April 4, 1944. S. F. MONTAGUE 2,346,039

METHOD OF FORMING WOODEN SPOONS FROM BLANKS

Filed Dec. 7, 1939 8 Sheets-Sheet 1

Fig. 1

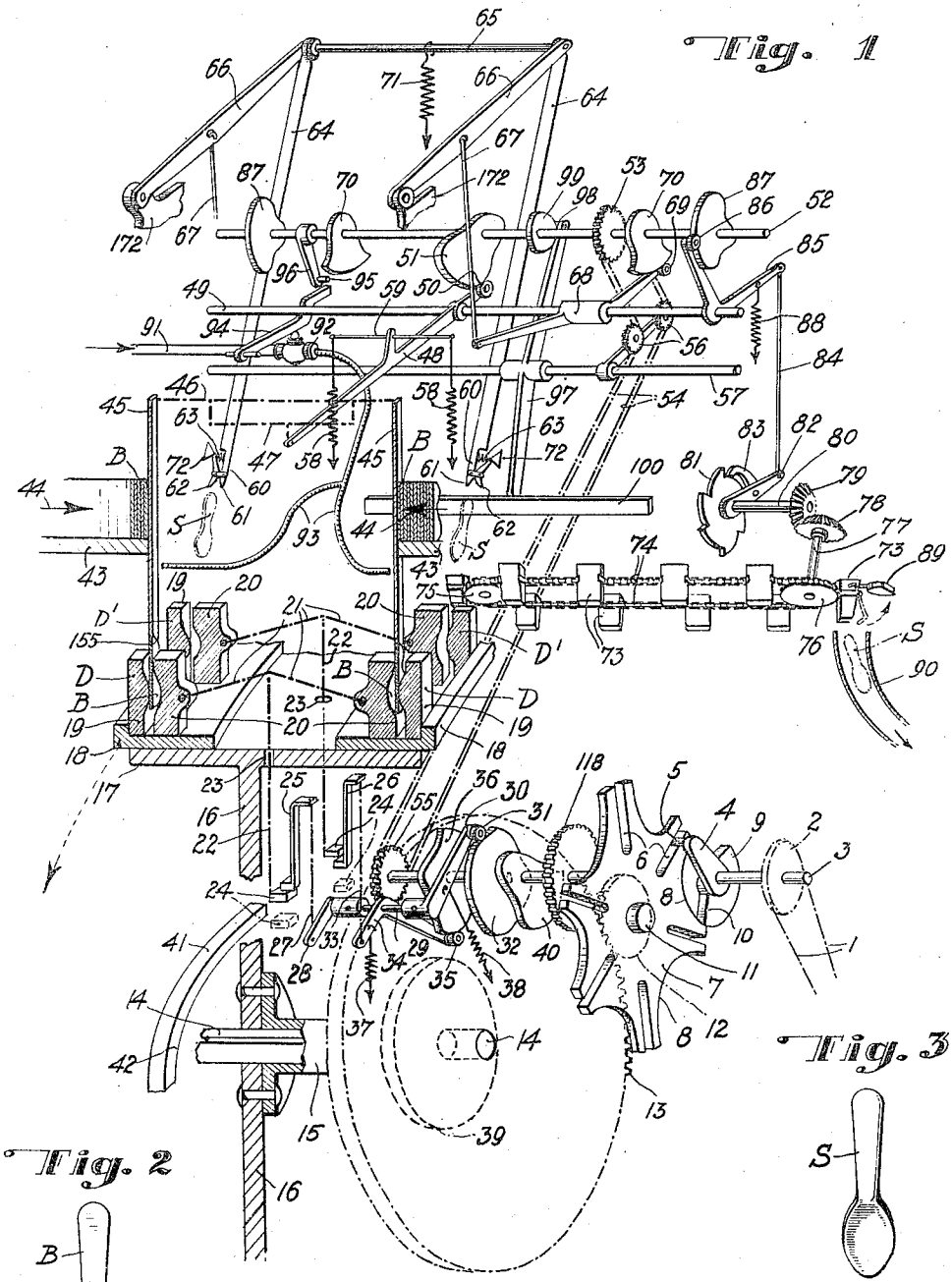


Fig. 2

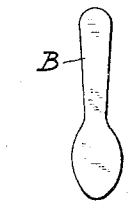


Fig. 3

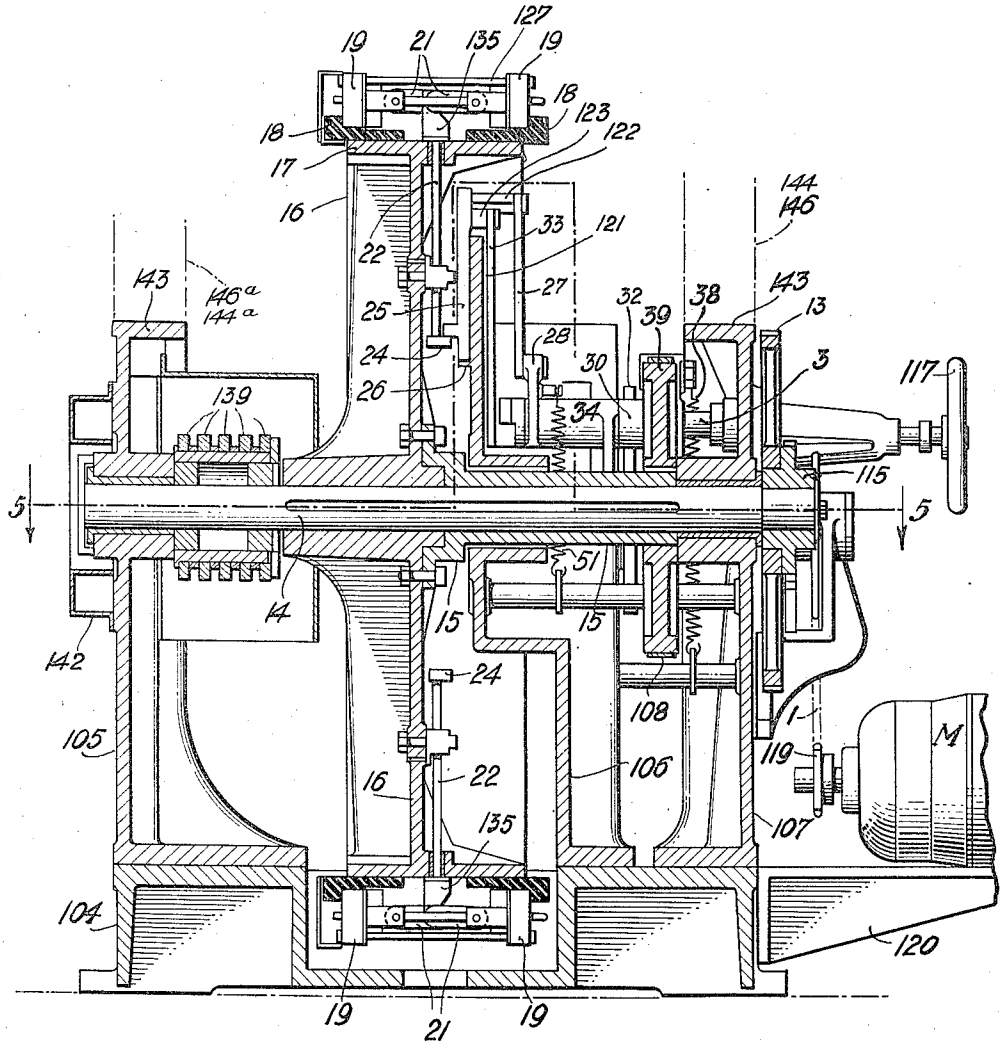
INVENTOR.
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BY Cornelius Zabriskie
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April 4, 1944. S. F. MONTAGUE 2,346,039

