4 Sheets—Sheet 1.

S. L. WORSLEY.

Machine for Nutting Bolts.

No. 211,826. **Patented Jan. 28, 1879.**

Fig. 1.

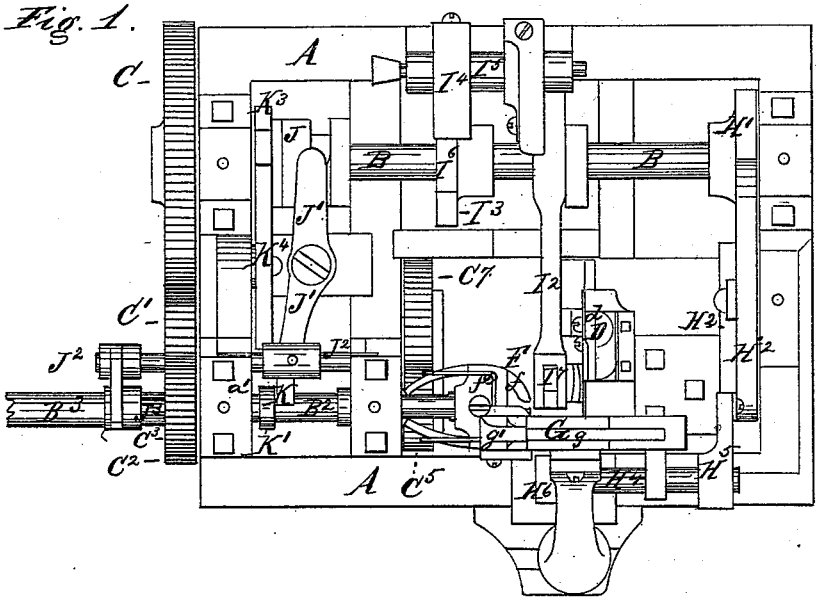
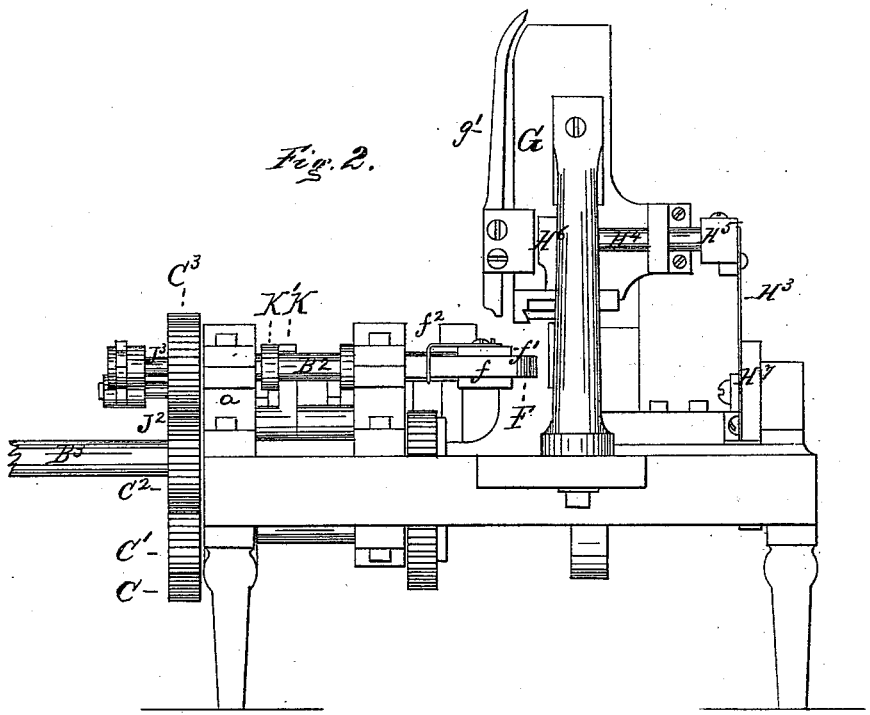


Fig. 2.



