June 16, 1925.

1,541,874

C. C. THOMSON ET AL

NUT AND BOLT ASSEMBLING MACHINE

Filed March 1, 1924 4 Sheets-Sheet 1

FIG. I.

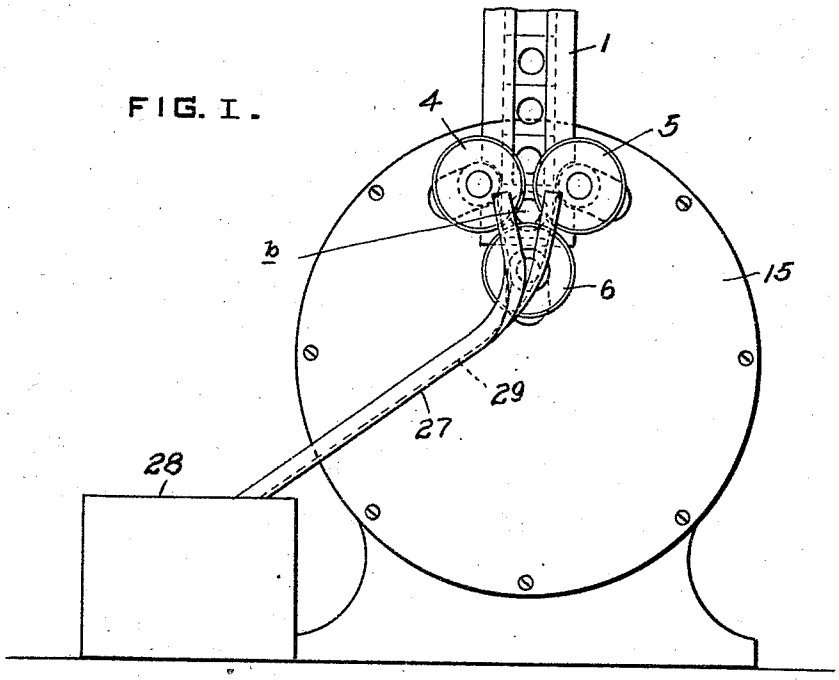
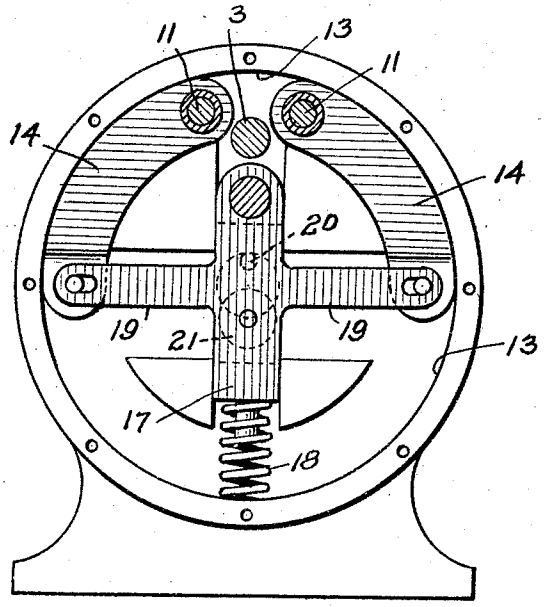


FIG. III.



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FIG. II.