METHOD OF FORMING WOODEN SPOONS FROM BLANKS

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Fig. 4



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METHOD OF FORMING WOODEN SPOONS FROM BLANKS

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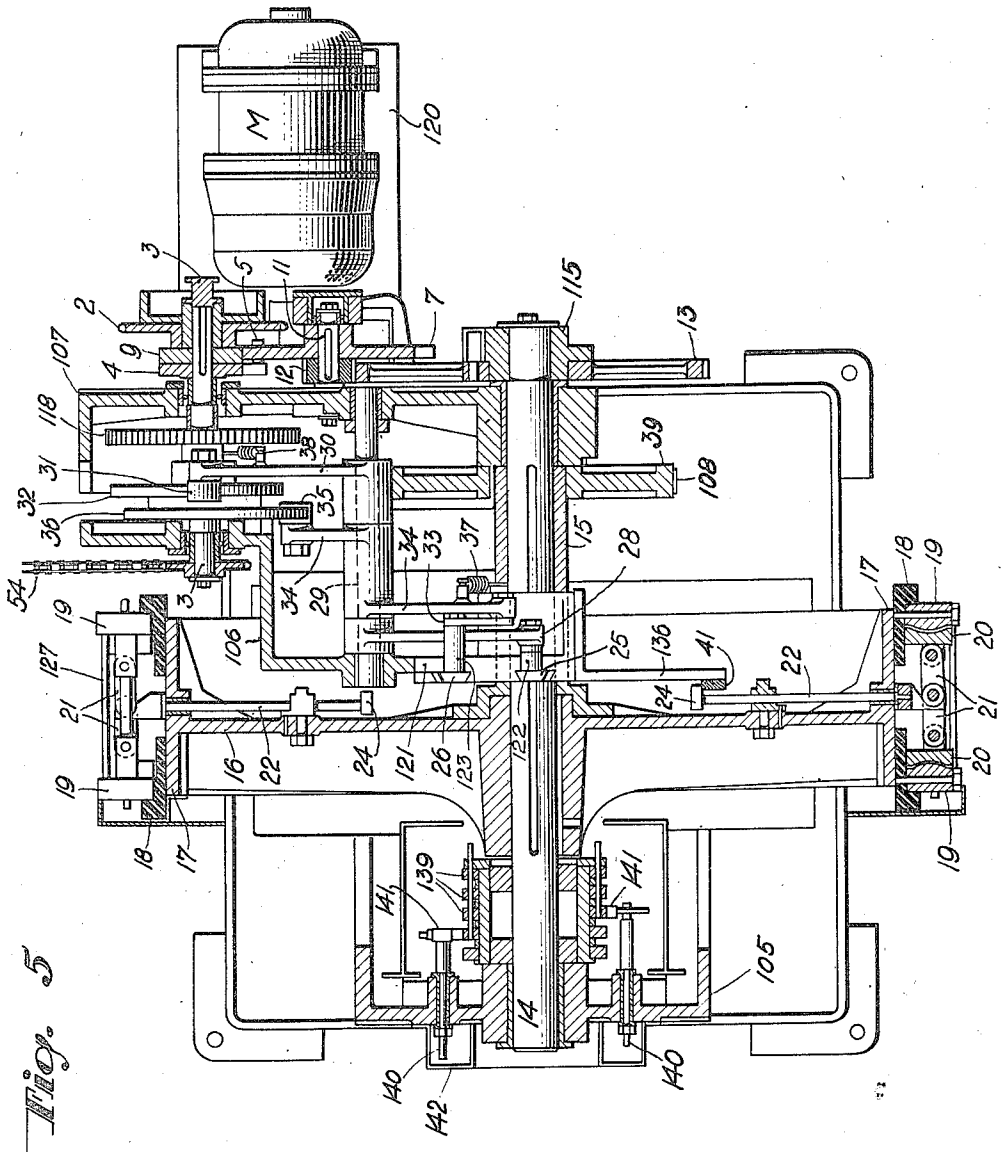


Fig. 5

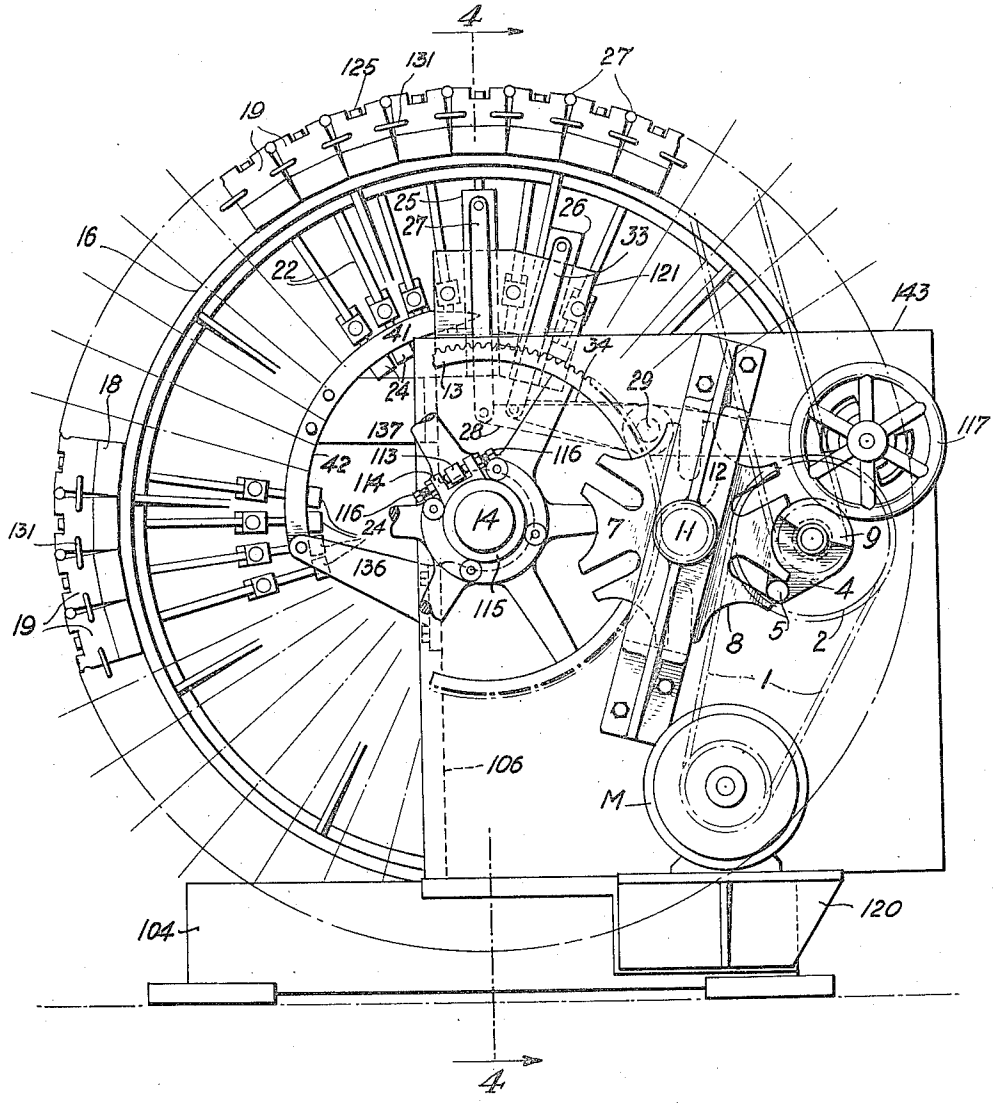
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METHOD OF FORMING WOODEN SPOONS FROM BLANKS

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Fig. 6



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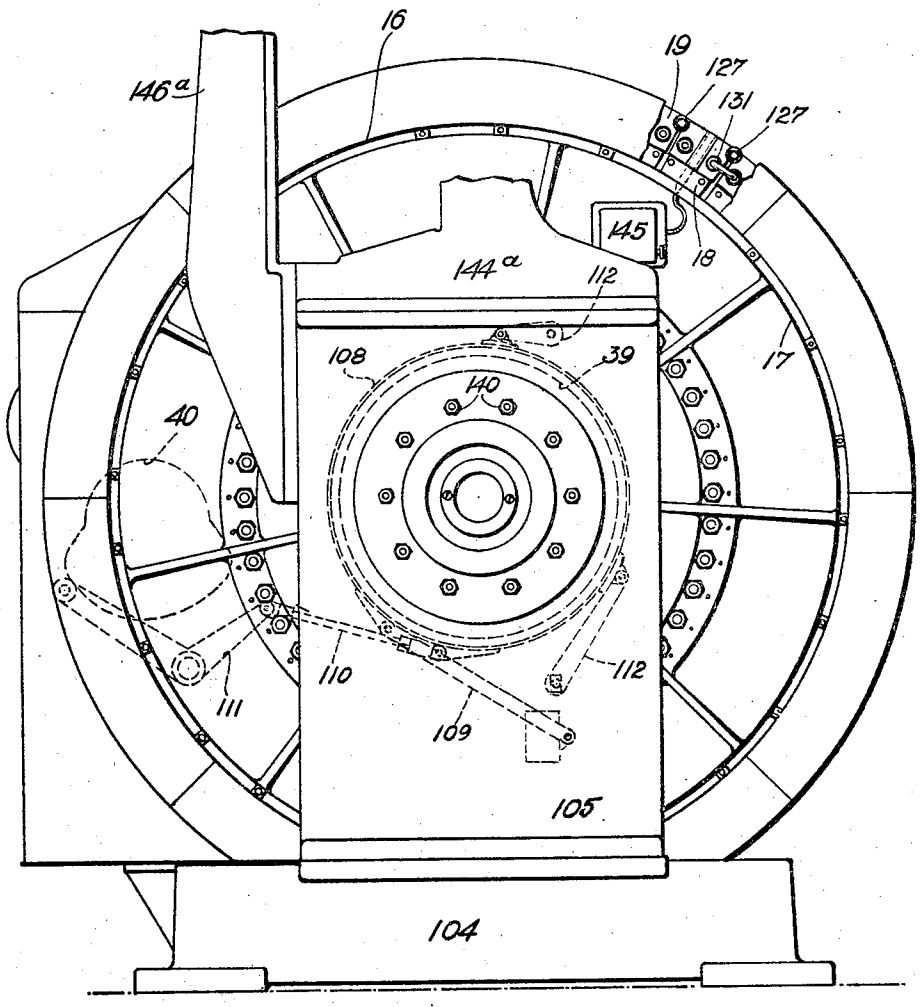
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METHOD OF FORMING WOODEN SPOONS FROM BLANKS