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4 Sheets—Sheet 2.

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Fig. 3.

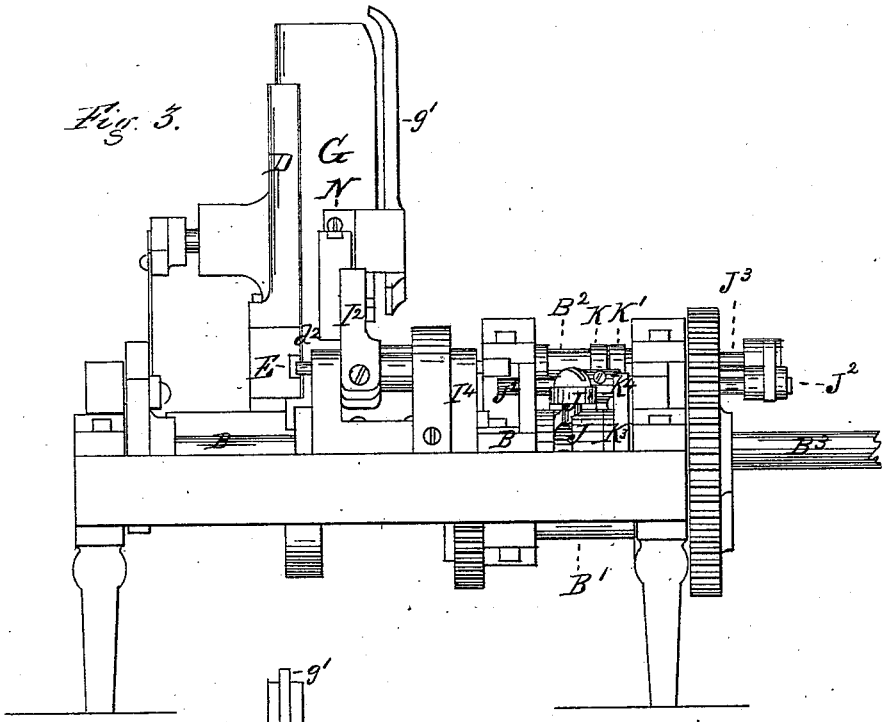
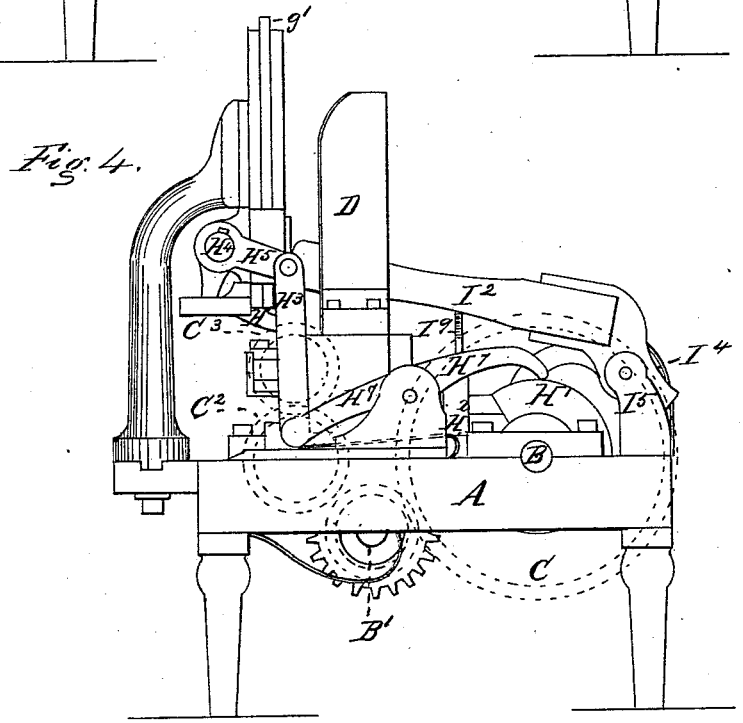


Fig. 4.



