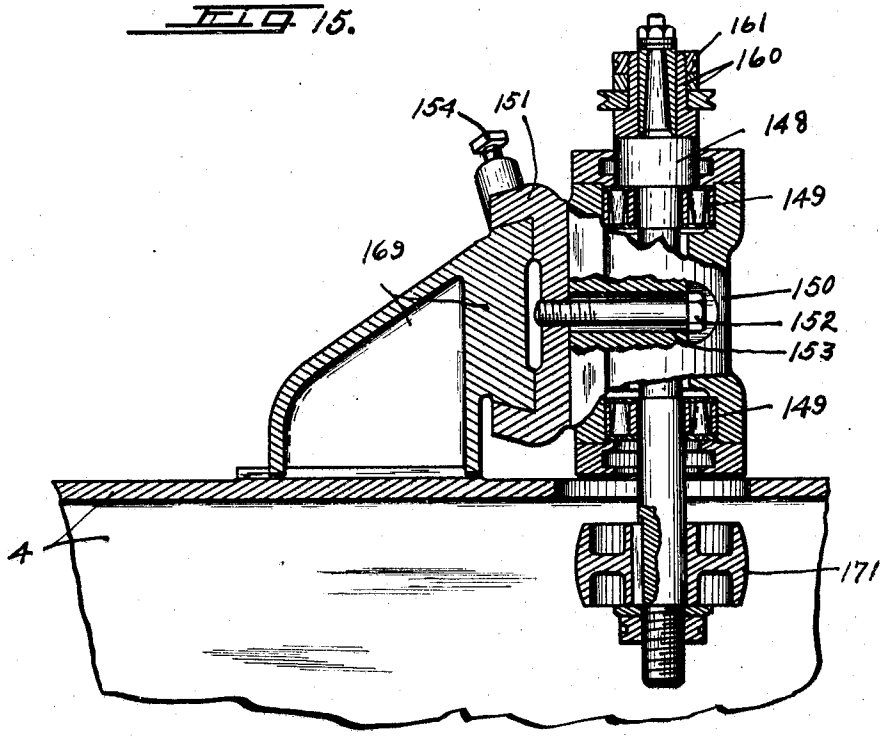
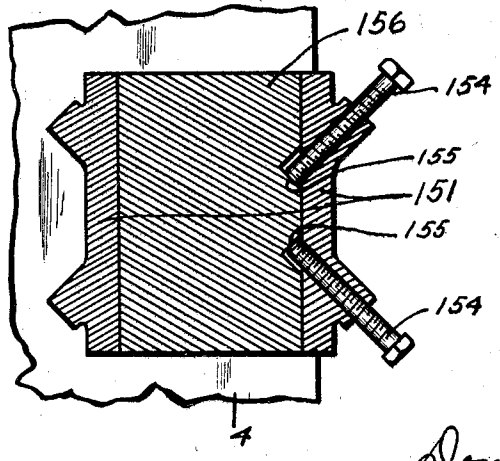


FIG. 16.



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PRONG MAKING MACHINE

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FIG. 17.

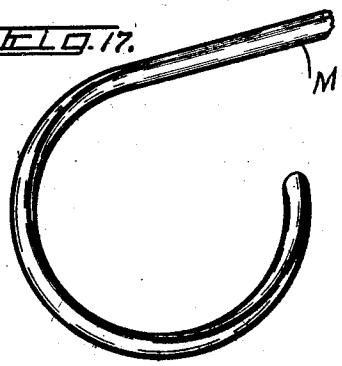


FIG. 18.

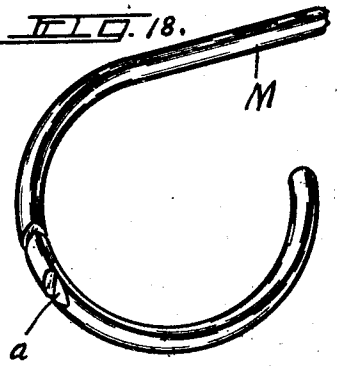


FIG. 19.

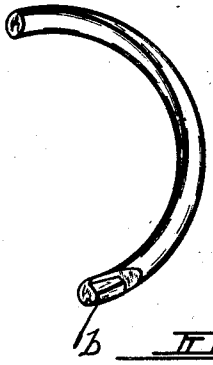


FIG. 20.

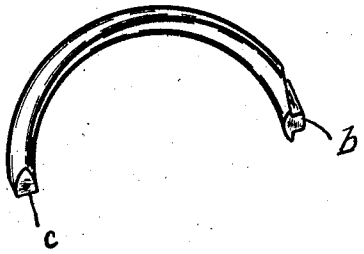
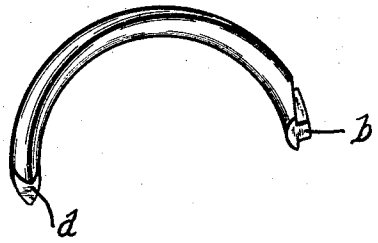


FIG. 21.



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UNITED STATES PATENT OFFICE

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PRONG-MAKING MACHINE

Application filed September 11, 1929, Serial No. 391,845.

This invention relates to a new and improved machine for the manufacture of arcuate prongs or posts to be used in loose leaf binders to retain the sheets therein.

The main object of this invention is to construct a mechanism which will automatically form and properly machine prongs or posts from suitable stock and which will be adapted to be secured in a loose leaf binder for the purpose of supporting and retaining loose sheets therein.

In other words I have sought to construct a device which will successively form a straight piece of wire stock into a prong of the desired size and shape for a loose leaf binder and which in this instance is semi-circular, to simultaneously cut the semi-circular portion from the remainder of the stock and mill a notch in one face thereof a short distance from the end being formed; to form a tongue between the notch and adjacent end of the semi-circular ring by simultaneously cutting away a portion of the upper and lower side surfaces of said ring; to cut the opposite end of the semi-circular ring so as to form a male or a female portion adapted when assembled within the binder to register one within the other; and finally to eject the completed prong from the device.

Other objects and uses relating to the details of the structure and the form and relation of the parts thereof will be brought out more fully in the following description taken in connection with the accompanying drawings in which:

Figure 1 is a top plan of a machine for producing arcuate prongs for loose leaf binders.

Figure 2 is a longitudinal vertical section taken in the plane of the line 2—2 Figure 1.

Figure 3 is a horizontal section taken on the line 3—3, Figure 2.

Figure 4 is an enlarged horizontal sectional view taken in the plane of the line 4—4, Figure 2.

Figures 5, 6 and 7 are enlarged transverse vertical sectional views taken in the planes of the lines 5—5, 6—6 and 7—7 respectively, Figure 1.

Figure 8 is an enlarged detail vertical section of the wire stock holding clamp taken on the line 8—8, Figure 1.

Figure 9 is a horizontal section taken on line 9—9, Figure 8.

Figure 10 is a vertical section taken on line 10—10, Figure 8.

Figure 11 is an enlarged detail horizontal section taken in the plane of the line 11—11, Figure 2.

Figure 12 is a detail section taken on line 12—12, Figure 6.

Figures 13 and 14 are enlarged vertical sections taken through the wire straightening device on lines 13—13 and 14—14 respectively, Figure 1.

Figure 15 is a detail vertical section taken on line 15—15, Figure 4.

Figure 16 is a detail horizontal section taken on line 16—16, Figure 5.

Figure 17 is a perspective view of the wire stock after being formed into the semi-circular ring.

Figure 18 is a perspective view illustrating the ring severed from the wire stock and with the notch in the surface thereof.

Figure 19 is a perspective view of the ring with the tongue formed between the notch and the adjacent end thereof.

Figure 20 is a perspective view of the completed prong as it is ejected from the machine with the male end formed thereon. Figure 21 is a perspective view of a completed prong having a female end formed thereon.

In carrying out the objects stated a work supporting head 1 is secured to a hollow vertically disposed spindle —2— which is rotatably mounted in a reciprocating carriage —3— near the forward end thereof Figures 1 and 2. The carriage 3 is disposed horizontally and substantially central of the main supporting frame 4 of the machine and adapted to move longitudinally thereon. Said carriage is slidably mounted in suitable spaced guide ways 5 formed on the upper surface of the frame 4.