Filed Dec. 7, 1939 8 Sheets-Sheet 5

Fig. 7



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METHOD OF FORMING WOODEN SPOONS FROM BLANKS

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Fig. 8

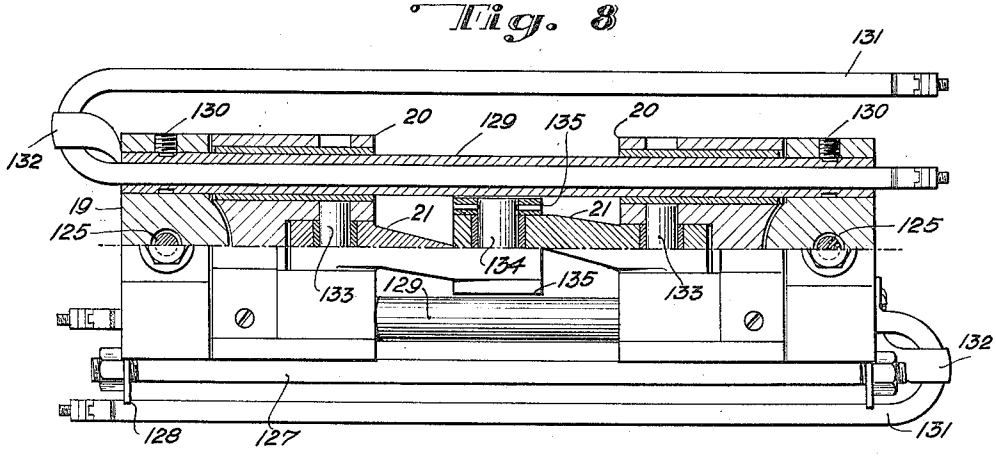


Fig. 9

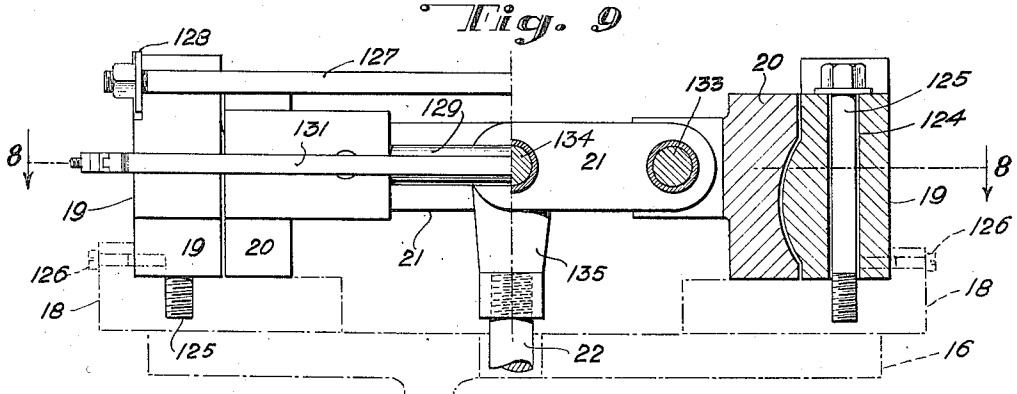


Fig. 10

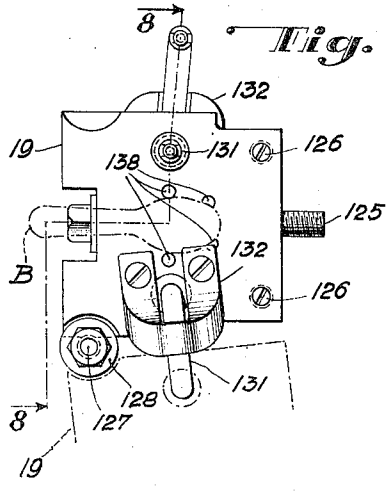


Fig. 24

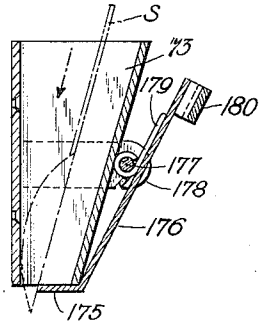
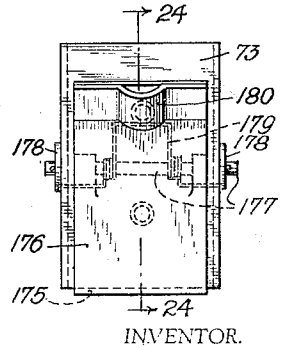


Fig. 25



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METHOD OF FORMING WOODEN SPOONS FROM BLANKS

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Fig. 13

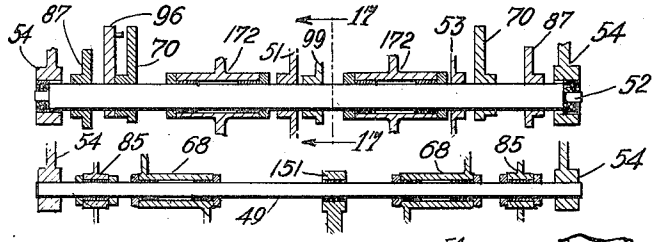


Fig. 14

Fig. 12

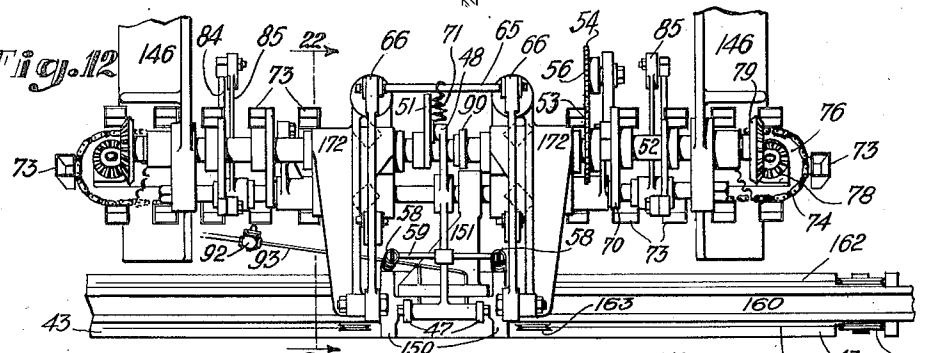


Fig. 15

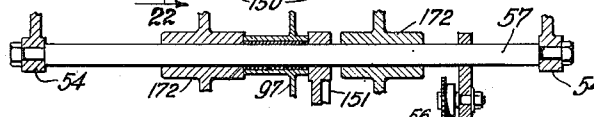


Fig. 11

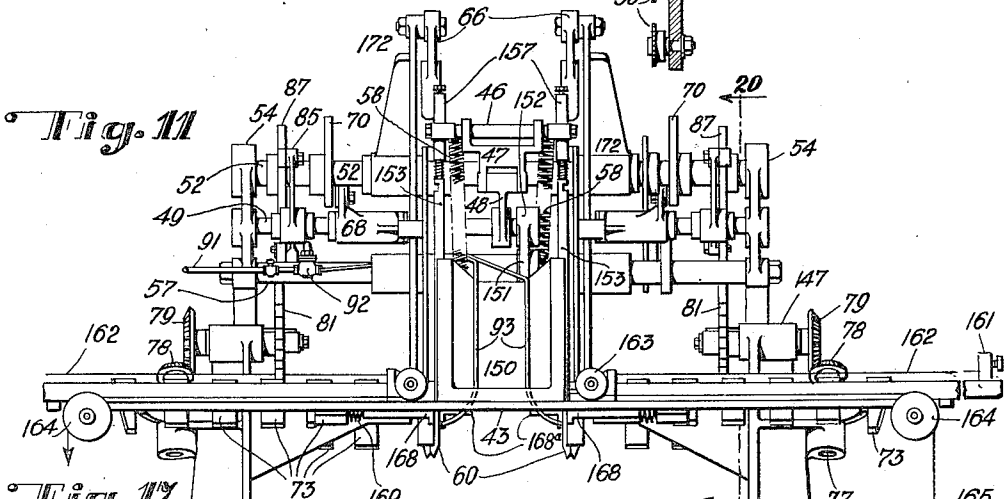


Fig. 17

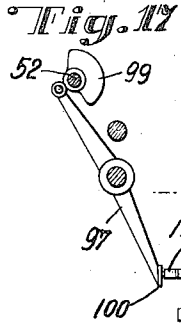
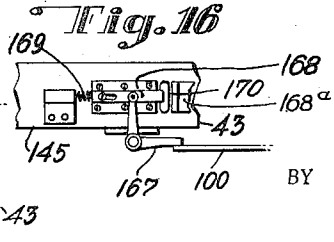


Fig. 16



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April 4, 1944. S. F. MONTAGUE 2,346,039