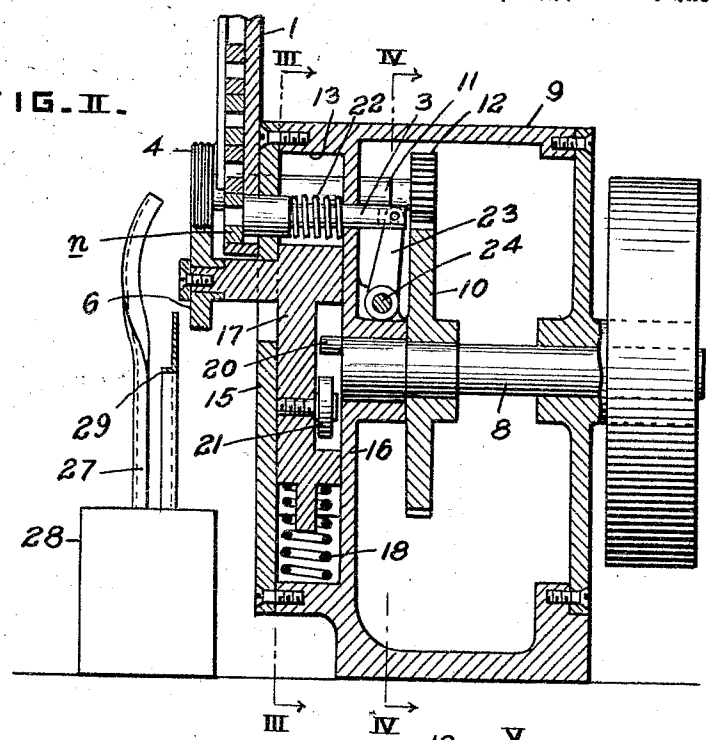
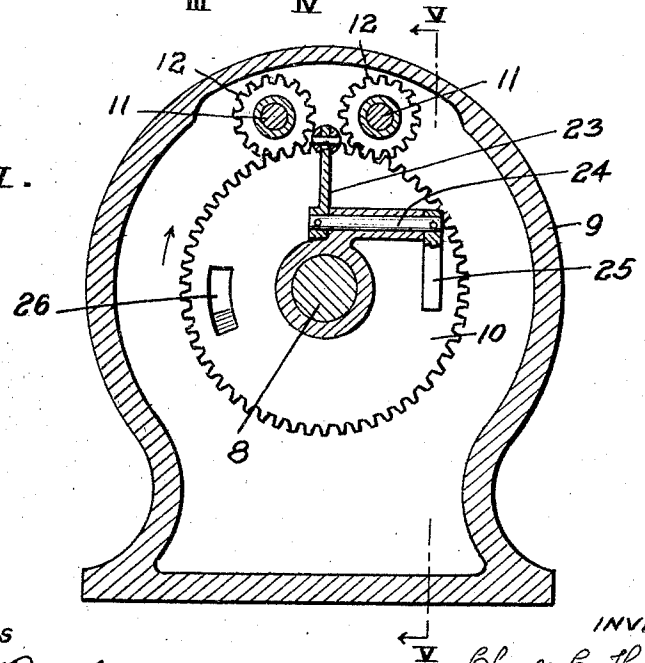


FIG. IV.



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FIG. V.

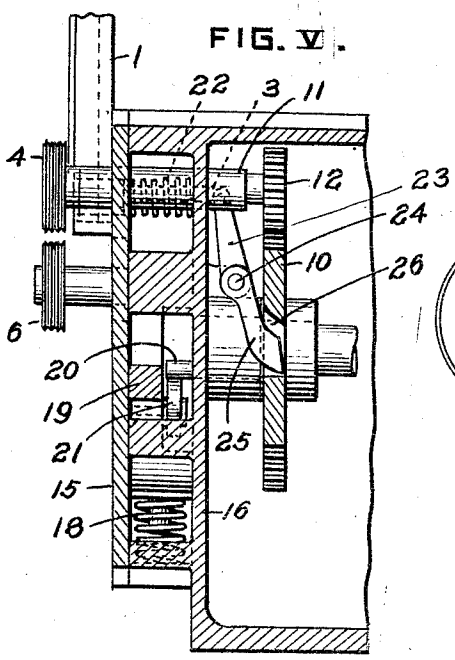


FIG. VI.

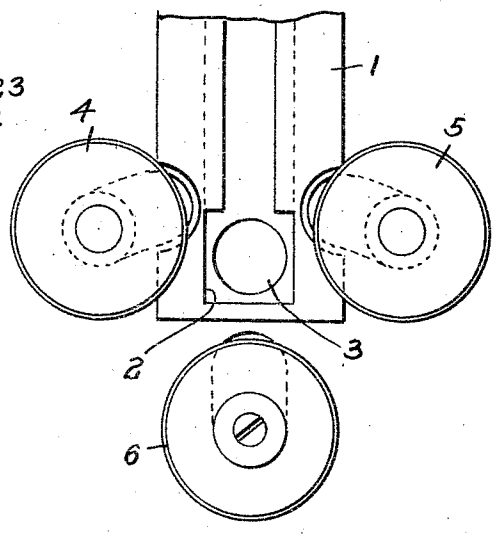


FIG. VII.