A portion of the upper surface of the frame 4 between the guide ways 5 is left open to form a longitudinal slot as 6 thru which various mechanical members secured to and thereby moved by the carriage 3 may extend

downwardly to a co-operating position with their respective actuating cams which may be secured to or made integral with a cam wheel 7. The cam wheel 7 is keyed or otherwise secured to a horizontally disposed cam shaft 8 which is journaled in suitable spaced bearings 9 and 10 supported by adjacent portions of the frame 4. The carriage 3 is reciprocated longitudinally by the cam wheel 7 by means of a pendant roller bearing member 11 secured to the carriage 3 and adapted to be engaged in a cam groove 12 formed on the periphery of the cam wheel 7.

The cam shaft 8 is rotated by a shaft 13 through the medium of a gear 14 secured to the rear end of the shaft 8 and meshing with a worm 15 secured to the horizontally disposed shaft 13. The shaft 13 is journaled in suitable bearings as 16 and 17 secured to the adjacent portion of the frame 4 and extends transversely to the machine in a plane below the cam shaft 8 outwardly beyond one of the side walls of the frame 4 and has a pulley as 18 secured to the outer end thereof, Figure 3. The shaft 13 may be driven in any suitable manner as by the horizontal drive shaft 20 by means of a belt 21 which passes around the pulley 18 and a companion pulley —22— secured to the shaft —20—.

The drive-shaft —20— is provided to drive the various units of the apparatus, such as the millers and cutters, as well as the cam-wheel, and is rotatably mounted in roller bearings —23— positioned in suitable supporting brackets —24— and —25— secured in spaced relation to the forward end portion of the frame —4—.

A pulley as —26— is secured to one end of the shaft —20— for rotating said shaft. The shaft —20— may be rotated from any suitable source as by a belt and engine (not shown).

The work-supporting head which is positioned some distance above the carriage —3— is constructed with a vertically disposed body portion —28— having a plurality of, in this instance four radial arms —29— positioned near the base thereof, and arranged slightly tangential to the axis of said head, and at right angles to each other.

To the upper surface of the outer ends of each of the arms —29— is secured by screws —30— a tempered work-retaining block —31— which is rectangular in plan view, and is provided with a substantially semi-circular recess —32— in the upper surface adjacent the outer end thereof.

The recess 32 is constructed with a radius substantially equal to the radius of the outer edge of the prong ring comprising the work so that the ring when positioned in said recess will be firmly supported therein by the vertical wall of the recess while the depth of the recess 32 is less than the vertical diameter of the work stock so that said work may be securely held in its proper position within the recess by a tempered work clamp member 34 which is secured by screws 35 to a clamp supporting arm 36 and is positioned in a plane above the work retaining prong and adapted to be moved by the action of the arm 36 to and from the prong member 31 for clamping or releasing the work positioned therein.

These clamping and releasing movements of the work clamp 34 are automatically effected at pre-determined positions and in synchronism with other units of the apparatus in the following manner: The work clamp arms 36 provided for each of the clamps 34 are normally positioned in a substantially vertical plane over each of the radial arms 29 and secured at their lower ends to a shaft 37 which is journaled at its ends in the adjacent portion of the work head 1. The arms 36 are formed with an outwardly projecting lug as 36′ near the lower end thereof to which the work clamp 34 is secured. The upper end of the arm 36 terminates in substantially the horizontal plane of the upper end of the head 1 and is provided with a screw member 38 which is screw threaded transversely through said end of the arm 36 and has the inner end thereof recessed to receive one end of toggle pin 39 which is positioned in a slot 40 provided in respective plungers 41.

The plungers 41 are slidably mounted in respective bores 42 arranged in the four opposite sides of the body portion 28 of the head 1 in co-operative alinement with the respective arms 36. Each of the bores 42 extends from the upper face of the body 28 to within a short distance of the lower end thereof. A helical spring 43 is positioned within each of the bores 42 between the lower end thereof and the respective plunger 41. A guide pin 44 is secured in the plunger 41 near the lower end thereof and extends outwardly therefrom and has its outer end adapted to register in respective slots 45 provided in the body portion 28. Said pins 44 serve to hold the slot 40 in alignment with respective arms 36. The plungers 41 are each constructed with their upper ends reduced to form an upwardly projecting pin member 41′, adapted to extend through suitable apertures 46′ provided in a plunger retaining plate 46 which is secured to the upper end of the work supporting head 1 by screws 46″. The apertures 46′ in the plate 46 are adapted to permit the reduced portions 41′ of respective plungers 41 to freely move therethrough and at the same time said plate will limit the upward movement of the plungers 41 by the upper surface of said plungers formed by the reduced portion 41′ coming in contact with the lower surface of the plate 46.

It may now be understood that with the pins 39 in substantially the horizontal posi-

tion in respective slots 40 and with the outer end thereof in registration with recessed end of respective screw members 38 and of the proper length to move the upper end of the arm 36 outward sufficiently to bring the clamp 34 into clamping engagement with the work by moving the plunger 41 downwardly the pin 39 will be withdrawn from its respective screw member 38 and permit the upper end of the arm 36 to move inwardly and thereby cause the clamping member 34 to release the work, and it is evident that the work will again be clamped in the block 31 by the upward movement of the plungers 41 which will cause the pin 39 to again assume the horizontal position. The pins 39 and respective screw members 38 are maintained in contact at all times by means of retracting springs 47 having their ends secured to adjacent upwardly projecting pins 48 secured in the upper end of respective arms 36.

The downward movement of the plungers 41 for releasing the work may be accomplished at pre-determined positions by means of cam members 49 or 49′ positioned in spaced relation on the inner surface of the peripheral rim of the cam wheel 7 at the forward edge thereof, acting upon a substantially horizontally disposed rock arm 50 to move it downwardly. The rock arm 50 is pivoted at its outer end to a shaft 51 secured in the lower end of a bracket 52 connected with the under surface of the forward end of the carriage 3. The inner end of the rock arm 50 is provided with a roller 50′ adapted to engage the face of the cam 49. An aperture 53 is provided in the rock arm 50, substantially rectangular in plan view and disposed in vertical alinement with the axis of the hollow spindle 2.

A vertically disposed plunger rod 54 is slidably mounted within the spindle 2 with the lower end thereof passing through the aperture 53 in the rock arm 50. An enlarged annular flange 55 is provided on the lower end of the plunger rod 54 adapted to prevent the plunger rod from moving upwardly through the aperture 53. A plunger operating plate 56 is secured to the upper end of the plunger rod 54 and positioned normally a short distance above the work supporting head 1. The plate 56 is substantially triangular in plan view and adapted in this instance to have the outer edge thereof in registration with two of the plunger members 41 at a time. The plunger rod 54 and plate 56 are prevented from rotating by means of a squared portion 54′ provided at the lower end of the plunger rod 54 registering in the rectangular slot 53 provided in the arm 50.

The spindle 2 together with the work supporting head 1 and the co-operating parts therewith are rotated by means of an indexing plate 57 secured to the lower end of the spindle 2 in a horizontal plane above the cam wheel 7. The plate 57 is substantially square in plan view and is provided with a plurality of in this instance 4 outwardly extending arms 58 formed by an equal number of inwardly extending slots 58′ provided one at each corner of the plate 57 said slots being adapted to receive an actuating roller 59 therein. The roller 59 is rotatably mounted on a pin 60 secured to the periphery of the cam wheel 7 so that on each revolution of the cam wheel 7 the roller 59 will register in one of the slots 58′ engage the adjacent arm 58 and rotate the plate 57 and thereby the spindle 2 and head 1 one quarter of a revolution.

The work supporting head 1 may be temporarily locked at each of the pre-determined indexed positions against rotation by means of a lock bar 62 and a latch bar 63 each of which is disposed in a horizontal plane and in spaced relation below the arms 29 of said head member, and a positioning key 64 one for each of the indexed positions. One of said keys is secured to the under surface of the arms 29 by screws 65 and positioned in the horizontal plane of the lock bar 62 with the outer end of said key positioned between said lock bar and latch member 63 when in the locking position, see Figures 2, 4 and 11. The lock bar 62 and latch 63 are slidably mounted in respective grooves 66 and 67 provided in the upper surface of the lock supporting bracket 68 which is secured to the upper surface of the carriage 3 by screws 69 at the rear of the work supporting head 1.