METHOD OF FORMING WOODEN SPOONS FROM BLANKS

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Fig. 18

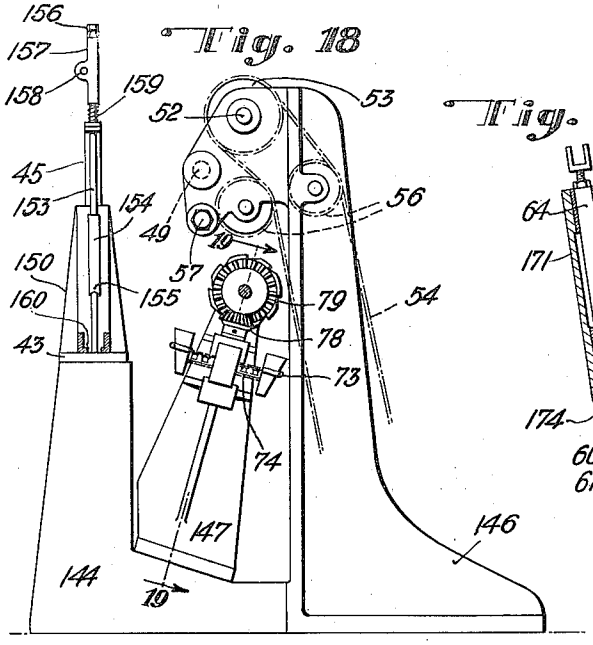


Fig. 22

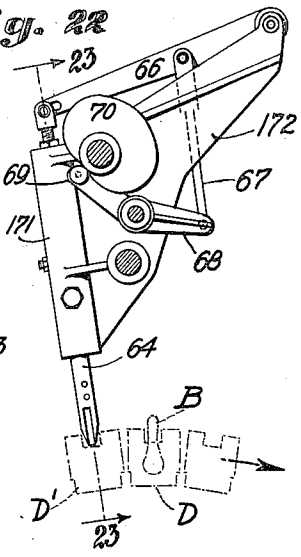


Fig. 23

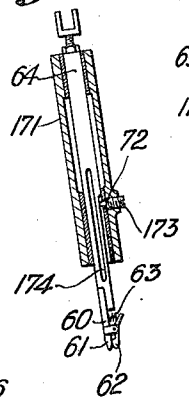


Fig 20

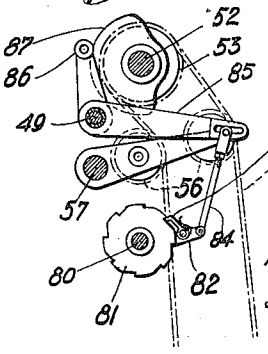


Fig. 19

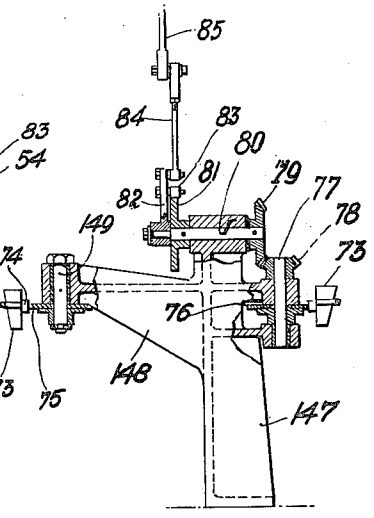
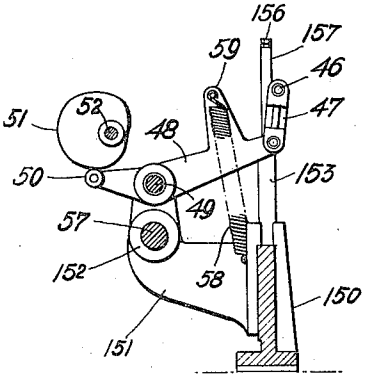


Fig. 21



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Patented Apr. 4, 1944 2,346,039

UNITED STATES PATENT OFFICE

2,346,039

METHOD OF FORMING WOODEN SPOONS FROM BLANKS

Stephen F. Montague, Oswego, N. Y., assignor to Berst-Forster-Dixfield Company, New York, N. Y., a corporation of Maine

Application December 7, 1939, Serial No. 307,954

9 Claims. (Cl. 144—309)

This invention relates to a method of and apparatus for forming wooden articles from blanks and, while adapted for general application in this connection, is designed primarily for the making of spoons from wood veneer in an economical and efficient manner.

Wooden spoons have been extensively used, for example, in connection with the sale of packaged ice cream and other confections and edibles and have been commonly given away to each purchaser. In order to permit of this practice the spoons must be very cheaply produced and nevertheless must have sufficient strength to permit of their satisfactory employment. The spoons heretofore commonly used in this connection have been of flat veneer material, having the general outline configuration of a conventional spoon, but lacking the surface shaping of the spoon handle and bowl. Such spoons are usable for these purposes, but are far from satisfactory, as material tends to slip off of the flat surface and the article, because of its flat formation, lacks structural strength unless made quite thick.

The primary object of the invention is to provide the means for cheaply producing wood veneer spoons having a hollow bowl adapted to satisfactorily contain and retain therein solid, liquid or semi-liquid materials and so shaped throughout as to impart appreciable structural strength to the article while permitting the use of relatively thin wood stock.

My research and tests in connection with the manipulation of wood veneer have demonstrated that it is practical to stamp flat blanks of substantially spoon outline from relatively thin clear stock of the hard wood variety, and thereafter manipulate such blanks between dies shaped to press or form such blank into approximately the shape of a conventional spoon, provided, however, that the blanks are manipulated in dies which are heated and in the presence of sufficient moisture to soften the wood appreciably through the permeation of the cellular fibrous structure thereof by steam generated by the heat of the dies.

I have obtained my best results by applying water, as by atomizing the same, to the individual blanks immediately prior to the time that they are introduced into the heated dies and by then closing the dies gradually, so that the water present, i. e., the concomitant moisture, may be generated into steam and soften the wood as the dies are progressively closed. By this method the forming of the blank into spoon shape is accomplished gradually and breakage or splitting of the blank is avoided. Gradual closing of the dies is important for the steam must have a sufficient time to penetrate and soften the blank in order to overcome the inherent brittleness of wood veneer. Nevertheless, from a manufacturing standpoint, very small quantities of water are desirable, for this water should be practically all eliminated or go off in steam by the time the spoon forming operation is completed. When this is so, the spoons will be delivered from the machine in substantially dry condition and their form will be permanent. For these reasons I preferably employ as little water as is possible to generate the necessary steam and preferably supply this water directly to each blank as it is fed to the die. This permits the handling of dry blanks up to the time that they are fed to the die for dry blanks may be much more satisfactorily handled than blanks in a wet condition. I may, however, feed wet blanks to a die charging station and then introduce the blanks individually into the die without departing from this invention.

In the preferred form of the method of this invention, the method comprises passing cut wooden blanks to a die feeding station, introducing said blanks individually between relatively movable heated die sections, applying moisture to the blanks during their passage from the feeding station to the die, then closing the dies gradually and at such rate that the moisture applied to the blanks may be converted into steam and penetrate the blanks to soften the same and render them susceptible to the forming operations of the die sections, utilizing the die sections not only to shape, but to dry the wood stock by pressing the resulting steam therefrom, and thereafter opening the die sections and removing the substantially dry finished products therefrom.

In its preferred form, the apparatus employed comprises a succession of pairs of die couples arranged in closely spaced apart circumferential relation about the periphery of a drum. The companion die couples of each pair are arranged in the same radial plane and each die couple embodies two suitably heated complementary die sections. The outer die sections of each pair of couples are rigidly mounted with respect to the drum, while the inner die sections are mounted for movement toward and away from one another and are connected together by a toggle, which is adapted to be flexed by the action of appropriate cams, hereinafter more fully described. These cams are so constituted as to produce a substantially quick preliminary closing of each die for the purpose of gripping a blank therein, and to

thereafter gradually progressively close such die as the drum is intermittently rotated, through the employment of properly timed mechanism, to successively bring the consecutive die couples into register with a stationary feeding station, with periods of dwell at the feeding station for each couple. In addition to the die feeding and operating means referred tc, the apparatus includes means for opening the die couples at the conclusion of the spoon forming operation and for removing and conveying away the finished product to be discharged from the machine.

An important feature of the present invention resides in the capacity of the method and apparatus of this invention to produce a high grade finished product in a completely automatic manner and with remarkably high quantity production, all of which results in economy of manufacture and the ability to sell the product at relatively low cost.

Features of the invention, other than those adverted to, will be apparent from the hereinafter detailed description and claims, when read in conjunction with the accompanying drawings.

In the accompanying drawings, I have shown one form of apparatus for carrying out the method of this invention, but this apparatus is to be understood as illustrative, only, and not as defining the limits of the invention.

Figure 1 is a diagrammatic showing of apparatus embodying the present invention, illustrating the parts in perspective and showing their general relation in the apparatus shown in the other figures.

Figure 2 is a face view of a spoon blank adapted to be manipulated by the machine of this invention.

Figure 3 is a face view of the finished spoon.

Figure 4 is a central vertical section taken in the plane of the line 4—4 of Figure 6 through the lower or spoon forming portion of the machine, with certain parts in elevation in the interest of clearness.

Figure 5 is a plan view taken on the broken line 5—5 of Figure 4.

Figure 6 is an end elevation of the spoon forming portion of the machine taken from the right hand end of Figure 4, with certain parts omitted in the interest of clearness.

Figure 7 is an end view of the spoon forming portion of the machine taken from the left hand end of Figure 4.

Figure 8 shows one die couple, partly in plan view and partly in central section on the line 8—8 of Figures 9 and 10.

Figure 9 is a front elevation of the die couple shown in Figure 8, with the right-hand half of that view in substantially central vertical section, but showing both links of the toggle in elevation.

Figure 10 is an end view of the die couple shown in Figures 8 and 9, with one adjacent die couple indicated in phantom.

Figure 11 is a front elevation of the upper portion of the machine, constituting the blank feeding and removing apparatus.

Figure 12 is a plan view of the structure shown in Figure 11.

Figure 13 is a section through the upper cam shaft assembly.