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Machine for Nutting Bolts.

No. 211,826. Patented Jan. 28, 1879

Fig. 5.

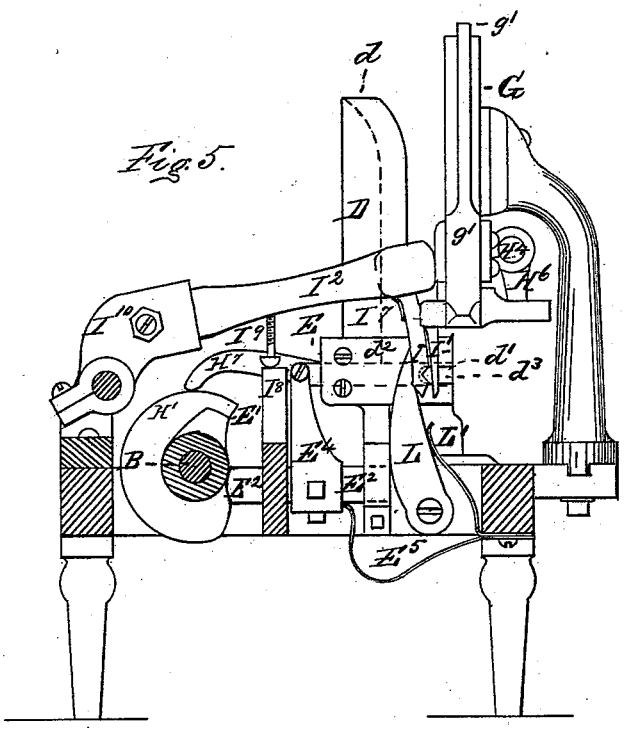
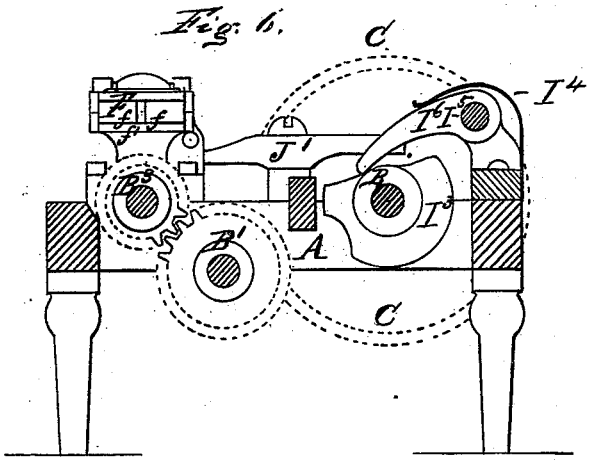


Fig. 6.



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Machine for Nutting Bolts.

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Fig. 7.

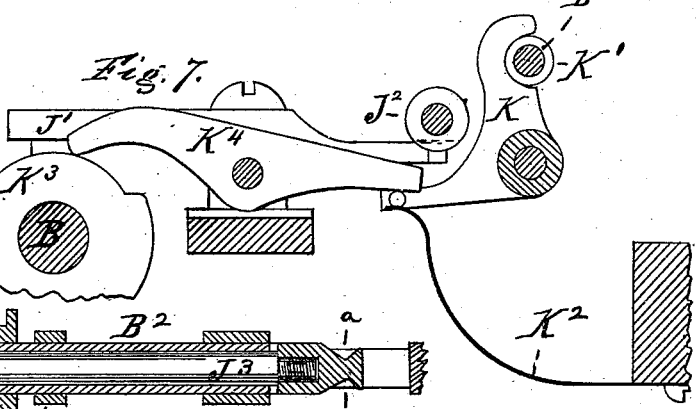


Fig. 8.