A cover plate 70 is secured by screws 71 to the upper surface of the bracket 68 for maintaining the bars 62 and 63 in their respective grooves. Said cover plate is provided at one end with a downwardly projecting flange 72 adapted to be positioned across the rear end of the bracket 68 to close the adjacent ends of the grooves 66 and 67. The lock bar 62 and latch 63 are yieldingly held in their forward operative position by respective helical springs 73 positioned within the grooves 66 and 67 between the rear ends of the respective bars 62 and 63 and the end flange 72 of the cover plate 70. The latch bar 63 is provided at its rear end with a lateral lug as 74 extending from the inner side thereof into a slot 75 provided in the upper surface of the bracket 68 adjacent the groove 67 for the purpose of limiting the forward movement of said latch bar.

The lock bar 62 is maintained in its forward locking position against the action of its spring 73 by a bell-crank lever 77 which is pivotally mounted on a shaft 78 having its ends secured in the side walls of the bracket 68. The upper end of the upwardly extending leg of the bell-crank lever 77 is positioned in an aperture 79 provided in the lock bar 62 near the rear end thereof

while the other leg of said bell-crank lever extends forwardly in a substantially horizontal plane with the forward end thereof positioned in a groove 80 extending longitudinally across the upper end of a lock operating plunger 81.

The plunger 81 is slidably mounted in the carriage 3 intermediate the spindle 2 and carriage operating bearing member 11 with the lower end thereof terminating in close relation with the periphery of the cam wheel 7. A roller 82 is rotatably mounted on the lower end of the plunger 81 and adapted to co-operate with the plunger actuating cam 83 secured to or integral with said cam wheel for moving the lock bar 62 inwardly against the action of its respective spring 73 out of the path of movement of the co-operating key member 64 thereby releasing the work supporting head 1 and permitting it to be rotated in an anti-clockwise direction as indicated by the arrow X Figure 11.

The plunger actuating cam 83 is so constructed that as soon as the respective key member 64 has passed beyond the path of movement of the lock bar 62 that the plunger 81 will be permitted to return to its lower normal position and the lock bar 62 again moved to its outward locking position by the action of its respective spring 73 so as to be in the path of movement of the succeeding key member 64. As the key member 64 approaches the lock bar 62 it will engage the outer end of the latch bar 63 and move said latch inwardly against the action of its respective spring 63 thereby permitting said key member to come in contact with the lock bar 62 whereupon the respective spring 73 will again move the latch 63 outwardly to engage the outer edge of said key member 64 thereby securely holding or locking the work supporting head 1 against further rotating movement until the plunger 81 is again actuated by the cam 83.

The upper end of the plunger 81 is also provided with a lateral arm —85— which extends horizontally therefrom through a suitable slot —86— provided in the wall of the bracket —68— and terminates a short distance from and on that side of the bracket —68— at which the work is fed into the machine. The arm —85— is adapted to co-operate with an adjusting screw —87— which is screw threaded in the outer end of a forwardly projecting arm —88′— of a rock arm —88—, Figures 4, 7, 8, 9 and 10.

The rock arm 88 is pivotally mounted on a stud —89— which is secured to the inner face of a work feed slide —90— midway between the sides and near the bottom thereof. The rock arm —88— is also provided with a rearwardly extending arm 88″ which is provided with an adjusting screw —91— screw threaded in the outer end thereof and adapted to be engaged by a lateral arm —92— connected with an operating plunger —93—. The rock arm actuating plunger —93— is mounted in a vertical position in the carriage 3 at the rear of the lock bar supporting bracket —68— and adapted for lengthwise movement therein. The lateral arm —92— is secured to the upper end of the plunger —93— and extends horizontally across the upper face of the carriage 3 in the same direction as the arm —85— of the plunger member —83— with its outer end positioned between a pair of upwardly extending lugs —94— integral with the upper surface of the carriage 3 for maintaining the plunger —93— in its normal operative position. The lower end of the plunger —93— extends below the carriage 3 and terminates in proximity to the upper surface of the cam wheel 7. A roller —95— is rotatably mounted on the lower end of the plunger —93— and is adapted to co-operate with a cam member —96— secured to or integral with the cam wheel 7 for moving the plunger upwardly to rock the arm —88— in a direction opposite to that it is moved when actuated by the plunger —83—.

A pair of slightly spaced horizontally disposed work clamping jaws 98 and 99 are positioned one above the other in a plane above the rock arm 88 and are held in the normal position against the inner face of the work feed slide 90 by means of a retaining plate 100 positioned in a plane above said jaws to determine their upward position and having a downwardly projecting member 100′ adjacent the inner side surfaces of the jaws to maintain said jaws against lateral movement. The retaining plate 100 is adjustably clamped to the inner face of the slide 90 near the upper end thereof by means of a screw 101 which passes through a vertically elongated slot 101′ provided near the upper edge and midway between the ends of said retaining plate and screw threaded into the adjacent portion of slide 90. The retaining plate 100 is maintained in a vertical position by means of a vertically disposed adjusting screw 102 screw threaded in an inwardly projecting lug 103 which is provided in the upper surface of a slide 90 and which extends inwardly over the upper face of the retaining plate 100.

The jaws 98 and 99 have their adjacent inner surfaces provided with grooves 98′ and 99′ respectively extending longitudinally therethrough and adapted to receive the work therein. The lower jaw 99 is supported by a toggle link 104 which is vertically disposed between said jaw and the rock arm 88 with the lower end of the link pivotally mounted on a pin 105 which is secured to the rock arm 88 in the vertical plane of the stud 89 while the upper end of the link 104 registers in a circular recess 106 provided in the lower edge of the jaw 99 midway between the ends

thereof. The outer ends of the jaws 98 and 99 are each provided with outwardly extending lugs 98'' and —99''— respectively adapted to engage respective outer vertical sides of the slide —90— to prevent the longitudinal movement or displacement of the jaw members —98— and —99—.

The work feed slide 90 is slidably mounted for longitudinal movement upon a supporting bracket —107— secured to the upper surface of the frame —4— by means of screws —108—. The rearward movement of the work feed slide —90— may be limited by an adjusting screw —109— which is screw threaded in an inwardly extending lug —110— provided on the rear face of the bracket —107— and extends inwardly across the path of movement of the slide member —90—. The screw —109— may be locked in a pre-determined position by means of a lock nut —111—. The slide —90— is yieldingly held in its forward position against a stop plate —112— secured to the front face of the bracket —107— by screws —113— and positioned across the outer open end of a longitudinal bore —114— which extends from the forward face of the bracket —107— rearwardly, by means of a helical spring —115— positioned in the bore —114— between the rear end thereof and the rear face of a lug —117— integral with or secured to the slide —90—.

The bore —114— in this instance is positioned in the bracket —107— in a horizontal plane which is intermediate the upper and lower edges of the slide —90— and near the inner face of said bracket. A portion of the inner face of the bracket —107— adjacent the bore is slotted to form an opening —118— which extends from the forward end of the said bore rearwardly a portion of the length of the bore. The lug —117— may as shown be provided with a threaded stud —119— and nut —120— for securing it to the slide —90—. The lug —117— is secured to the forward end of the slide —90— and is adapted to extend latterly therefrom through the opening —118— into the bore —114— so that said lug is adapted to limit the forward movement of the slide —90— by the front face thereof coming in contact with the stop member —112— while the amount of the rearward movement of the slide —90— is controlled a pre-determined amount by the adjusting screw —109—. The rearward movement of the slide —90— against the action of the spring —115— is effected when the jaws —98— and —99— are brought into gripping engagement with the work through the action of the rock arm 88 and toggle link —104— whereby the work is forced through a pair of prong forming dies —122— and —123— by the rearward movement of the carriage 3 to which said dies are secured.

The dies —122— and —213— are mounted in a die supporting block —124— which is secured by means of screws —125— to the upper face of the upwardly extending bracket —126— integral with the upper face of the carriage 3 and positioned at one side thereof ahead of the work feed slide —90—. The block —124— is provided with a longitudinal slot —127— in the upper face thereof adapted to receive the die —122— therein while the die —123— which in this instance is a tempered pin is secured in the forward portion of the block —124— adjacent the inner face of the slot —127—.