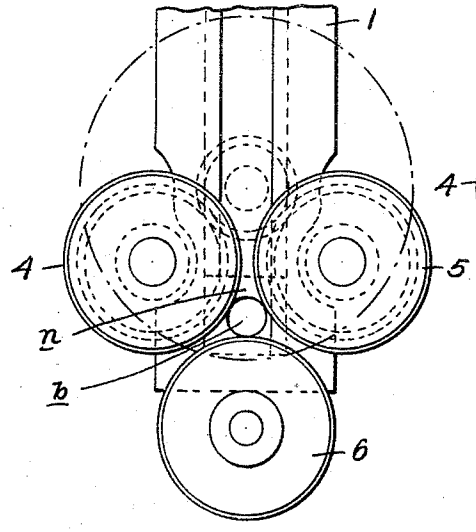
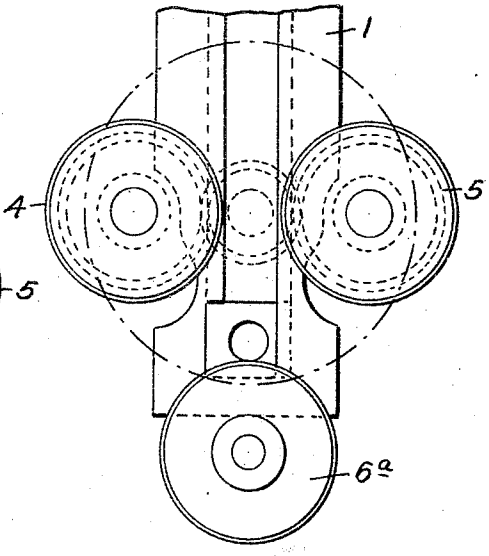


FIG. VIII.



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C. C. THOMSON ET AL

NUT AND BOLT ASSEMBLING MACHINE

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FIG. IX.

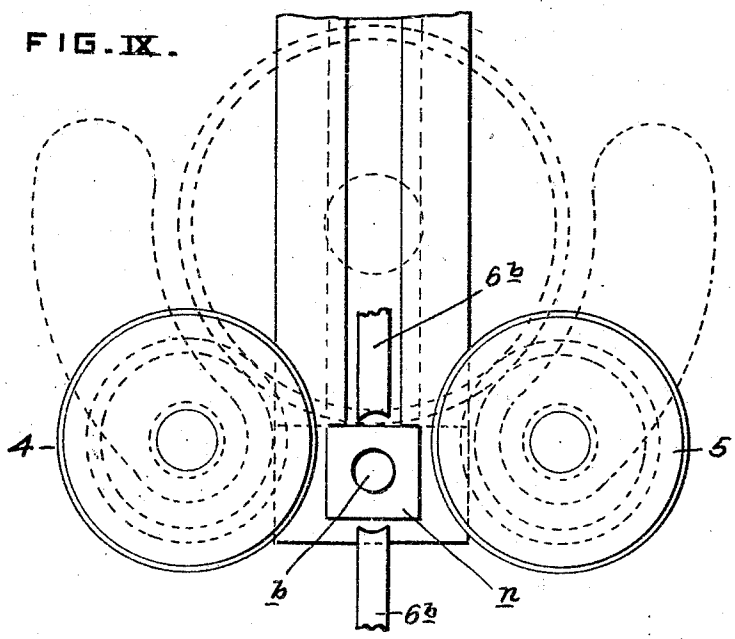
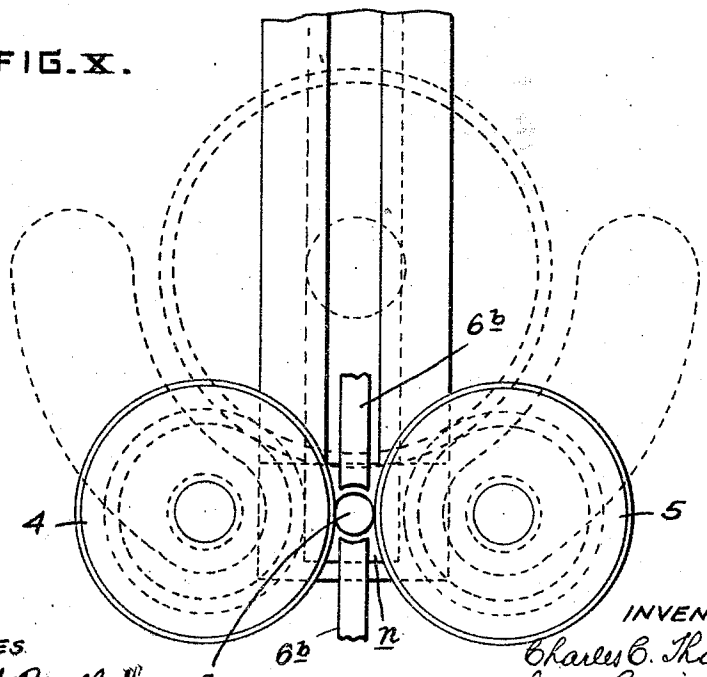