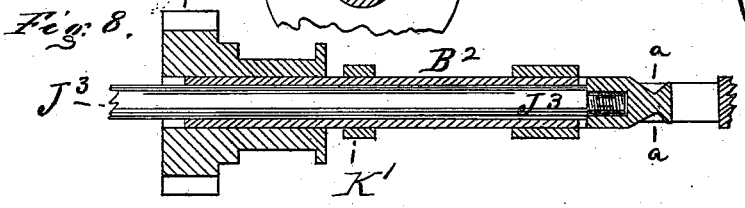


Fig. 9

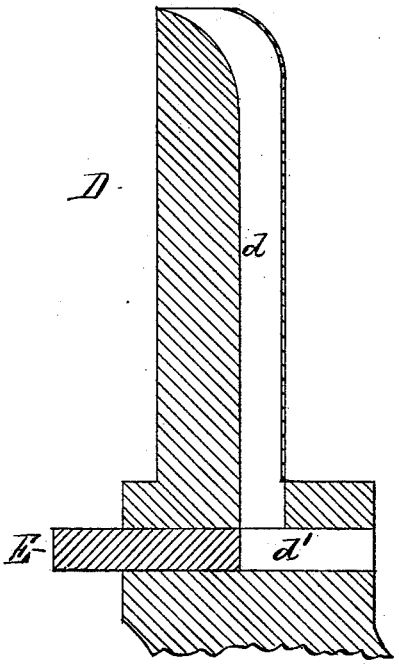
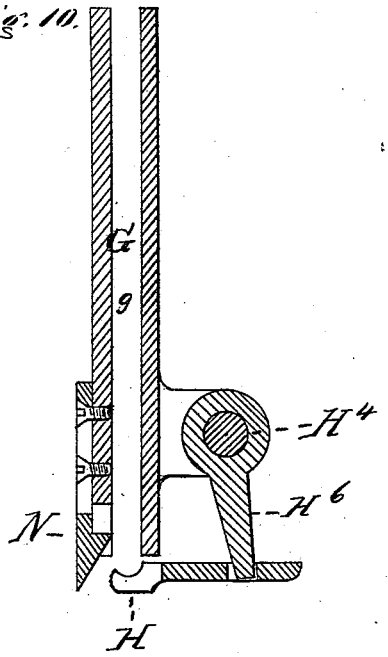


Fig. 10.



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Inventor.
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by his Atty
C. L. Renwick

UNITED STATES PATENT OFFICE.

SAMUEL L. WORSLEY, OF TAUNTON, MASSACHUSETTS, ASSIGNOR TO PLUMB, BURDICT, AND BARNARD.

IMPROVEMENT IN MACHINES FOR NUTTING BOLTS.

Specification forming part of Letters Patent No. **211,826**, dated January 28, 1879; application filed March 23, 1878.

To all whom it may concern:

Be it known that I, SAMUEL LORD WORSLEY, of Taunton, in the county of Bristol and State of Massachusetts, have made an invention of a new and useful Machine for Nutting Bolts; and that the following is a full, clear, and exact description and specification of the same, reference being had to the accompanying drawings, which form part of the said description.

Screw-bolts are usually sold in the market with the nuts screwed onto the bolts, each bolt having its appropriate nut screwed upon it.

Previous to my invention it has been customary to form the screw-threads of screw-bolts by automatic machines, or (in technical language) to screw the bolts. It has also been customary to cut the screw-threads in the nuts, or tap the nuts by other automatic machinery; but, after the bolts have been screwed and the nuts tapped, it has been the practice to apply the nut to its particular bolt by hand, the operator taking a bolt from a box of bolts with one hand and a nut from a box of nuts with the other hand, applying the two to each other, and screwing the one to the other. This operation of nutting bolts by hand involves much hand-labor; and the object of my invention is to dispense with this hand-labor and effect the operation automatically by machinery, which is charged with the nuts and bolts and which applies a nut to a bolt, screws the two together, and discharges the nutted bolt ready for packing for the trade.