Figure 14 is a section through the upper rocker shaft assembly.

Figure 15 is a section through the upper tie rod assembly.

Figure 16 is an underneath fragmentary plan view of the blank feeding plate and certain associated parts as they appear directly above this figure in Figure 11.

Figure 17 is a section in approximately the plane of the line 17—17 of Figure 13, showing the connections between the cam shaft and the parts shown in Figure 16.

Figure 18 is an end view of the upper portion of the machine showing more particularly the end frames which support the spoon introducing and removing parts.

Figure 19 is a front elevation of a bucket conveyor and its operating mechanism, with certain parts shown in section in the plane of the line 19—19 of Figure 18.

Figure 20 is a fragmental section taken substantially in the plane of the line 20—20 of Figure 11.

Figure 21 is a fragmental vertical section taken substantially midway of the length of the machine and through the upper portion thereof to illustrate the operating devices for imparting movement of spoon introducing plungers.

Figure 22 is a fragmental section on the line 22—22 of Figure 12.

Figure 23 is a section on the line 23—23 of Figure 22.

Figure 24 is a section on the line 24—24 of Figure 25.

Figure 25 is a front view of one bucket of a bucket conveyor shown in Figure 1.

In Figure 1 of the drawings, I have shown in a diagrammatic way the apparatus illustrated in the other figures of the drawings. This figure is not intended to be an exact showing of the shapes of the various parts or of their proportions, but schematically illustrates the manner in which these parts are associated with one another and are operable in the manner hereinafter described to carry out the method of this invention, in order that a clear understanding may be had of how the operations of the machine and the steps of the method are carried out.

Referring first to Figure 1, power from a prime mover, such as an electric motor, is delivered through a sprocket chain 1 to a sprocket 2 fixed on a lower cam shaft 3. On this shaft is fixed an arm 4 carrying a pin 5 adapted to cooperate progressively with the slots 6 of a Geneva disk 7. Between the slots 6, the periphery of the disk 7 is hollowed as at 8 to cooperate with a locking disk 9, cut away at 10, so as to clear the disk 7 while the pin 5 is driving this disk, but to lock the Geneva disk when the pin is disengaged from the slots. The parts 4, 5, 7 and 9 constitute collectively a Geneva movement, for the purpose of intermittently driving a shaft 11 with intermittent periods of rest or dwell.

Fixed on the shaft 11 is a pinion 12, meshing with and driving a gear 13 which, in turn, is fixed on main shaft 14 and keyed to this shaft is a sleeve 15 rigidly secured to the web of the die drum 16. The drum has a peripheral flange 17 on the face of which are mounted strips of heat insulation 18 and on these strips are supported a plurality of die couples arranged side by side around the entire face of the drum. Two pairs of die couples are shown in Figure 1 and are designated D and D', respectively. The die of each couple comprises a fixed die section 19 and a movable die section 20. The movable die sections are guided for movement toward and away from the fixed die sections, as will be hereinafter explained, and they are connected by toggle links 21, whereby, when flexed, the corresponding die couples will be opened and closed.

For operation of the toggles, each is connected at its elbow with an operating rod 22 and the operating rods of all of the couples extend radially inwardly through perforations 23 in the flange of the drum and carry at their inner ends operating feet 24. The constructions of all of the dies and all of the toggles with their respective operating rods 22 and feet 24 are identical. In other words they are duplicated about the drum, so that, when the drum is rotated through the Geneva movement and other operating connections which have been described, the operating feet of the several toggles will be successively, periodically brought into position to be operated upon by trains of mechanisms which will operate the toggles in predetermined sequence to close and open the dies.

In the showing of Figure 1, the two feet 24 are so illustrated that one is in position wherein it is about to be operated upon to close the toggle of the foremost die couple D, while the other is in a position wherein it has been just operated by mechanism to open the rear couple D' for the removal of the finished product. The operation of these toggles through the feet 24 is directly accomplished by a closing slide 25 and an opening slide 26, mounted for reciprocating movement substantially radially of the drum. The closing slide is connected by a link 27 to an arm 28 fixed on a shaft 29 to which is also fixed an arm 30. This latter arm carries a cam follower 31 acting against a cam 32 on the cam shaft 3. The toggle opening slide 26 is connected by a link 33 to a bell crank lever 34 which has a cam follower 35 acting against a cam 36 also fixed on the cam shaft 3. A spring 37 acts upon the arm 34 to normally depress the opening slide 26, while the spring 38 acts upon the arm 30 to normally elevate the closing slide 25. Thus the die closing slide 25 acts downwardly on the toggle to close the same under the positive operation of the cam 32, while the opening slide 26 acts upwardly under the positive operation of the cam 36. The spring 37 serves to maintain the follower 35 in contact with cam 36 and spring 38 serves to keep the follower 31 in engagement with the cam 32. The parts described are so timed that the closing slide 25 will be depressed while the Geneva movement is holding the drum at rest but just before it starts to move the drum, and the opening slide 26 will be operated while the Geneva movement is holding the drum at rest and immediately after the drum is so brought to a condition of rest.

In order to assure of quick stopping of the drum, so that the machine may be run at fairly high speeds, there is fixed to the bushing 15 of the drum a brake element 39 with an associate brake band, not shown in Figure 1, but controlled by a cam 40 on the cam shaft 3, and so positioned as to brake the drum as soon as positive rotation by the Geneva movement is completed.

With this arrangement, it will be apparent that the Geneva movement will periodically rotate the drum through a predetermined angle to bring the successive die couples consecutively into cooperative relation with the die opening and closing slides.

Immediately forward of the foot of the die closing slide 25, there is positioned a cam member 41 having a cam track 42 into engagement with which the feet 24 of the toggle operating rods 22 pass before they individually leave contact with the slide 25 and this cam track 42 is of decreasing radius in the direction of travel of the feet therealong, so as to progressively increase the die-closing pressure on the toggle as the drum is periodically rotated.

Arranged above the drum and at either side thereof are a pair of feed tables 43 on which are positioned horizontal stacks of flat wood blanks B of the shape shown in Figure 2. These are stamped from wood veneer and have the general outline configuration of a spoon. They are arranged in stacks with the bowl end down and are adapted to be urged in the direction of the arrows 44, so that the blanks at the forward ends of each stack normally bear against upright pushers 45 at the respective feeding stations for the forward die couple D. The pushers 45 are mounted for vertical reciprocation in such manner that, when raised above the blank stacks B, the stacks will move forward to position the end blank of each stack beneath and in alinement with one of the pushers, so that, when the pushers are subsequently lowered, they will move these two forward blanks simultaneously downward and introduce them into the dies of the forward couple, as shown in Fig. 1. Reciprocation is imparted to the pushers in proper timed relation with the operation of the dies in the manner next to be described.

The pushers are tied together for simultaneous operation, as indicated at 46, and depending from the tie rod is a pivoted yoke 47 pivotally connected to one arm of a lever 48 which is in turn fulcrumed on a rocker shaft 49. The other arm of the lever carries a follower 50 acting against the cam 51 fixed to an upper cam shaft 52. On this cam shaft is a sprocket 53 connected by a sprocket chain 54 to a sprocket 55 fixed on the lower cam shaft 3 and the upper cam shaft is driven from the lower cam shaft through these connections. Direction idlers 56 are mounted on an arm secured to a tie rod 57, so that the sprocket will clear the tie rod 57 and the rocker shaft 49. By these connections the pushers are operated in timed relation to the die operating mechanism, as well as the mechanism which rotates the drum, so as to introduce the blanks into the dies, when the dies are opened.

It will be noted that the cam 51 furnishes the power for elevating the pushers, whereas said pushers are lowered by springs 58 connected to a cross bar 59, rigid with the lever arm 48. These springs depress the pushers with yielding pressure, so that, in the event a blank jams or fails to properly feed, the apparatus will not be damaged.

After the spoons have been formed and otherwise completed, as will be hereinafter more fully explained, they finally come into the position of removal in which is shown the rear die couple D' in Figure 1, and they are removed from these dies by a pair of grippers 60. These grippers each embody a fixed jaw 61 and a movable jaw 62 normally spring pressed by a spring 63 to cause the jaws to close, but so constituted that, when pressed against the upper end of a formed spoon, the jaws will yieldably open until the spoon is gripped and held by spring pressure in the grasp of the grippers.

These grippers are supported on the lower ends of spoon-removing plungers 64 mounted for vertically inclined longitudinal reciprocation toward and away from the dies d'. They are pivotally secured at their upper ends to a tie rod 65 which is, in turn, secured to the rear ends of operating levers 66, the distant ends of which are pivoted to fixed brackets 172. These levers are each connected by a link 67 to one end of a rocker 68, the

other end of which carries a follower 69, held against a cam 70 by a spring 71 associated with the tie rod 65. The cam 70 is fixed on the upper cam shaft 52, so that the operations of the spoon removing grippers are timed with respect to the operations of the toggle operating mechanism of the dies.