FIG. X.



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Patented June 16, 1925. 1,541,874

UNITED STATES PATENT OFFICE.

CHARLES C. THOMSON AND JAMES CRAIG, OF BUTLER, PENNSYLVANIA.

NUT AND BOLT ASSEMBLING MACHINE.

Application filed March 1, 1924. Serial No. 696,189.

To all whom it may concern:

Be it known that we, CHARLES C. THOMSON and JAMES CRAIG, residing at Butler, in the county of Butler and State of Pennsylvania, citizens of the United States, have invented or discovered certain new and useful Improvements in Nut and Bolt Assembling Machines, of which improvements the following is a specification.

Our invention relates to nut-and-bolt assembling machines. The object in view is a machine of simplest construction and maintenance in which bolts and nuts may be assembled at adequate speed and with attention such as to involve no high degree of skill.

The machine is illustrated in the accompanying drawings. Figure I shows the machine in front elevation. Figure II shows it in vertical and medial section. Figure III is a view in transverse vertical section on the plane indicated by the line III—III, Figure II. Figure IV is a view in transverse section on the plane indicated by the line IV—IV, Figure II. Figure V is a view in vertical and longitudinal section on the plane indicated on the line V—V, Figure IV. Figures VI and VII show somewhat diagrammatically certain work-engaging parts of the machine in open and in closed position, respectively. Figure VIII is a view similar to Figure VI illustrating a permissible variation. Figures IX and X are figures which in a general way correspond to the showing afforded by Figures VI and VII, and they also illustrate another and further modification and variation in detail.

Referring first to Figures VI and VII, a succession of nuts, which in this case will be understood to be square, is caused to descend by gravity through a chute 1, and the nuts are caused to come to place successively in a seat 2. That seat 2 is open on opposite sides, but peripherally it holds the nut under restraint and against turning. On one side (the further side, as seen in Figure VI) a spring-backed plunger 3 stands opposite the nut seat. On the other side (the side toward the observer) a plurality of relatively yielding abutments, of which one at least is a positively driven roller, is adapted to engage the shank of a bolt when introduced between the abutments and in alignment with the hole in a nut in a nut-seat. Consequent rotation of the bolt accompanied by a forward feed (which preferably will be mechanically accomplished) effects assembly.

Specifically as shown in Figure VI (compare Figure VII) these abutments take the form of three rollers 4, 5, and 6. The face of one of these rollers, and preferably the faces of all of them are grooved (cf. Figure V) with grooves adapted to engage the threads on the stems of the bolts, thereby when under rotation to give to the bolts not rotation merely but longitudinal advance, such as to effect assembly.