The die —122— is positioned longitudinally in the slot —127— and has the inner face thereof provided with a groove —122'— adapted to receive the work therethrough and positioned in co-operative alinement with the grooves 98' and 99' in respective jaw members —98— and —99—. The die —122— is adjustably clamped in the slot —127— by means of a screw —129— screw threaded through the outer portion of the block —124— while said die member may be adjustably positioned relative to the die —123— by means of a screw —130— also screw threaded through said block —124— near the forward end thereof. The forward outer end of the groove —122'— is formed to curve inwardly to co-operate with a companion annular groove —123'— formed in the die —123— in co-operative alinement with the groove —122'— to bend the stock as it is forced forward between said dies into a ring of the desired size to form an arcuate prong adapted to be used in a loose leaf binder. The dies —122— and —123— are positioned in co-operative alinement with the recess —32— provided in the work retaining block —31— which is positioned adjacent said dies so that as the stock is forced through the dies to form the ring said ring will be positioned within recess —32— below the respective work clamp —34— as indicated in dotted line, Figure 4. A spring member —131— is secured to the inner face of the die supporting block —124— by screws —132— and has its forward end positioned in spaced relation to the inner face of said block and in the path of the end of the work as it is formed into the ring so that said spring will be displaced by the ring and will act to readjust the ring in the work retaining block after it has been cut from the remaining portion of the work stock which will hereinafter be more fully explained.

The apparatus may as shown be provided with a pair of stock straightening devices —134— and —135— positioned in the rear of the work feed slide —90— and secured to the carriage —3— at or near the rear end thereof, Figures 1, 13, and 14. One of the stock straightening devices as —134— is arranged in vertical position and is secured to a rearwardly extending bracket —136— integral

with the rear end of the carriage 3 while the other device as —135— is secured in a horizontal position to the upper face of the carriage 3 ahead of the straighteners —134—. Each of the devices are composed of a plurality of in this instance 3 grooved rollers —137— journaled in longitudinal spaced relation upon suitable studs —138— secured to respective supporting brackets —139— which are secured to the carriage 3 by screws —140—. Another set composed of in this instance 2 groove rollers —141— are arranged in staggered relation to the rollers —137— and are journaled upon suitable studs —142— secured to an adjustable bracket —143— slidably mounted on respective brackets —139—. Each of the brackets —143— may be moved relative to the respectiveo rollers —137— by means of a screw —144— which is screw-threaded in a laterally extending portion —145— formed at one end of each bracket —139—, while each of the brackets —143— are clamped in their adjusted position to their respective retaining bracket —139— by means of a screw —146— which passes through an elongated slot —147— provided in each bracket —143— and screw-threaded in the corresponding bracket —139—.

At the forward end of the frame 4 is positioned a plurality of tool supporting spindles —148— positioned in co-operative relation with respective work supporting blocks —31— secured in the 3 forwardly positioned arms —29— of the work supporting head 1, Figures 1, 2, 4, 5, and 15. The spindles —148— are arranged in 3 groups and positioned in respect to the work supporting head 1 so that the tools carried by said spindles in each group will perform its required operation upon the work located in the respective blocks —31— at substantially the same time, as said head with the work, therein is moved forwardly by the carriage 3 to bring the work into operating engagement with respective tools. The spindles —148— are each rotatably mounted in suitable spaced rolling bearings —149— secured in respective ends of the spindle supporting housings —150—.

Each of the spindle supporting housings —150— are adjustably mounted upon a housing supporting slide —151—, and is adapted to be adjusted thereon in a direction transverse to the adjusting movement of the respective slide. The housings —150— are clamped to their respective slides —151— by means of screws or bolts —152— passing through elongated slots —153— formed in the housing on opposite sides of the respective spindles —148— and screw threaded in said slide, while each of the slides —151— is adjustably mounted upon respective brackets and may be secured thereto in their adjusted position by means of a pair of screws —154— screw threaded in the respective slide —151— and disposed at an angle to each other with the inner end of said screws abutting against suitable shoulders —155— formed in the adjacent edge of the respective supporting brackets, Figure 16.

The spindle —148— positioned at the right side of the work supporting head 1 bas its supporting bracket —150— adjustably mounted for longitudinal movement to and from the center portion of the carriage 3 upon the housing supporting slide —151— which in turn is slidably mounted for longitudinal movement relative to the frame 4 upon the upper end of a vertically disposed upwardly projecting bracket —156— integral with the upper portion of the frame 4, positioned at the right side of and near the forward end of said frame. The spindle —148— may be driven from the drive shaft —20— by means of a belt —157— which passes around a pulley —158— secured to the outer ends of the spindle —148— and another pulley —159— secured to the outer end of the drive shaft —20—. The inner end of the spindle —148— is provided with a tool supporting head —160— adapted to support suitable tool or tools for doing the work required which in this instance consists of a cutter as A and a slot milling tool B clamped in spaced relation upon said head by a clamping nut —161— screw threaded on the outer end of the head —160—. The cutting tool A in this instance is of slightly larger diameter than the cutting tool B so that while the cutter A is cutting the semi-circular prong ring from the stock the miller B will be forming the slot —*a*— Figure 18 in said ring.

On the left side of the machine is positioned a pair of horizontally disposed tool supporting spindles 148 arranged in spaced relation in the same vertical plane one above the other. The spindles are positioned a short distance in advance of the stock cutting spindle just described so that the tools mounted on the inner end thereof will be in co-operative alinement with the work carried in the forwardly extending longitudinally disposed arm 29 and positioned relative to the cutting spindle so that they will engage the work at the same time that the tools on the cutting spindle are doing their work. These spindles are mounted similarly to the spindle on the right side of the machine with the respective housing supporting slides 151 adjustably mounted for vertical movement on an upwardly extending vertically disposed bracket 162 secured to the frame 4 at the forward end thereof. To the inner end of the spindles 148 are mounted the tool supporting heads 160 each having a milling cutter as C secured thereto by the clamping nuts 161.

The cutters are positioned in the same vertical plane one above the other with their ad-

jacent peripheral edges spaced apart sufficiently to form the tongue as —*b*— Figure 19 as they cut away a portion of the outer surface of the semi-circular ring, between the notch —*a*— and adjacent end thereof. The width of the tongue may be varied by the vertical adjustment of the respective slides —151— upon the supporting bracket —162— while the spindle may be adjusted latterly to bring the tools mounted thereon into proper alinement with the work to determine the depth of the cut in said work by adjusting the housing —150— upon the respective slides —151—. The tongues —*b*— are adapted to register in suitable slots provided in the prong retaining plate so that the prongs may be secured to said plate by riveting or upsetting the under surface of the tongue. To each of the outer ends of said spindles —148— is secured a pulley as —163— and —164— arranged in staggered relation and connected by belts —165— and —166— to respective pulleys —167— and —168— mounted on the drive shaft —20— for rotating said spindles and the tools mounted thereon.

The vertically disposed spindle —148— positioned at the left of the work supporting head 1 has its housing slide —151— adjustably mounted on a supporting bracket —169— adjustably clamped to the frame 4 for latteral adjustment of the spindle and tools thereon to bring said tool into proper reation with the work which is carried by the arm —29— extending transversely and to the left of the work supporting head 1 so as to cut a V shaped tongue as —*c*—, or groove —*d*—, depending upon the tool used, Figures 20 and 21 in the remaining or unfinished end of the ring carried by said arm. The tongue —*c*— and groove —*d*— are to be cut with a sufficient depth so that when assembled in a loose leaf binder and with said ends interlocked a smooth and even joint will be formed to permit the ready and uninterrupted transfer of the sheets from one prong to the other.

The vertical adjustment of the spindle to bring the tool into horizontal alinement with the work may be accomplished by adjusting the housing relative to the slide in the same manner as previously explained for the cut off and notch forming spindle. The tongue and groove forming spindle —148— and tool mounted thereon may be rotated by the shaft —20— by means of an endless belt —170— which passes around a pulley —171— secured to the lower end of said spindle and a companion pulley —172— secured to the shaft —20— as illustrated by dotted lines in Figure 3.