To this end my invention consists of certain combinations of mechanical devices, of which the following are the principal members, viz.: a nut-holder, for holding a supply of one or more nuts; a bolt-holder, for holding a supply of one or more bolts; a nut-mover, by means of which the nuts are moved one at a time to the position where they are to be applied to the bolt or are moved from that position; a bolt-mover, by means of which the bolts are moved or permitted to move one at a time from the bolt-holder; a bolt-clamp, by means of which the bolt is held during the nutting, or the application of the nut to it; turning mechanism, by means of which either the nut or the bolt is turned relatively to the other, so as to screw the one to the other, (in practice I prefer to so construct and arrange this turning mechanism that it turns the bolt while the nut is held at rest, but the converse arrangement may be used if preferred, the nut in such case being turned while the bolt is held at rest;) transferring-fingers or mechanism, for causing a bolt or a nut to move crosswise of its axis from its holder to the line in which the bolt and nut are screwed together, (in practice I prefer to use transferring-fingers, and to so construct and arrange them as to transfer a bolt to the mechanism for turning it, but the transferring mechanism need not have the form of fingers; and if the nut is to be turned upon the bolt, the transferring-fingers, if used, may be arranged to transfer the nut from the nut-holder or mover to the turning mechanism;) a leading-cam, or its equivalent, to cause either the nut or the bolt to move relatively to the other in the direction of the length of the screw-bolt, so as to enter the screw of the bolt in the nut; a bolt-discharger, for insuring the discharge of the nutted bolt from the machine in case it does not drop when released by the bolt-clamp, or be not detached by the act of bringing a new nut or bolt to the positions where they are applied to each other; a stop-latch, or its equivalent, by means of which the forward movement of the bolt-clamp can be stopped; a bolt-guard, for preventing accident in case the transferring-fingers fail to transfer a bolt; a safety device, to permit the bolt or nut to maintain its position longitudinally of the other in case either the bolt or the nut has no screw-threads, and notwithstanding the action of the leading-cam or its equivalent.

The various combinations of the said devices which constitute the invention are specified in detail at the close of this specification. I believe that it is expedient to embody all of these combinations in the same machine, but more or less of my combinations may be used, as deemed best.

In order that they may be fully understood I have represented in the accompanying drawings, and will proceed to describe a bolt-nutting machine embodying my said invention in the best form known to me at this date, it being understood that in the said machine the aforesaid principal members are combined by means of a main frame, shafts, and other de-

vices constituting connecting mechanism, which may be varied as circumstances or the peculiar views of users of the invention render expedient.

Figure 1 of said drawings represents a plan of the said machine. Fig. 2 is a front view of the same. Fig. 3 is a rear view of the same. Fig. 4 is a view of the right-hand end of the same. Figs. 5 and 6 represent cross-sections. Figs. 7 to 10 represent parts of the machine detached from the residue.

The various moving parts of the said machine are connected with a strong bed-frame, A, which, in practice, is bolted fast to the rails of the factory-benches, but which, for convenience of representation, is represented in the drawings as mounted upon legs.

The various operating parts of the machine have motions imparted to them from a set of shafts, B B^1 B^2 B^3, connected by cog-wheels C C^1 C^2 C^3 C^4 C^5, and the last shaft, B^3, is fitted with belt-pulleys, (not shown in the drawings,) to which power is applied by means of a belt in the usual manner, the belt-pulleys being fast and loose pulleys, and a belt-shipper being provided to control the belt.

The nut-holder D of this machine is upright, so that the nuts are held in a column, and it contains a channel, *d*, Figs. 1 and 9, of the size to permit the nuts to slide edgewise freely down it to a cross-channel, d^1, Fig. 9, in which the lowest nut is held for the nut-mover, by which it is presented in the position in which the nut and bolt are screwed together.