These three rollers 4, 5, and 6 are mounted to move in unison from the open position shown in Figure VI to the closed position shown in Figure VII and back again. When in the open position a bolt ready to be applied to a nut may be thrust into position between them. When closed they engage a bolt so thrust in, and carry it forward to engagement with a nut resting in the nut-seat. Figure VII shows a nut *n* in place in the nut-seat, and bolt *b* engaged by rollers 4, 5, and 6, and by action of the machine in course of being assembled.

One of these rollers (in this case the roller 6) is idly rotated. The other two, rollers 4, 5, are by instrumentalities presently to be described caused to rotate simultaneously at the same surface speed, and, since they are of equal size, that means rotation in unison.

The operation will readily be understood. The operating parts being in the position shown in Figure VI, and a nut having descended through the guideway 1, and having come to position in the nut-seat 2, a bolt is manually brought to position opposite the hole in the nut, and between the rollers 4, 5, and 6.

Upon the bolt so brought to position the rollers close, and closing upon it and engaging the threads with which the bolt itself is equipped, these rollers by their rotation give rotation to the bolt and at the same time carry it forward to the nut. The forward end of the advancing bolt enters the hole in the nut. If registration be not immediate of the threads upon the bolt with the threads

in the nut, the recession of the spring-backed plunger 3 will allow the engagement to be effected automatically. Thereupon assembly will proceed. When assembly has been made, the rollers recede to the position shown in Figure VI, and at the same time by means of the plunger 3 driven in a manner presently to be explained, the assembly of nut and bolt is expelled. Presently the plunger 3 will recede again, and the following nut will then descend to the nut seat, and the machine will stand ready to receive another bolt.

Having indicated above the general features of structure and operation, we pause to note more carefully the matter of configuration of the rollers and their consequent effect in operation. The faces of the rollers are as has been said grooved and the grooves are such in their proportioning as to register with precision with the thread upon the bolt shank. Furthermore the grooves upon the rollers 4, 5, and 6 are so relatively placed that they coincidently engage the threaded shank of a bolt held between them, its axis extending in parallelism with the axes of roller rotation. As shown in Fig. I, for example, the three rollers 4, 5, and 6 engage the bolt at points equally spaced about its periphery, that is to say, 120° apart. The grooves of the rollers successively engaging the threaded bolt shank must therefore stand at successive intervals, measured in the direction of the length of the bolt, equal to one third of the interval of pitch of the thread. Given this minute formation of the faces of the rollers and this relative position of the grooves, roller rotation will effect forward feed of the bolt, in the manner already described. During the operation of actual advance of the bolt within the nut, it will be understood that the space interval between the grooves on the roller and the threads in the nut is a multiple of the interval between successive turns of the thread. And it will be understood that it is the capacity of the nut to yield slightly in its position while engagement between bolt and nut is being effected, that makes possible this minute accuracy, automatically achieved.

It will here be proper, before describing the mechanical details for effecting machine operation of the nature which now has been generally described, to indicate certain permissible variations. In Figure VIII the idle roller 6^a is stationary, while rollers 4 and 5 travel from and to bolt-engaging position. In this case the bolt introduced by hand may rest upon the upper surface of roller 6^a (which it will be remembered is an idler) and while so resting may be picked up by rolls 4 and 5, closing upon it. In the modification illustrated in Figures IX and X there is no roller 6, but in place there are upper and lower stops 6^b, 6^b which recede as the rollers 4 and 5 recede, and which advance as rollers 4 and 5 advance, and which cooperate with rollers 4 and 5 to the same end as roller 6 of Figures VI and VII, namely, to assist in maintaining the bolt b in place between rollers 4 and 5 when the latter engage the bolt, and rotate and drive it forward to engagement with the nut n.

We turn now to Figures I and II. A drive shaft 8 extends within a casing 9. This shaft carries a gear wheel 10. In the casing are mounted the shafts 11 which carry the rollers 4 and 5 already described, and these shafts 11 carry pinions 12. Pinions 12 mesh with the gear wheel 10, and thus rotation of shaft 8 effects rotation of the rollers 4 and 5.