Through the connections described, synchronized as specified, the rear dies D'—D' will be opened after they have been brought into cooperative relation with the grippers and in proper timed relation with this operation, and preferably slightly before these dies are opened, the grippers descend and engage with and grip the finished spoons in the die couples D'—D', while these dies are at rest. The cams 70, which are duplicated for each gripper, now act through the connections described to lift the grippers until they are an appreciable distance above the plane of the top of the dies, whereupon the upwardly extending tails of the pivoted jaws of the grippers engage with fixed cam stops 72, mounted in their paths and, as the upward movement of the grippers continues, the pivoted jaws of the grippers are rotated about their pivots sufficiently to release the finished spoons. These fall by gravity into buckets 73, hereinafter described and which in the meantime have been brought into position below the finished spoons, designated by the reference character S in Figure 1. The spoons fall into these buckets and are adapted to be conveyed thereby to appropriate places of delivery.

The buckets which thus individually receive the finished spoons are mounted in suitable numbers on each side of the machine in a manner to travel successively past and beneath the point of discharge of the spoons by the grippers. As shown, each set of these buckets is fixed on an endless sprocket chain 74 extending around spaced apart sprockets 75 and 76. This arrangement is duplicated at opposite sides of the machine, but only the right hand assembly is shown in Figure 1. Here it will be noted that the shaft 77 of the sprocket 76 carries a bevel pinion 78 meshing with a bevel gear 79 fixed on a shaft 80 of a ratchet wheel 81. On the shaft 80 is pivoted an arm 82 carrying a pawl 83 to coopperate with the ratchet 81 and a link 84 connects the arm 82 to one arm of a bell crank 85. This bell crank is pivoted on the rocker shaft 49 and its other arm carries an idler 86 held against a cam 87 by a spring 88. The cam 87 is fixed on the cam shaft and is driven thereby. The gearing connections, teeth of the ratchet, and shape of the cam are such as to cause one of the buckets to be moved beneath a finished spoon, as soon as the spoon is lifted above the plane of the buckets by the corresponding gripper and to move such bucket out of the path of the gripper before it again descends to pick the finished spoon out of the next die.

As the machine operates, step by step in a manner which will be now understood, the buckets with spoons therein will be brought one by one into the position of the right hand bucket in Figure 1 or into a corresponding position at the left hand side of the machine, and at this point a fixed abutment 89, in the path of such buckets, will act upon them one at a time at each side of the machine to open the bottom of the buckets and drop out each finished spoon, so that it is adapted to fall through a chute 90 to a convenient place of delivery. The spoon, as thus delivered, is in finished form and by preference is fed by the chute 90 to suitable wrapping apparatus wherein it is wrapped in an appropriate paper or cellulosic container and sealed ready for the market.

To permit of the discharging of the spoons from the buckets in the manner described, each bucket has a movable bottom mounted on an operating tongue pivoted to the bucket and normally spring pressed to close the bottom. This tongue has a camming projection on its outer face above the pivot and when this projection engages the fixed abutment 89, continued travel of the bucket will cause the tongue to be tilted and the bottom will be opened to discharge the spoon.

The operations described in connection with the removal of the finished spoon from the dies, and its delivery, are duplicated at opposite sides of the machine through duplication of the mechanism hereinbefore described.

In the manipulation of wooden blanks into spoon form, it is essential that the die forming operation be carried out while the wood is moist. Means is therefore provided for supplying this moisture and in the machine shown in Figure 1 in the drawings, such moisture is atomized on to the blanks as they are individually fed from the stacks to the dies. The atomizing mechanism and its controlling devices are shown in Figure 1. Water or any other liquid suitable for the purpose is fed through a pipe 91 to a valve 92, beyond which a branch tube leads to the spaces between the tables and the dies. The two branches of this tube are designated 93 and they may terminate in atomizer nozzles if so desired. The valve 92 is normally closed, but bearing against its valve stem is a lever 94 adapted to be periodically engaged by a pin 95 carried by an arm 96 which is fixed to the upper cam shaft 52. The position of the arm 96 is such that it will open the valve momentarily as blanks pass the outlet ends of the tube branches 93, so that liquid is atomized onto the blanks on their way to the dies. The arrangement is such as not to cause a drenching of the blanks, but rather the supply of sufficient moisture to result in the generation of the requisite amount of steam to produce the necessary moldability of the wood stock.

During the feed of blanks from the tables 43 into the dies D—D, the dies are of course opened to receive these blanks and it is therefore necessary to support such blanks in proper position in the die until the dies can close and grip them. The design of the dies is such that the blanks preferably are slipped in between the die sections with slight friction, but this cannot always be depended upon to hold them in proper position until the dies are closed. Consequently means is provided to frictionally grip and hold the blanks during the latter portion of the feeding thereof and until the dies close sufficiently to grip them. The mechanism whereby this is accomplished will be hereinafter more fully described. It is shown specifically in Figures 14, 16 and 17, but the means for operating the same is illustrated in Figure 1 as comprising a rocker 97 pivoted on the tie rod 57 and provided at its upper end with a follower 98 coacting with the cam 99 on the upper cam shaft 52. The rocker carries at its lower end an elongated bar head 100 and this head is sufficiently long to act upon the clamping devices associated with both dies of the forward couple for the purpose of holding the blanks as stated.

Particular attention is called in connection with Figure 1 to the cam 42 in the lower portion

of the machine for it is this cam which controls the progressive closing of the dies after the blanks have been inserted. The toggles of the dies are of course initially closed by the closing slide 25, but they do not completely close each die, they merely partially close it, because if these dies were immediately forced to final closed position, they would split and break the blanks. Sufficient time must be allowed for the blanks to heat up and become permeated with the steam from the moisture thereon. Consequently, it is the function of the closing slide to merely partially close each die in order to tightly grip the blank therein and shape it to a slight degree. The dies are fully closed by the cam face 42, different portions of the length of which progressively act upon the die toggle as the drum is moved step by step to cause the foot 24 of the corresponding toggle to traverse the length of the cam track. The radius of this cam track becomes increasingly less in the direction of its length, until at its end the radius is sufficiently small to have carried the die toggle slightly beyond dead center, so that said toggle becomes locked in die closing position and will remain locked as the foot 24 leaves the end of the cam track. As the drum continues to be intermittently rotated, the toggles remain locked as they leave the cam track until they finally are consecutively brought into cooperative relation with the cam opening slide 26. The distance travelled in the interim will constitute almost a complete circle. The elapsed time will be sufficient, not only to complete the forming of the spoon, but a sufficient drying (due to the heat in the dies), so that the material is set and will retain its shaped condition after the articles have been removed from the dies. After the feet of the toggles have been brought into a position above the die opening slide, this slide is operated to flex the toggle to open the dies, so that the spoons may be removed in the manner described. The arrangement described provides for intermittent feed of blanks in closely timed sequence and a corresponding removal of the finished product, but with a relatively long intervening period of treatment during which the blanks are formed and set in finished shape. The spoons, as they leave the machine, are in the form shown in Figure 3.

It will thus be apparent that, instead of quickly closing the die sections to rapidly form the blank into finished shape, the intermittent rotation of the drum about the stationary cam face 42 results in the progressive closing of the die sections in a plurality of stages. In the preferred form of the invention described, the periods of rotation of the drum are of uniform duration and are uniformly spaced apart by the Geneva movement and consequently the blanks are correspondingly formed in progressive stages of uniform duration, uniformly spaced apart.

The closing of the two die sections of each couple is thus accomplished by successive stages of partial closing movement. These stages are additive, in contradistinction to successive die closing movement interspersed by die opening movements. They are incremental and accumulative and they collectively add up to the complete closing of the die couple. The die sections are not moved apart between stages of closing movement. On the contrary, these die sections are, throughout these periods, held in fixed relation against opening movement and they are heated to a temperature above the boiling point of the water present, i. e., the concomitant moisture, whereby their temperature is sufficient to convert such moisture into steam and ultimately dry said blank in substantial conformity with said die sections.

From the foregoing description of the invention, as exhibited in Figures 1–3, the mode of operation of the apparatus and the steps of the method will be apparent. Some understanding will also be had of the mechanical parts which enter into the construction. However, and inasmuch as it is not feasible in a drawing, such as Figure 1, to accurately show the construction of these parts, I shall next consider the construction of the several parts of the machine where it is felt desirable to a more clear understanding of the present invention in one of its preferred practical forms. In these remaining figures the same reference numerals as used in Figure 1 will be employed to designate the corresponding parts with supplemental detailed description where it is thought desirable.

From Figures 4–7 it will be noted that the entire machine is mounted on a base 104 on which are superimposed three spaced apart standards or frames 105, 106 and 107. The shaft 14 which carries the drum 16 extends through all of these frames and is journalled for rotation in the two end frames. The bushing 15, which is bolted to the hub of the drum, passes loosely through an opening in the intermediate frame 106, is keyed to the shaft 14 and carries the brake drum 39. The brake band 108 which cooperates with this drum is best seen in Figure 7. One end of this brake band is anchored by a link 109 to the end frame 105, while its other end is secured to a link 110 connected to a rocker 111 carrying a follower which rides on the cam 40. Stay links 112 hold the brake band in position with reference to the face of the brake drum.

The gear 13, as best shown in Figure 6, is mounted on the shaft 14 for circumferential adjustment in order to permit of timing of the parts. To this end the gear 13 is loosely mounted on said shaft but carries a lug 113 projecting between the arms 114 of a yoke forming part of a collar 115 fixed on said shaft. Adjusting screws 116 permit of such angular adjustment as may be necessary to obtain accurate timing between the operations of the Geneva movement and the position of the dies.