At the rear of the tongue and groove spindle supporting bracket —169— and at the left of the carriage 3 is pivotally mounted a work ejecting or unloading arm —173— which is journaled at its outer end to a vertical upwardly extending post —174—, Figures 1, 2, 4, 6 and 7. The pivotal post —174— rests upon the upper surface of the frame 4 and is clamped thereto by means of a nut —175— positioned on the lower side of said frame and screw threaded on a reduced lower end of the post —174— which extends through a suitable opening in said frame. The post —174— extends some distance above the frame 4 and has the uppper portion thereof reduced to form a pivotal support —174'— for the arm —173—. The outer end of the arm —173— is constructed with a downwardly projecting tubular boss —173'— which rests upon the shoulder formed on the post by the reduced portion —174'—. The arm —173— normally extends inwardly from the upper end of the boss —173'— over the lock supporting bracket —68— and has secured to the inner end thereof a finger supporting block —175— which is clamped to the under side of said arm in cooperative alinement with the rearwardly extending longitudinal arm —29— of the work supporting head 1 by means of a screw —176—, Figures 4, 6 and 7.

The block —175— is substantially rectangular in plan view and has a spring finger as —178— secured to the inner end thereof and projects forwardly beyond the forward surface of the block —175— a sufficient distance so as to grip the adjacent end of the work as said work is brought in proximity to the forward face of the block —175— by the rearward movement of the head 1 and carriage 3. A co-operating finger —179— is pivotally mounted at —180— to the opposite or outer end of the block —175— and is held in its normal position for gripping the opposite end of the work by means of a spring —181— positioned in a recess —182— provided in the block —175— at the rear of the pivot —180—. The outer end of the spring —181— is positioned in a recess —183— provided in the adjacent inner side of the finger —179—.

The arm —173— is yieldingly held in its normal forward position by means of a retracting spring —184— which is coiled around the upper end of the post —174— with the upper end of the spring turned outwardly at right angles to said spring and positioned in a hole —185— provided in the lower face of a collar —186— which is clamped by a screw —187— to the upper end of the post —174—.

The lower end of the spring —184— is bent to form an annular opening through which a pin —188— secured to the upper adjacent portion of the arm —173— may pass. The normal forward position of the arm —173— is adjustably determined by a screw —190— screw threaded in an outwardly and downwardly extending lug —191— formed at the lower end of the boss —173'— with the inner end of the screw abutted against a shoulder —192— formed in a groove —193—

provided in the outer edge of the post —174— a short distance below the reduced upper end —174'— of said boss, see Figure 12. The groove —193— extends in a clock-wise direction from the shoulder —192—, a portion of the distance around the post —174— so as to permit the free rearward movement of the arm —173— to bring the finger member —179— into tripping engagement with a roller —194— rotatably mounted on the upper end of an upwardly extending arm —195—.

The arm —195— is provided at its lower end with a split collar —195'— positioned at right angles thereto, said collar is mounted upon the post —174— and is adapted to be clamped thereto by a screw —196— a short distance below the arm —173— so that with the roller —194— in the path of movement of the finger —179— the rearwardly extending end of said finger will be moved inwardly against the action of the spring —181— when the finger comes in contact with the roller —194— thereby moving the forward end of the finger outwardly to release the work. The arm —173— is rocked rearwardly to bring the finger —179— into contact with the roller —194— by means of a roller —197— rotatably mounted on an upwardly extending stud —198— secured to the outer end of a horizontally disposed arm —199—. The arm —199— is positioned in a transverse groove provided in the upper surface of the cover plate —70— near the forward end thereof and secured to said plate by screws —200—. The arm —199— extends outwardly a short distance beyond the outer edge of the plate —70— with the roller —197— positioned in a plane intermediate said plate and the post —174— and in the horizontal plane of the arm —173— so that as the arm —199— is carried rearwardly by the movement of the carriage 3, the roller —197— will come in contact with the ejector arm —173— and rock said arm rearwardly against the action of the spring —184— about the pivotal post —174— until the finger —179— engages the ejector roller —194—, to actuate said finger, to release the work at the time the carriage 3 completes its rearward movement. The carriage will now being the forward movement carrying the arm —199— and roller —197— forward away from the arm —173— which will now be returned to its normal position ready to receive the next completed prong by the action of the spring —184—.

Operation

The stock wire as M is first fed into the machine between the straightening rollers —137— and —141— from any suitable source such as a reel not shown. From the straightening rollers the wire is passed between the clamping jaws —98— and —99— to the ring forming dies —122— and —123—, with the forward end curved to conform to the curve in the forward end of the die —122— and terminates in the longitudinal plane of the cutting tool A, Figures 1 and 2.

The machine is illustrated in the drawings with the work supporting head 1 just having completed the indexing operation and with the table 3 about to move rearwardly. The work clamp —34— positioned in the arm —29— extending longitudinally rearwardly and also in the arm adjacent the dies are in the open or unclamping position, due to the action of the cam —49— upon the arm —50— rod —54— and plate —56—. The rock arm —88— has been moved by the arm —85— to bring the jaws —98— and —99— into clamping engagement with the wire stock. Now by referring to Figures 2 and 3 it is clear that with the cam wheel 7 rotating in the direction indicated by the arrow X that the carriage 3 will be moved rearwardly and therefore the work supporting head 1 and the prong forming dies —122— and —123— mounted thereon will also be moved rearwardly.

This rearward movement of the dies will move the clamping jaws —98— and —99— and the feed slide —90— rearwardly through the medium of the stock wire, against the action of the retracting spring —115—, Figure 9 until said slide member comes in contact with the screw member —109— when the rearward movement of the jaws and the wire grip thereby will be discontinued and the wire will then be forced through the dies and into the recess —32— of the adjacent work retaining block —31— as the dies continue the rearward movement. The screw —109— is adjusted relative to the slide —90— so that as said slide is brought to rest by the screw a sufficient amount of wire stock will be fed through the dies to form the proper sized ring to form the prong as indicated in Figure 17.

As the carriage 3 reaches its extreme rearward position by the substantially quarter revolution of the cam wheel 7 the rock arm —88—will be moved to release the gripping engagement of the jaws —98— and —99— upon the wire by the action of the cam —96— upon the plunger —93— which then will have been moved by the carriage 3 to a position in co-operative alinement with the cam —96—, see Figures 3 and 7 and said jaws and slide —90— will be returned by the spring —115— to the normal forward position. The work clamp —34— positioned over the ring just formed will be brought into clamping engagement with said ring by the upward movement of the respective spring actuated plunger member —41— which action is permitted by the cam —49— having passed beyond the roller —52— thereby releasing the arm —50—, plunger rod —54—, and the plunger operating plate —56—, and thereby permitting their upward movement,

which action is caused by the spring —43— acting upon the respective plunger —41—, Figures 5 and 6.

As the carriage 3 is moved forward by the continued rotation of the cam wheel 7 the stock wire M with the ring connected therewith and which is clamped in the work supporting head 1 will be drawn forwardly between the wire straightening rollers —137— and —141— and the clamping jaws —98— and —99— so as to be in position to again be fed through the ring forming dies —122— and —123— upon the return movement of the carriage. As the carriage together with the work supporting head 1 approaches the limit of its forward stroke the work will be brought into contact with the cutting and milling tools as A and B which will cut a portion of the ring formed from the remainder of the stock as indicated in Figure 18 and also the slot *a*. The depth of the slot —*a*— depends upon the relative positions of the tool B and the end of the forward stroke of the carriage and therefore the work supporting head.

As previously explained as the ring is being formed the head end thereof will be brought into contact with and will compress to a certain degree the spring member —131— so that before the carriage —3— begins its rearward movement and upon the completion of the cutting work of the tool members A and B the respective work clamp —34— will be caused to release the work for a moment by the V cam —49′— coming into contact with the roller —52— and thereby actuating the plunger rod —54— and plate —52— to force the respective plunger —41— downwardly. This momentary releasing of work permits the spring —131— to rotate said work to bring the cut end of the ring against the adjacent side surface of the cutter A. This surface being always in a given position relative to the work holders will uniformly position the work in the respective holder each time a ring segment is formed so as to insure a uniform construction of the prongs.

The carriage 3 then moves rearwardly until the roller bearing member —11— enters the straight portion of the cam groove —12—, Figure 3 at which time said table will discontinue its rearward movement for a short period. The roller —82— provided on the plunger —81— will have been brought by the movement of the carriage into co-operative alinement with the cam —83— and will be acted upon by said cam to move the plunger —81— upward. This upward movement of the plunger —81— will move the lock bar —62— rearwardly through the medium of the bell crank lever —77— out of the path of movement of the positioning key —64— which is secured to the arm —29— extending rearwardly thereby permitting the work supporting head 1 to be rotated in an anti-clockwise direction. The cam —83— is so constructed that the plunger —81— will be held in its upward position during a greater portion of the time the carriage 3 remains stationary so that the lock bar —62— will remain in its rearward position a sufficient time to permit the indexing of the work supporting head 1 and is returned to the normal locking position just before the completion of the indexing of the head so as to be in the path of movement of the next succeeding positioning key —64— and thereby again position and lock the head 1 in the next succeeding position.