We have said the casing 9 carries the shafts 11 of the rollers 4 and 5, and so it does, but it carries them through intermediate mechanism. There is formed in the casing 9 a slideway 13 concentric with the axis of shaft 8, and in this slideway 13 are mounted segmental slides 14, and these slides immediately carry the shafts 11 of the rollers 4 and 5. Comparing Figure III with Figures VI and VII, it will be perceived that as the slides 14 of Figure III slide in the slideway 13, they carry the rollers 4 and 5 from the relative position shown in Figure VII to that shown in Figure VI and back again, and comparing Figure III with Figure IV, it will be observed that as this movement takes place the pinions 12 borne by the shafts 11 continue in mesh with the gear wheel 10 and thus, so long as shaft 8 continues in rotation, rollers 4 and 5 continue in rotation. Further, it will be observed that the rotation so imparted to rollers 4 and 5 is simultaneous and in the same direction.

Within the casing 9 and between its wall 15 and an inner partition 16 is a vertical slideway for a head 17. Within the slideway and beneath the head 17 is arranged a spring 18 which tends to hold the head at the upper end of its range of sliding. In this head, as best seen in Figure II, the roller 6 is idly journalled. The head 17 is provided with cross arms 19, and these engage the segmental slides 14 already mentioned in a pivotal engagement which admits of some latitude of horizontal displacement. The assembly will be clearly understood on comparing Figures II and III, and it will be perceived that, as the slide moves down against spring tension and rises again in response to spring tension, the rollers 4, 5, and 6 move in unison from the position shown in Figure VII to that shown in Figure VI and back again.

Periodic reciprocation is given to slide 17. To this end the relative position of the slide 17 with respect to the shaft 8 is that specifically shown in Figure II. The slide reciprocates vertically opposite the end of

shaft 8. Shaft 8 at its end carries eccentrically a pin 20, and slide 17 carries an abutment in the form of an idly mounted roller 21, the relative positions being such that as the shaft rotates the eccentric pin 20 makes periodic engagement with the roller 21, and with each rotation of shaft 8 the sliding head 17 is by such engagement forced downward against spring tension, and allowed to rise again. Thus, with each rotation of shaft 8 the rollers 4, 5, and 6 are shifted from the closed position shown in Figure VII to the open position shown in Figure VI, and then in sequence allowed to come again to closed position under the impetus of spring 18. Figure II shows the pin 20 remote from the roller 21, the slide raised and the rollers 4, 5, and 6 accordingly in closed position. Figure V shows the eccentric pin 20 in engagement with the roller 21, and holding the slide 17 depressed to its fullest limit, and in this position the rollers are in open position.

We have mentioned the spring-backed plunger 3, and described it as an abutment against which the nut may bear as the bolt impelled by rollers 4 and 5 makes engagement with its screw-threaded interior. This spring-backed plunger 3 has another function, that namely of an ejector for the assembled nut and bolt. To this end this plunger 3 extends through the forward wall 15 of the casing, and also the internal partition wall 16, and the spring 22 which cushions it for the purpose already described, is disposed between the walls 15 and 16, and bears from the rear upon an enlarged head upon the plunger 3, the arrangement being that best shown in Figure II. It will there be seen that the plunger is in position to recede in left-to-right direction against the tension of spring 22. Normally the spring 22 is under compression and tends to expand.

We come now to describe the means whereby the plunger serves as an ejector. A bell-crank lever 23 engages the plunger 3. This bell crank lever is fulcrumed in the casing at 24, and its power arm 25 bears against the web of gear wheel 10. This web is in the main a continuous web, but it is interrupted at a proper point, and to a suitable extent, with an orifice 26. This orifice in the range of rotation of the gear wheel comes opposite and interrupts the bearing of the power arm 25 of the bell-crank lever upon the web of the gear wheel. Normally the condition is that shown in Figures II and IV. The power arm 25 bearing against the web of the gear wheel 10 normally holds the plunger 3 retracted, and while in that position the plunger serves as the spring-backed abutment to effect proper engagement of bolt with nut, as already described. When in the course of rotation the orifice 26 in the web of the gear wheel 10 comes opposite the power arm 25 of the bell-crank lever, the spring 22 is relieved of restraint, and immediately drives the plunger forward, that is to say, from right to left, as shown in Figure II, and from the position shown in Figure II to the position shown in Figure V.