The hand wheel 117 appearing in Figures 4 and 6 is affixed to a shaft normally spring retracted, but provided at its inner end with a pinion not shown. This hand wheel when pressed inwardly may be brought into mesh with a gear 118 on the lower cam shaft 3, so that, when the hand wheel is turned, the entire apparatus may be manually operated to shift the parts into particular positions which for any reason or other it is desirable to have them when the parts are brought to rest. The normal drive is from the motor M which drives a sprocket 119 meshing with the main drive chain 1. This motor is mounted on a bracket 120 supported at one end of the base 104.

The closing slide 25 for closing the dies, as well as the die opening slide 26 are mounted in guides on an upstanding portion 121 of the intermediate frame 106, so as to extend substantially in a radial direction, as shown in Figure 6. These slides respectively carry rigid extension arms 122 and 123 which reach laterally over the part 121 of the intermediate frame, so that the links 27 and 33 may pass unobstructedly to the rockers 28 and 34 which operate them.

All of the die couples are identical in construction and in Figures 8–10 the details thereof are shown. The fixed die sections 19 constitute the male sections of the die. They are made in the form of solid blocks provided therethrough with vertical holes 124 through which are passed anchoring studs 125. These studs are tapped into the insulating material 18 which is secured to the face of the drum 16 and the outer face of this insulating material is rabbeted to receive these die sections. Screws 126 pass through the insulating material and thread into the die sections 19 to assist in securing said sections in rigid spaced apart relation. Tie rods 127 extend between the dies of each pair with washers 128 bridging the gap between them, so that these tie rods serve circumferentially adjacent pairs of dies and, together with the studs 125 and screws 126, preclude lateral separation of the male members 19 of the dies.

Extending between the two male sections 19 are tubular guides 129 locked in place by set screws 130. These guides extend through bushings in the female die sections 20 and thus mount said sections for sliding movement toward and away from the male sections 19. Electrical heating elements 131 of U-shaped form are so arranged that one leg of each element extends through one of the guide rods 129 of each two adjacent pairs of dies and consequently each heating element thus serves said two die pairs. The insulating elements are braced by brackets 132 mounted on the outer sides of the male sections.

Each of the female sections 20 carry a wrist pin 133 and is bifurcated to receive on these wrist pins the distant ends of the toggle arms 21. The elbow pin 134 of the toggle passes through the overlapping links as shown and through the bifurcated upper end of the fitting 135 to which the upper end of the operating rod 22 is rigidly secured. It will be noted from Figure 9 that the fitting 135 is closely adjacent the outer face of the drum when the links of the toggle are at dead center, so that, as soon as the toggle has been drawn slightly beyond dead center, the fitting 135 will engage with the outer face of the drum and preclude the breaking of the toggle either inwardly or outwardly. Consequently, if blanks are in the dies, the dies will be locked closed thereon until the toggles are forcibly flexed in an outward radial direction. This permits the cam 41 of Figures 1 and 6 to be made relatively short. In fact it only need be long enough and of such pitch as to allow of the closing of the dies to the desired extent in the period in which it is possible to do so without splitting the wood, with the tail or lower end of the cam track such as to leave the toggles below dead center, i. e., locked, in which position they will remain locked until they are flexed outwardly by the releasing slide 26.

The mounting for the cam track 41 will be clear from Figure 6. It is supported on its lower end by a bracket 136 mounted on the intermediate frame 106, while the upper portion of the cam track is supported in a similar bracket 137, also mounted on the same frame.

In order to insure accurate positioning of the blanks in the die, each die is provided with internal pins 138 shown in Figure 10 and in this figure a blank is indicated in the position which it occupies with respect to these pins.

Current is supplied to the heating elements 131 of the several dies by suitable wiring connections (not shown) with a series of collector rings 139 mounted on the lower shaft 14, as shown best in Figures 4 and 5. To these rings current is supplied from terminals 140 having brush connections 141 with the rings. The terminals are contained within a removable housing 142.

It will be noted from Figures 4, 6 and 7 that the upper portions of the lower end frames 105 and 107 are inwardly flanged to provide seats 143 for the reception of upper frame sections which support the means for holding and feeding the blanks and for removing the finished products and conveying them away. The particular frames and the parts which they support are shown in Figures 11–23 and reference is now directed primarily to the sheets containing these figures.

Resting upon the flat seats 143 of the lower end frames 105 and 107 are two upper frames 144—144*a*, shown best in Figures 18 and 7. These are firmly bolted to the lower frames and secured across them is the elongated, relatively narrow plate 43 which extends for substantially the full width of the machine. This is a rigid plate and forms a support for the blanks and the blank feeding mechanisms. Back of the frames 144 and 144*a* are two upstanding frames 146 and 146*a*, the former of which rests on the seat 143 of the end frame 107, as in Figure 18, while the latter is bolted to the back of the end frame 105 as in Figure 7. These frames 146 and 146*a* collectively support the cam shaft 52, the rocker shaft 49, and the tie rod 57.

The standards 147, shown as mounted in inclined relation in Figure 18, are positioned at each end of the machine and are shown in detail in Figure 19. Each of the standards 147 embodies an upstanding portion which is tilted rearwardly and is provided with an inwardly extending arm 148 projecting toward the center of the machine. This arm carries the stub shaft 149 which supports the idler sprocket 75, shown in Figure 1, while the drive sprocket 76 is carried by bearings formed on the upstanding part of the standard. The sprocket chain 74, which carries the several buckets 73, is passed around these two sprockets and is driven from the shaft 77, rigid with the sprocket 76 and connected to the shaft 80 of the escapement disk 81 by the bevel gears 78 and 79. The ratchet 83, with its operating arm 82 and its link connection 84 with the rocker 85, hereinbefore described in connection with Figure 1, are very clearly shown in Figure 19. The ratchet disk 81 and its operative connections are also shown in Figure 20. The general relation of the buckets to the remainder of the structure is also shown in Figures 11 and 12.

The pushers 45, diagrammatically illustrated in Figure 1, are shown structurally and with their mountings in Figure 18. They are supported upon a guide block 150 shown in Figure 18 as mounted centrally of the plate 43. The guide block 150 is, in horizontal cross section, substantially of I-beam form and it is bolted to the plate 43. It is stayed by an integral arm 151 which extends rearwardly and has a boss 152 through which the tie rod 57 passes (see Figure 21).

At the opposite lateral faces of the guide block are formed upright guides, undercut to receive therein pusher rods 153 thus mounted for vertical reciprocation. To the outer faces of the pusher rods are connected pusher blades 154, with notches at their lower ends 155 (see Fig. 18) and it is these notched ends that engage with the upper ends of the individual blanks and feed them downwardly to the dies. The blades 154 have a thickness approximately equal to or slightly less than the thickness of the blanks B.

The upper ends of the pusher rods 153 are provided with rigidly attached, upwardly extending cylindrical stems, threaded to receive jamb nuts 156 and between the jamb-nuts and the rods are positioned sleeves 157, perforated at 158. Springs 159 are interposed between the sleeves and the upper ends of the pusher rods, so that downward impulse of the sleeves upon the pusher rods, to feed the blanks, is cushioned by these springs. Through the perforations 158 of the sleeves 157 of both bushings is passed the tie rod 46 of Figure 1 and on this tie rod is hung the yoke 47 connected, in turn, to the lever 48 (see Fig. 21) which carries the cam follower 50, coacting with the cam 51. The springs 58, which act upon the cross rod 59 to feed the blanks, when so permitted by the cam 51, are clearly shown in this figure, as well as in Figures 11 and 12.

The blanks are adapted to be received in horizontal stacks in guides 160 (Fig. 18) on the transverse plate at each side of the guide block 150 and are adapted to be pressure fed. To this end, there is mounted for sliding movement, on the plate 43, followers 161. Attached to each follower are the free ends of a cable 162. The two reaches of each cable extend from the follower toward the guide block 150 on each side of the guide 160 and pass around directional pulleys 163, then pass laterally around guide pulleys 164 and, in the loop, is a pulley 165 mounted on a weight 166. The mass of its weight tends to draw the followers 161, at the opposite ends of the machine, toward one another to force the forward ends of the blank stacks against the outer faces of the guide block 150 and to thus position the forward blank of each stack in the path of one of the pusher blades, so that when the blades descend they feed the foremost blanks at both sides of the machine. As the blades are retracted the weights feed the next blanks into alinement with the blades for the next operation.

I have hereinbefore referred, in connection with Figure 1, to the rocker 97, its operating cam 99 and its elongated head 100 and have stated that the purpose of this construction is to guide and hold the blanks, while they are fed from the feeding station to the dies. The structure whereby this is accomplished is shown in Figures 11, 16 and 17. Figure 17 shows the cam 99 fixed on the cam shaft 52 and acting upon the rocker 97 to actuate the elongated head 100. This head is broad enough to reach across and bridge the space between the power arms 167 of two levers associated, respectively, with the two feed stations. The work arm of each of these levers extends forwardly beneath the plate 43 and is pivotally connected to a clamping bolt 168, normally forced by a spring 169 in the direction of an abutment 168a at the opposite side of the opening 170 through which the blanks at the corresponding side of the machine are fed downwardly to the dies. The bell cranks and clamping bolts are duplicated at opposite sides of the machine, as will be seen in Figure 11 and the parts are so timed that, as the blanks are fed through the opening 170, the cam 99 will permit the springs 169 to force the clamping bolts against the blanks, so that the blanks are steadied and held in proper relation with the dies. As soon as the dies are preliminarily closed, however, the cam 99 will move to a position to retract the bolts for there is then no longer any requirement that the blanks be steadied. It will thus be noted that the clamping bolts are retracted by the head 100 before the drum starts to move.