The indexing of the head 1 to move the arms —29— one quarter of a revolution to bring said arms to the next succeeding position is accomplished by the roller —59— coming in contact with an arm —58— of the indexing plate —57— which action will cause the arm —29— with the ring segment therein to move into the forward extending longitudinally disposed position and the arm —29— which was in the rearward position and which contained an empty work retaining block 31 will have been moved into co-operative registration with the ring forming dies. At the completion of the indexing operation the cam —49— contacts with the roller —50′— to rock the arm —50— downwardly thereby forcing the rod —54—, plate —56— and the two plungers —41— in contact with the plate downwardly against the action of the respective springs —43— to permit the respective clamping members —34— to be moved to the open position by the respective springs —47— acting upon the upper ends of the respective arms —36—.

The machine is now in the position illustrated in the drawings and the carriage will now continue the rearward travel as hereinbefore explained forming a ring in the work retaining block —31— adjacent the dies —122— and —123—. As the carriage again moves forward to bring the newly formed ring into operative engagement with the cutting tool A and milling tool B the first formed ring segment will be brought into operating contact with the tongue milling cutters as —C— and the tongue —*b*— will then be formed as illustrated in Figure 19 after which the carriage again begins its rearward travel the work supporting head 1 is again rotated one quarter of a revolution to bring the first formed ring segment to the next position which is in co-operative alinement with the tongue or groove milling cutter —D— so that upon the carriage again moving to the forward position the tongue —*c*— or groove —*d*— will be cut in the opposite end of the ring segment to that in which the tongue —*b*— is formed depending upon the tool used as illustrated in Figures

20 and 21 thereby completing the construction of the loose leaf binder prong.

As the head 1 is indexed again the arm —29— carrying the finishing prong will be moved to the rearward longitudinal position and as the carriage resumes its rearward movement the prong will be brought into proximity with the finger supporting block —175— with the ends of said prong member gripped between the respective unloading fingers —178— and —179—. The respective work clamp —34— is brought into the open or unclamping position at the same time that the clamp —34— positioned in the arm adjacent the dies —122— and —123— is opened as hereinbefore explained so that the prong is now free to be carried from the respective work supporting block —31— by the unloading fingers as the arm —173— is rocked about the pivotal post —174— by the action of the roller —197— as the carriage continues its rearward movement.

The prong is released from between the fingers when the carriage reaches its extreme rearward position by the outer rear edge of the finger —179— coming into contact with the periphery of the roller —194— which action will move the gripping end of the finger outwardly away from the spring finger —178— thereby releasing the work. The work or prong member is released upon the adjacent upper face of the frame 4 or it may be deposited into a suitable chute not shown, adapted to convey said work into a suitable receptacle or elsewhere. This leaves the work retaining block —31— positioned in the rearwardly extending arm —29— empty and ready when moved by the next indexing operation into co-operative alinement with the ring forming dies to receive another ring.

Although I have shown and particularly described the preferred embodiment of this invention, I do not wish to be limited to the exact details of the construction shown as various changes may readily be made without departing from the spirit of the invention as set forth in the appended claims.

I claim:

1. In a machine for producing arcuate prongs for loose leaf binders, a plurality of rotary cutting tools arranged in circumferential spaced relation, means for bringing work into successive operating engagement with the tools comprising a rotatable work supporting head mounted for reciprocative movement towards and from said tools, a stock bending means adapted to deposit the stock as it is being bent into the work supporting head, and means for operating said work supporting head.

2. In a machine for producing arcuate prongs for loose leaf binders, a plurality of rotary cutting tools arranged in circumferential spaced relation, means for bringing work into successive operative engagement with the tools comprising a rotatable work supporting head mounted for reciprocative movement towards and from said tools, a stock bending means adapted to deposit the stock as it is being bent into the work supporting head, means for operating said work supporting head, and means for ejecting finished prongs from the work supporting head.

3. In a machine for producing arcuate prongs for loose leaf binders, a plurality of rotary cutting tools arranged in circumferential spaced relation, means for bringing work into successive operating engagement with the tools comprising a rotatable work supporting head mounted for reciprocative movement towards and from said tools, a stock bending means adapted to deposit the stock as it is being bent into the work supporting head, feed mechanism adapted to intermittently feed the stock through the bending means, means for operating the work supporting head, and means for ejecting the finished prong from the work supporting head.

4. In a machine for producing arcuate prongs for loose leaf binders, a plurality of rotary cutting tools arranged in circumferential spaced relation, means for bringing work into successive operating engagement with the tools comprising a rotatable work supporting head mounted for reciprocative movement towards and from said tools, locking means adapted to secure the work supporting head against rotary movement at predetermined positions, a stock bending means adapted to deposit the stock as it is being bent into the work supporting head, means for operating the work supporting heads, and means for ejecting the finished prong from the work supporting head.

5. In a machine for producing arcuate prongs for loose leaf binders, a plurality of rotary cutting tools arranged in circumferential spaced relation, means for bringing work into successive operating engagement with the tools comprising a rotatable work supporting head mounted for reciprocative movement towards and from said tools, locking means adapted to secure the work supporting head against rotary movement at predetermined positions, a stock bending means adapted to deposit the stock as it is being bent into the work supporting head, feeding means adapted to intermittently feed the stock through the bending means, means for operating the work supporting head, and means for ejecting the finished prong from the work supporting head.

6. In a machine for producing prongs for loose leaf binders, a frame, a plurality of cutting tools secured to the frame in spaced relation, a reciprocally movable carriage mounted for movement on the frame, a work

supporting mechanism mounted on the carriage adapted to bring the work into successive operating alinement with the tools, a stock forming means secured to the carriage adapted to deposit stock as it is being formed into the work supporting mechanism, means for moving the work supporting mechanism relative to the carriage, means for reciprocating the carriage to bring the work into operative engagement with the tools and means connected with the frame for ejecting the finished prongs from the work supporting mechanism.

7. In a machine for producing prongs for loose leaf binders, a frame, a plurality of cutting tools secured to the frame in spaced relation, a reciprocally movable carriage mounted for movement on the frame, a work supporting mechanism mounted on the carriage adapted to bring the work into successive operating alinement with the tools, a stock forming means secured to the carriage adapted to deposit stock as it is being formed into the work supporting mechanism, stock feeding means secured to the frame adapted to feed the stock intermittently through the forming means, means for moving the work supporting mechanism relative to the carriage, means for reciprocating the carriage, and means connected with the frame for ejecting the finished prong from the work supporting mechanism.

8. In a machine for producing prongs for loose leaf binders, a frame, a plurality of cutting tools secured to the frame in spaced relation, a reciprocally movable carriage mounted for movement on the frame, a work supporting mechanism rotatably mounted on the carriage adapted to bring the work into successive operating alinement with the tools, means for rotating the work supporting mechanism, a stock forming means secured to the carriage adapted to deposit the stock as it is being formed into the work supporting mechanism, means for reciprocating the carriage to bring the work into and out of operating engagement with the tools and means connected with the frame for ejecting the finished prong from the work supporting mechanism.

9. In a machine for producing prongs for loose leaf binders, a frame, a plurality of cutting tools secured to the frame in spaced relation, a reciprocally movable carriage mounted for movement on the frame, a work supporting mechanism rotatably mounted on the carriage adapted to bring the work into successive operating alinement with the tools, means for rotating the work supporting mechanism, a stock forming means secured to the carriage adapted to deposit the stock as it is being formed into the work supporting mechanism, stock feeding means secured to the frame adapted to feed the stock intermittently through the forming means, means for reciprocating the carriage to bring the work into and out of operating engagement with the tools, and means connected with the frame for ejecting the finished prong from the work supporting mechanism.