The several parts of the machine are so coordinated that this occurs immediately upon the opening of the rollers 4, 5, and 6, (an opening effected by engagement of eccentric pin 20 with the roller 21 borne by slide 17). The rollers 4, 5, and 6 having effected an assembly, open, and, immediately upon such opening, plunger 3 drives forward and ejects the assembled bolt and nut.

When this has happened the re-engagement over properly arranged surfaces of the power arm 25 of the bell-crank lever with the web of the gear wheel 10 causes the plunger to recede again to the position shown in Figure II, and thereafter it continues through the remainder of the cycle of the operation to serve as the abutment for effecting proper assembly, in the manner already described.

Figures I and II show a delivery mechanism, adapted to serve in cooperation with the ejector just described. This delivery mechanism includes a chute 27 which is arranged opposite the front of the machine, to the left as shown in Figure II, and extends from a point opposite the place of assembly obliquely downward to a receptacle 28. This chute at its upper end is bifurcated and its bifurcations rise on either side of the axis of the bolt *b* in the position of assembly. The ejected bolt passes through the bifurcation but the nut is caught between the prongs. So caught it descends by gravity down the chute, the shank of the bolt projecting through the slot 29 in the chute, and is deposited by gravity in the receptacle 28.

It will be understood that in the case of an arrangement of rollers such as that illustrated in Figure VIII wherein the idle roller 6^a remains stationary and is not shifted in synchronism with the shifting of the rollers 4 and 5, the assembled nut and bolt may be allowed to escape laterally when the rollers are in the position shown in Figure VIII, and the receiving mechanism with its bifurcated chute will not be employed.

The operation of the apparatus implicit in what has been said may be summarized in a few words. The nuts descend by gravity and come successively to position in the nut seat automatically. An attendant places the bolts one by one in position upon the lower idle roller 6 when the rollers are open. And as the rollers close they engage and rotate the bolt so brought to position. As they rotate the bolt, engaging as they do the thread of the bolt in the grooves with which their

surfaces are provided, they cause the bolt to advance toward the nut upon its seat. As the bolt engages the nut, the nut recedes slightly against the yielding plunger, so far as is necessary for the threads of bolt and nut to engage. Continued rotation effects assembly, the nut itself being held in its seat against rotation. After an interval of rotation in engagement with the bolt, an interval sufficient to effect the assembly, the rollers recede, and coincidentally the plunger drives forward, and in doing so it drives the assembled bolt and nut out from between the rollers and into the receiving device. The chute of the receiving device catches the nut and the finished article is delivered automatically by gravity. The machine is then ready for a repetition of the cycle of operations, and the attendant places another bolt in position as before.

We claim as our invention:

1. In a nut-and-bolt assembling machine the combination of a nut-seat, a pair of carriers, bolt-engaging abutments borne one by each of said carriers, one of such abutments being a rotatable roller, the said carriers being relatively movable to and from a position in which the abutments which they bear are in bolt-engaging position, means for effecting periodic relative movement of the carriers, and means for rotating said roller.

2. In a nut-and-bolt assembling machine the combination of a nut-seat, a pair of opposite slideways, a slide movable in each slideway, means for moving the slides oppositely and in unison and for yieldingly maintaining them in proximate relative positions, a rotatable roller borne by each of said slides, the two rollers being adapted, when the slides are in proximate relative positions, to sustain a bolt in assembling position relative to a nut borne in said nut-seat, and means for rotating one of said rollers.

3. In a nut-and-bolt assembling machine the combination with a nut-seat of a plurality of rotatable grooved rollers adapted to engage simultaneously the threaded shank of a bolt, and to make their engagement upon the bolt at intervals circumferentially of the bolt, the relative position of the grooves upon the rollers, measured in the direction of the length of the bolt, corresponding to the intervals at which the rollers stand circumferentially of the bolt.