The general relation of the elements constituting the upper part of the machine is shown clearly in Figures 11 and 12. For a more complete understanding of the relation of the several parts on the cam shaft attention is directed to Figure 13. The position of the parts on the rocker shaft is shown in Figure 14, while the position of the parts on the tie rod is shown in Figure 15.

In Figure 11 I have omitted the showing of the upper frame 144 in order that the frames 147 and 146 might be seen, it being clear from Figure 18 that the frame 144 extends downwardly from the plate 43 to the bottom of the frame 146.

The spoon removing devices are shown in Figures 22 and 23. Here the plungers 64, shown generally in Figure 1, are each supported in a vertical cylindrical guide 171 forming part of a bracket 172. There are two of these brackets, as shown in Figures 11 and 12, and they are supported on the cam shaft 52, the rocket shaft 49 and the tie rod 57, so that they are in effect suspended on these parts in properly spaced apart relation. The purpose of employing these brackets is to permit of a long throw of the spoon removing plungers through the use of reasonably gradual cams 70.

As shown in Figure 22 the cam of each plunger acts against the follower 69 of the rocker 68, secured by a link 67 to the lever 66 of the second class, the forward end of the lever being pivoted to the corresponding bracket 172, while the rear end of the lever is pivotally connected to the upper end of a plunger 64. The two cams 70, for the two plungers, act together upon the plungers to raise them in withdrawing the spoons from two die couples of each pair simultaneously. The fixed gripping finger 60 of each plunger coacts with the movable spring pressed gripping finger 62, the tail of which is adapted, when the plunger is raised, to enter into the tubular guide 171 and engage with the cam stop 72 within the guide and mounted on the end of an adjusting screw 173. The grippers are maintained against turning by a feather-and-slot connection 174 between the plunger and its guides (Fig. 23).

The bucket details are shown in Figures 24 and 25. Here the body of the bucket bears the reference character 73. It is open at both ends and has a movable bottom 175 integral with and carried by the lower end of an operating tongue 176. This tongue is mounted on a transverse pivot pin 177 carried by brackets 178 and a spring 179 is coiled about this pin and bears against the tongue to normally hold the bottom in its closed position. The camming projection 180 is carried by the tongue, above the pivot pin 177, and it is this projection which, when engaged with the fixed abutment 89, serves to tilt the tongue against the tension of spring 179 and open the bottom to discharge the spoon.

It will be noted that the bottom, when in its closed position, does not completely close the bottom opening of the bucket, so that, when a spoon is dropped into the bucket, it comes to rest in the position indicated in dotted lines in Figure 24. The spoon is supported in this position until it is discharged from the bucket into the chute 90, when the bottom 175 is opened.

The box 145 shown in Figure 7 is a heat control device for the die heating elements and may be of any suitable and conventional thermostatic type which will control the feed of electric cur-

rent to the heating elements 131, to maintain the dies at proper uniform temperature.

In the specific illustrative embodiment of the method of this invention which I have hereinbefore described, each blank is first fed into position between separated die sections which are maintained at a sufficient temperature to convert water into steam. As the blank is fed into this position a predetermined quantity of water is atomized onto the surface thereof. The die sections are then closed sufficiently to partially shape the blank and are held in this condition until the stresses on the blank have substantially ceased. The die sections are then further closed and thereupon held in this further closed relation until the stresses set up in the blank by this latter closing have substantially ceased to exist. Thereafter the intermittent closing of the die sections is continued, with intermittent periods of holding, until the die sections are fully closed upon the blank. They are thereafter held in closed positions until the blank is substantially dried and set in substantial conformity therewith and are then opened for the removal of the resulting product.

In the foregoing detailed description, I have set forth the method of this invention specifically and have shown the preferred form of apparatus for carrying out this method, but I am aware that modifications may be made by the substitution of equivalents without departing from the invention and they are to be construed as within the appended claims.

The invention has been shown in the form for which it was primarily conceived for the manufacture of wooden spoons, but I wish it understood that it is susceptible, with appropriate changes in design, to feed and manipulate flat blanks for other articles than wooden spoons, e. g., forks, and many other articles which are susceptible to formation, in accordance with this invention, into desired surface configurations for particular uses.

The invention is therefore to be understood as not limited specifically to the details of construction shown in the accompanying drawings, but rather, as fully commensurate with the appended claims.

Having thus fully described the invention, what we claim as new and desire to secure by Letters Patent is:

1. The method of forming wooden spoons and the like which comprises; positioning a flat blank of predetermined peripheral contour between two opposed die sections of a die couple which are heated to a temperature sufficient to convert concomitant moisture into steam, moistening said blank, and closing the two die sections of said die couple upon said blank by successive stages of additive partial closing movement until they are completely closed on the blank, and interspersing between said successive stages of partial closing movement intervening periods of fixed die section relation throughout each of which the two die sections of the die couple are held against opening movement.

2. The method of forming wooden spoons and the like which comprises; positioning a flat blank of predetermined peripheral contour between two opposed die sections of a die couple which are heated to a temperature sufficient to convert concomitant moisture into steam, moistening said blank, and closing the two die sections of said die couple upon said blank by successive stages of additive partial closing movement until they are completely closed on the blank, interspersing between said successive stages of partial closing movement intervening periods of fixed die section relation throughout each of which the two die sections of the die couple are held against opening movement, thereafter holding the die sections of the couple in contact with the blank until it is in substantially dry fixed state, and thereafter opening the die couple.

3. The method of forming wooden spoons and the like which comprises; positioning a flat moist blank of predetermined peripheral contour between two opposed die sections of a die couple which are heated to a temperature sufficient to convert concomitant moisture into steam, closing the two die sections of said die couple upon said blank by successive stages of additive partial closing movement until they are completely closed on the blank, and interspersing between said successive stages of partial closing movement intervening periods of fixed die section relation throughout each of which the two die sections of the die couple are held against opening movement and the duration of which is sufficient to permit the stresses set up in the blank by the previous closing stages to substantially cease.

4. The method of forming wooden spoons and the like which comprises; positioning a flat moist blank of predetermined peripheral contour between two opposed die sections of a die couple which are heated to a temperature sufficient to convert concomitant moisture into steam, closing the two die sections of said die couple upon said blank by successive stages of additive partial closing movement until they are completely closed on the blank, interspersing between said successive stages of partial closing movement intervening periods of fixed die section relation throughout each of which the two die sections of the die couple are held against opening movement and the duration of which is sufficient to permit the stresses set up in the blank by the previous closing stages to substantially cease, thereafter holding the die sections of the couple in contact with the blank until it is in substantially dry, fixed state, and thereafter opening the die couple.

5. The method of forming wooden spoons and the like which comprises; placing a moist flat wooden blank of predetermined peripheral contour between two opposed die sections of a die couple heated to a temperature sufficient to convert concomitant moisture into steam, partially closing said two die sections sufficiently to partially shape the blank between them, then holding said two die sections in this partially closed condition until the stresses set up in the blank have substantially ceased, then further partially closing the same die sections, then holding them in thus further partially closed relation until the stresses set up in the blank by the latter closing operation have substantially ceased, and thereafter continuing to intermittently further close said two die sections with intervening periods of holding them in additive closing positions, until the two die sections of the couple are fully closed on the blank, thereafter holding said die sections closed until the blank has substantially dried and set in substantial conformity with said die sections, and thereafter opening said die couple.

6. The method of forming wooden spoons and the like which comprises; feeding a dry flat blank of predetermined peripheral contour into position between two opposed die sections of a die

couple which are heated to a sufficient temperature to convert concomitant moisture into steam, applying moisture to the dry blank as it is fed to said die couple, and closing said die couple upon said blank by successive stages of partial closing movement with intervening periods of fixed relation between said two die sections of the die couple, until they are completely closed on the blank.

7. The method of forming wooden spoons and the like which comprises; feeding a flat blank of predetermined outline configuration between the two opposed die sections of a die couple heated to a temperature sufficient to convert concomitant water into steam, applying moisture to the blank as it is fed into cooperative relation with said die sections, and thereafter closing the two die sections of the couple gradually upon the blank for the purpose of shaping said blank.

8. The method of forming wooden spoons and the like which comprises; passing cut wooden blanks to a die feeding station, introducing said blanks individually between relatively movable heated die sections, applying moisture to the blanks during their passage from the feeding station to the die sections, then closing the die sections gradually and at such rate that the moisture applied to the blanks will be converted into steam and penetrate the blanks to soften the same and render them susceptible to the forming operations of the die sections without splitting the blanks, holding the blanks between the die sections until the thus formed blanks are in substantially dry, set condition, and thereafter opening the die sections.

9. The method of forming spoons and the like which comprises; passing cut wooden blanks to a die feeding station, introducing said blanks individually between relatively movable heated die sections, applying moisture to the blanks, closing the die sections gradually and at such rate that the moisture applied to the blanks will be converted into steam and penetrate the blanks to soften the same and render them susceptible to the forming operations of the die sections without splitting the blanks, holding the blanks between the die sections until the thus formed blanks are in substantially dry, set condition, and thereafter opening the die sections.

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