10. In a machine for producing prongs for loose leaf binders, a frame, a plurality of cutting tools secured to the frame in spaced relation, a reciprocally movable carriage mounted for movement on the frame, a work supporting mechanism mounted on the carriage adapted to bring the work into successive operating alinement with the tools, a stock forming means secured to the carriage adapted to deposit stock as it is being formed into the work supporting mechanism, stock feeding means secured to the frame comprising a pair of jaws adapted to intermittently feed the stock through the forming means, means for bringing the jaws into and out of gripping engagement with the stock, means for moving the carriage to bring the work into and out of operative engagement with the tools and means for operating the work supporting mechanism.

11. In a machine for producing prongs for loose leaf binders, a frame, a plurality of cutting tools secured to the frame in spaced relation, a reciprocally movable carriage mounted for movement on the frame, work supporting mechanism rotatably mounted on the carriage adapted to bring the work into successive operating alinement with the tools, operating means adapted to intermittently rotate the work supporting mechanism, a stock forming means comprising a pair of grooved dies secured to the carriage and adapted at pre-determined positions of the work supporting mechanism to feed the stock as it is being formed into said mechanism, stock feeding means secured to the frame comprising a pair of jaws adapted to grip the stock to prevent the longitudinal movement thereof, operating means for bringing the jaws into and out of gripping engagement with the stock at pre-determined positions of the carriage, means for reciprocating the carriage to bring the work into and out of operative engagement with the tools.

12. In a machine for producing prongs for loose leaf binders, a frame, a plurality of cutting tools secured in spaced relation to the frame, a reciprocally movable carriage mounted for movement on the frame, a work supporting mechanism rotatably mounted on the carriage comprising a work holding means, a ring forming means adapted to deposit the ring into the work holding means at a pre-determined position of said holding means, operating means for rotating the work supporting mechanism to bring the work supported thereby into successive operative alinement with the tools, and means for reciprocating the carriage.

13. In a machine for producing prongs for loose leaf binders, a frame, a plurality of cutting tools secured in spaced relation to the frame, a reciprocally movable carriage mounted for movement on the frame, a work supporting mechanism rotatably mounted on the carriage comprising a work holding means, actuating means adapted at pre-determined positions of the work supporting mechanism to bring the work holding means into and out of gripping engagement with the work, a ring forming means adapted to deposit the ring into the work holding means at a pre-determined position of said holding means, operating means for rotating the work supporting mechanism to bring the work supported thereby into successive operative alinement with the tools and means for reciprocating the carriage.

14. In a machine for producing prongs for loose leaf binders, a frame, a plurality of cutting tools secured in spaced relation to the frame, a reciprocally movable carriage mounted for movement on the frame, a work supporting mechanism rotatably mounted on the carriage comprising a work holding means, a work ejector means secured to the frame for ejecting the finished work from the work holding means, carriage reciprocating means for moving the carriage in one direction to bring the work into operative engagement with the respective tool and in the opposite direction to bring the work into engagement with the ejector and means connected with the carriage for operating the ejector.

15. In a machine for producing prongs for loose leaf binders, a frame, a reciprocally movable carriage mounted for movement on the frame, a work-supporting mechanism rotatably mounted on the carriage, locking means for said work-supporting mechanism comprising key members secured to the mechanism at intervals, a pair of bars slidably mounted on the carriage adapted to receive a key member therebetween, and means for actuating one of said bars to release said key member at predetermined positions of the carriage.

16. In a machine for producing prongs for loose leaf binders, a frame, a reciprocally movable carriage mounted for movement on the frame, a work-supporting mechanism rotatably mounted on the carriage, locking means for said work-supporting mechanism comprising key members secured to the mechanism at intervals, a pair of bars slidably mounted on the carriage adapted to receive a key member therebetween, resilient means actuating one of said bars for permitting a key member to enter between the bars, and means for actuating the other one of said bars to release said key member at predetermined positions of the carriage.

17. In a machine for producing prongs for loose leaf binders, cutting tools, a rotary work holding means adapted to bring the work into and out of successive operative engagements with said tools, and a ring forming means adapted to deposit the ring into the work holding means at a pre-determined position of said holding means.

18. In a machine for producing prongs for loose leaf binders, cutting tools, a carriage mounted for movement toward and from said tools, a rotary work holding means mounted on the carriage for bringing the work into successive operative engagement with said tools, and a ring forming means adapted to deposit the ring into the work holding means at pre-determined positions of said holding means.

19. In a machine for producing prongs for loose leaf binders, cutting tools, a carriage mounted for movement toward and from said tools, a rotary work holding means mounted on the carriage for bringing the work into successive operative engagements with said tools, a ring forming means adapted to deposit the ring into the work holding means at a pre-determined position of said holding means and of said carriage.

20. In a machine for producing prongs for loose leaf binders, a frame, a plurality of cutting tools secured to the frame in spaced relation, a reciprocally movable carriage mounted for movement on the frame, a rotatable work supporting head comprising a plurality of spaced work holding means, a ring forming means adapted to deposit the ring into the work holding means at a predetermined position of the holding means, means for intermittently rotating the head to bring the work holding means into cooperative alinement with the ring forming means and to bring the work carried by said work holding means into operative alinement with respective tools and operating means for reciprocating the carriage to bring the work into and out of operating engagement with the tools.

21. In a machine for producing prongs for loose leaf binders, a frame, a plurality of cutting tools secured to the frame in spaced relation, a reciprocally movable carriage mounted for movement on the frame, a rotatable work supporting head comprising a plurality of spaced work holding means, a ring forming means adapted to deposit the ring into the work holding means at a predetermined position of the holding means, means for intermittently rotating the head to bring the work holding means into cooperative alinement with the ring forming means and to bring the work carried by said work holding means into operative alinement with respective tools and operating means to move the carriage in one direction to bring the work into operative engagement with

respective tools and in the opposite direction to bring the work into contact with an ejector means, an ejector means connected with the frame for ejecting the finished prong from the head and means connected with the carriage for actuating the ejector.

22. In a machine for producing prongs for a loose leaf binder, a frame, a plurality of cutting tools secured to the frame in spaced relation, a reciprocally movable carriage mounted for movement on the frame, a rotatable work supporting head mounted on the carriage comprising a plurality of work receiving apertures arranged in spaced relation therein, a clamp for each aperture adapted to secure the work in said aperture, clamp operating means adapted to bring the clamp into and out of holding engagement with the work at pre-determined positions of the carriage, a work forming means adapted to deposit the work into the apertures at a predetermined position of said apertures.

23. In a machine for producing prongs for a loose leaf binder, a frame, a plurality of cutting tools secured to the frame in spaced relation, a reciprocally movable carriage mounted for movement on the frame, a rotatable work supporting head mounted on the carriage comprising a plurality of work receiving apertures arranged in spaced relation therein, a clamp for each aperture adapted to secure the work in said aperture, clamp operating means adapted to bring the clamp into and out of holding engagement with the work at pre-determined positions of the carriage, a work ejecting means journalled on the frame comprising a pair of fingers adapted to move relative to each other and to engage opposite ends of the work, a finger actuating means for releasing the work from said fingers and means connected with the carriage for bringing the fingers into operative engagement with the finger actuating means.

24. In a machine for producing prongs for loose leaf binders, a frame, a plurality of cuttting tools secured to the frame in spaced relation, a reciprocally movable carriage mounted for movement on the frame, a rotatable work supporting head mounted on the carriage comprising a plurality of spaced work receiving apertures, a work clamp for each aperture adapted to secure the work in said aperture, clamp operating means adapted to bring the clamp into and out of holding engagement with the work at pre-determined positions of the carriage, a work ejecting means journaled to the frame in operative alinement with one of the work receiving apertures and comprising a pair of yielding fingers adapted to engage opposite portions of the work, a finger actuatitng means for releasing the work from the said fingers, operating means for moving the carriage in one direction to bring the work into operative engagement with the tools and in the opposite direction to bring the work into contact with the ejector fingers, means connected with the carriage to bring the fingers into operative engagement with the finger actuating means and means for returning the fingers to operative alinement with one of the apertures.

25. In a machine for producing prongs for loose leaf binders, a frame, a plurality of cutting tools secured to the frame in spaced relation, a reciprocally movable carriage mounted for movement on the frame, a rotatable work supporting head mounted on the carriage comprising a plurality of spaced work receiving apertures, a work clamp for each aperture adapted to secure the work in said aperture, clamp operating means adapted to bring the clamp into and out of holding engagement with the work at pre-determined positions of the carriage, a ring forming means adapted to deposit the ring as it is being formed into one of said apertures, a positioning means secured to the carriage in the path of movement of the ring as it is being formed and adapted to move the ring segment circumferentially after it has been cut by one of the tools from the work stock to bring the adjacent ends of the segment and work stock into engagement, and means for moving the carriage to bring the work into operative engagement with the tools.