4. In a nut-and-bolt assembling machine the combination with a seat for a nut, of a pair of rotatable rollers borne on parallel axes and adapted to be held yieldingly to position for engaging a bolt advancing to a nut in place within said seat, means for rotating said rollers, and a third roller idly mounted on an axis parallel with the axes of the pair of rollers first named and adapted to cooperate with the said first-named pair of rollers, to sustain a bolt in position between the pair and in alignment with a nut in place on said seat.

5. In a nut-and-bolt assembling machine the combination with a seat for a nut, of a pair of rollers with grooved surfaces rotatably mounted on parallel axes and movable relatively to and from a position of engagement upon the threaded shank of a bolt aligned with a nut in place within said seat, a third roller with grooved surface idly mounted for rotation on an axis parallel with the axes of the pair of rollers first named and movable in synchronism with said pair of rollers to and from the aforesaid position of bolt engagement, means for moving the three said rollers in unison to and from bolt-engaging position, and for sustaining the said rollers yieldingly in bolt-engaging position, and means for rotating simultaneously the pair of rollers first mentioned at equal surface speed and in the same direction.

6. In a nut-and-bolt assembling machine the combination with the nut seat 2, of the frame 9, the spring-backed slide 17 with its cross arms 19, the segmental toggles 14 movable in segmental slideways in the frame, the rollers 4 and 5 borne by said toggles, the idle roller 6 borne by said slide, and means for rotating the rollers 4 and 5 simultaneously.

7. In a nut-and-bolt assembling machine the combination of a seat for a nut, a yielding backing for a seated nut arranged on one side of said nut-seat, and a pair of oppositely placed and relatively yielding abutments, of which one is a rotatable roller with grooved surface, arranged on the side of the nut-seat opposite said yielding backing for the nut.

8. In a nut-and-bolt assembling machine the combination with a seat for a nut, of a spring-backed plunger arranged opposite said nut-seat on one side, a plurality of relatively yielding abutments placed opposite one another and arranged on the side of the nut-seat opposite said plunger, of which abutments one is a roller with grooved surface, the two said abutments being adapted to engage a bolt advancing to a nut in place within said seat, and means for rotating said roller.

9. In a nut-and-bolt assembling machine the combination with a seat for a nut, of a plurality of rotatable rollers adapted to be held yieldingly to position for engaging a bolt advancing to a nut in place within said seat, and adapted to be swung to and from bolt-engaging position, a spring-backed plunger arranged to advance through said nut-seat from the side opposite that on which said rollers are situated, means for holding said plunger in retracted position and under spring tension, means for

rotating said rollers, and for intermittently swinging them, said plunger-restraining means under control of said roller-rotating means, whereby the said plunger is in the course of roll rotation released.

10. In a nut-and-bolt assembling machine the combination with the nut-seat 2, the positively rotated and intermittently swinging spring-backed rollers 4 and 5, the idly rotating intermittently swinging spring-backed roller 6, the yielding and intermittently extensible plunger 3, the said rollers being arranged on one side of the nut-seat and the plunger on the other side of the nut-seat, and means for causing the said rollers to swing and the plunger to advance and recede in ordered sequence, substantially as described.

11. In a nut-and-bolt assembling machine the combination with a seat for a nut of two oppositely placed and relatively yielding abutments of which one is a rotatable roller, said abutments adapted to engage between them a bolt in position for advancement toward a nut in place within said seat, the said abutments being adapted to be swung one relatively to the other, to and from relative bolt-engaging positions, means for rotating said roller, a spring-backed ejecting plunger arranged adjacent to the nut-seat on the side opposite the abutments, and delivery apparatus including a bifurcated chute arranged adjacent the said abutments on the side thereof opposite the nut-seat, the bifurcations of said chute extending on opposite sides of the axial line of a bolt when in place between said abutments.

In testimony whereof we have hereunto set our hands.

CHARLES C. THOMSON.
JAMES CRAIG.

Witnesses:
WALTER W. SMITH,
W. J. TRUBY.