26. In a machine for producing prongs for loose leaf binders, a rotatable work-supporting head comprising a plurality of work-holding means, a ring-forming means adapted to deposit the ring into the work-holding means, and means for intermittently rotating the head to bring the work-holding means into successive operative relation with the ring-forming means.

27. In a machine for producing prongs for loose leaf binders, a frame, a carriage mounted for reciprocative movement on the frame, a rotatable work-supporting head comprising a work-holding means, a ring-forming die adapted to deposit the ring into the work-holding means at a predetermined position of the holding means, a stock-gripping means adapted to maintain the stock against longitudinal movement during the movement of the carriage in one direction for forcing the stock through said die and to release the stock during the opposite movement of the carriage to permit said stock to be fed through the gripping means.

28. A device as in claim 27 wherein the gripping means is provided with adjusting means for causing a predetermined amount of stock to be fed through the die.

29. In a machine for producing prongs for loose leaf binders in combination with a cutting tool, of a movable work-supporting head comprising a work-holding means, a ring-forming die adapted to deposit the ring into

the work-holding means, and means for moving the head and die in unison towards the tool to cause the ring to be severed from the stock remaining in the die.

30. In a machine for producing prongs for loose leaf binders in combination with a cutting tool, of a work-supporting head comprising a work-holding means, a ring-forming die adapted to deposit the ring into the work-holding means, means for moving the head and die in unison towards and from the tool to cause the ring to be severed from the stock remaining in the die, and means for re-adjusting the severed ring to a predetermined position in the work-holding means as the head is moved from the tool.

31. In a machine for producing prongs for loose leaf binders in combination with a plurality of cuttitng tools, of a work-supporting head comprising a plurality of work-holding means, a ring-forming die adapted to deposit the ring in a work-holding means at a predetermined position of said holding means, means for moving the head and die in unison towards and from the tools to cause the ring to be severed from the stock remaining in the die, and means for rotating said head to bring the ring thus severed, into operative alignment with another tool as the head is moved from the tools.

32. In a machine for producing prongs for loose leaf binders, movable means for receiving and holding a wire ring, a die for simultaneously forming and depositing a ring into said holding means, and means for severing the wire between the holding means and die.

33. In a machine for producing prongs for loose leaf binders, means for receiving and holding a wire ring, a die for simultaneously forming and depositing a ring into said holding means, and means for simultaneously severing the wire between the holding means and die and cutting away a portion of the ring to form a slot in slightly spaced relation with the severed end thereof.

34. In a machine for producing prongs for loose leaf binders, means for receiving and holding a wire ring, a die for simultaneously forming and depositing a ring into said holding means, means for simultaneously severing the wire between the holding means and die and cutting away a portion of the ring to form a slot in slightly spaced relation with the severed end thereof, and additional means for removing opposite sides of the ring between said slot and adjacent end of the ring to form a tongue member therebetween.

35. In a machine for producing prongs for loose leaf binders, means for receiving and holding a wire ring, a die for simultaneously forming and depositing a ring into said holding means, means for simultaneously severing the wire between the holding means and die and cutting away a portion of the ring to form a slot in slightly spaced relation with the severed end thereof, additional means for removing opposite sides of the ring between said slot and adjacent end of the ring to form a tongue member therebetween, and separate means for forming a tongue or groove in the opposite end of the ring.

36. In a machine for producing prongs for loose leaf binders, a plurality of cutting tools arranged in spaced relation, a rotatable work-supporting head mounted for reciprocative movement towards and from said tools and having a plurality of ring-receiving holding means arranged in spaced relation, a die for simultaneously forming and depositing a ring into one of said work-holding means, means for simultaneously reciprocating said head and die to bring the wire into and out of operative relation with one of said tools to simultaneously sever the wire between the holding means and die and cutting away a portion of the ring to form a slot in slightly spaced relation with the severed end thereof, and means for intermittently rotating the head as it is moved from the tool to bring the ring into operative alignment with the next positioned tool.

37. In a machine for producing prongs for loose leaf binders, a rotatable work-supporting head, means for intermittently rotating said head, a plurality of ring-holding means formed in spaced relation in said head, a ring-forming die adapted to simultaneously form and deposit a ring in each of said holding means at a predetermined position thereof, means adapted to simultaneously sever the stock between the holder and die and from a slot in the ring in slightly spaced relation with the severed end thereof, and separate means adapted to cut away opposite sides of the ring positioned in the next succeeding holder to form a tongue between the slot and adjacent end of the ring during the severing operation of the first-mentioned ring.

38. In a machine for producing prongs for loose leaf binders, a rotatable work-supporting head, means for intermittently rotating said head, a plurality of ring holders formed in spaced relation in said head, a ring-forming die adapted to simultaneously form and deposit a ring in said holders at predetermined positions thereof, means adapted to simultaneously sever the stock between the holder and die and form a slot in the ring in slightly spaced relation with the severed end thereof, and separate means adapted to simultaneously cut rings positioned in succeeding holders to form a tongue or groove in the opposite ends of the rings and to cut away opposite sides thereof to form a tongue between the slot and adjacent

end of the ring during the severing operation of the first-mentioned ring.

39. In a machine for producing prongs for loose leaf binders, a frame, a carriage mounted for longitudinal movement on said frame, a ring forming die mounted on the carriage, a stock feeding means comprising a bracket secured to the frame at one side of said carraige, a pair of jaws mounted on said bracket, means for reciprocating the carriage a pre-determined distance, and means for bringing the jaws into engagement with the stock to maintain said stock against longitudinal movement during the movement of the carraige in one direction for forcing the stock through said die and to relieve said jaws as the carriage moves in the opposite direction to permit said stock to be fed through the jaws.

40. In a machine for producing prongs for loose leaf binders, a frame, a carriage mounted for longitudinal movement on said frame, a ring forming die mounted on the carriage, a stock feeding means comprising a bracket secured to the frame at one side of said carriage, a pair of jaws slidably mounted on said bracket, means for reciprocating the carriage a pre-determined distance, means for bringing the jaws into engagement with the stock to maintain said stock against longitudinal movement during the movement of the carriage in one direction for forcing the stock through said die and to relieve said jaws as the carriage moves in the opposite direction to permit said stock to be fed through the jaws, and adjustable means connected with the bracket for limiting the travel of the jaws in one direction to cause a pre-determined amount of stock to be fed through the die.

41. In a machine for producing prongs for loose leaf binders, a plurality of rotating cutting tools arranged in circumferential spaced relation and work-holding means for bringing the work into and out of successive operating engagements with said tools comprising a rotatable head mounted for reciprocative movement toward and from said tools and having a plurality of work-receiving apertures arranged in spaced relation therein, a work holding clamp associated with each aperture, means for depositing work in said apertures at a pre-determined position thereof, and means for automatically actuating the clamps at the loading position to engage the work.

42. In a machine for producing prongs for loose leaf binders, a plurality of rotating cutting tools arranged in circumferential spaced relation, and work-holding means for bringing the work into and out of successive operating engagements with said tools comprising a rotatable head mounted for reciprocative movement toward and from said tools and having a plurality of work-receiving apertures arranged in spaced relation therein, a work holding clamp associated with each aperture, means for yieldingly maintaining the clamps in their released position and spring actuated means for moving the clamps into the holding position at a pre-determined position of the apertures.

43. In a machine for producing prongs for loose leaf binders, a plurality of rotating cutting tools arranged in circumferential spaced relation, and work-holding means for bringing the work into and out of successive operating engagements with said tools comprising a rotatable head mounted for reciprocative movement toward and from said tools and having a plurality of work-receiving apertures arranged in spaced relation therein, a work-holding clamp associated with each aperture, means for yieldingly maintaining the clamps in their released position, spring-actuated means for maintaining the clamps in their holding position, and means for automatically actuating said spring actuating means at pre-determined positions of the head for releasing the work.

In witness whereof I have hereunto set my hand this 27th day of August, 1929.

DON D. MYERS.