The nut-mover is a piston, E, moving horizontally, or thereabout, in the cross-channel d^1, Figs. 1, 5, and 9, which crosses the lower end of the upright nut-channel *d* of the nut-holder. This nut-mover E is operated at the proper time by means of a cam, E^1, which is secured to the main cam-shaft B of the machine, and which acts upon a slide, E^2, with which the nut-mover E is connected by an arm, E^4. The cam moves the nut-mover to push the nut along the cross-channel, and a spring, E^5, is provided to return the nut-mover to the position whence it is moved by the cam, the time of return being controlled by the form of the nut-moving cam E^1.

The nut, when fed, occupies a position near the end of the cross-channel d^1, and it remains there until the bolt is screwed into it. The plate d^2, which forms the front side of the cross-channel, is notched, as seen at d^3 in Fig. 5, to permit the end of the bolt to enter the hole of the nut, and to permit the bolt-stem to move laterally with the nut after the bolt is nutted.

Immediately opposite the position of the nut in the cross-channel d^1 is the bolt-clamp F, by means of which the bolt is held during nutting. This device consists of a pair of vibrating griping-jaws *f f*, which are connected by their pivots with a cross-head, f^1, secured to the end of the shaft B^2, while above this bolt-clamp, and a little to one side of it, is the bolt-holder G, for holding a supply of bolts to be nutted. This bolt-holder contains an upright channel, *g*, Figs. 1 and 10, wide enough to let the stems of the bolts slide sidewise down it, and the channel is capped at one edge by a guide, *g'*, between which and the adjacent edges of the plates forming the channel the heads of the bolts are received and guided. At the lower end of the channel of the bolt-holder a sliding bolt-mover, H, is fitted to move crosswise of said channel a sufficient distance to move a bolt laterally from the channel of the bolt-holder, and hold it for being taken by the bolt-transferring fingers, hereinafter described.

In order that the bolt-mover may remove a bolt from the bolt-holder the said mover is constructed (see Fig. 10) with a cavity to receive a bolt whenever this cavity is beneath the channel of the bolt-holder; and in order that the dropping of bolts from the bolt-holder may be prevented while the bolt-mover is moving a bolt therefrom, the shank of said mover is constructed as a slide to close the bolt-channel by sliding across its lower end.

The bolt-mover H is moved at the proper times by a cam, H^1, and a spring, H^2, the cam being secured to the main cam-shaft B, and operating upon the bolt-mover H through the intervention of the lever H^7, connecting-rod H^3, rock-shaft H^4, and rock-shaft arms H^5 H^6, while the spring H^2 is arranged to operate upon the lever H^7 antagonistically to the cam H^1.

In order that the bolt removed from the bolt-holder G by the bolt-mover H may be transferred to the bolt-clamp F, transferring-fingers are provided. These consist of a pair of fingers, I I^1, which are connected with an arm, I^2, by which they are held while being moved to and fro between the bolt-clamp on the one hand and the bolt-mover on the other. The movement at the proper times is effected by means of cam I^3, secured to the main cam-shaft, B, and a spring, I^4, acting antagonistically to said cam. The cam and spring operate upon the transferring-fingers I I^1 through the intervention of the arm I^2, rock-shaft I^5, and arm I^6. One finger, I^1, is secured rigidly to the arm I^2. The other finger, I, is connected with the arm by a pivot; and a spring, I^7, is provided to cause the movable finger to bear against the fixed finger with a yielding pressure, so that the former may open by pressure to admit a bolt-shank between the fingers or to release a bolt-shank. The adjacent points of the fingers are beveled, so that when these points are forced against a bolt-shank they may readily straddle it. The cam I^3 is of the proper form to impart the following movements to the transferring-fingers, (assuming that the latter are at their highest position, and that the cavity of the bolt-mover H is in its outermost position relatively to the bolt-channel:) The transferring-fingers are moved first downward sufficiently to cause the points of the fingers to straddle the shank of the bolt held by the bolt-mover, and until a notch in the inner side of the spring-finger I receives the bolt-shank; next the fingers are raised sufficiently to lift

the bolt clear of the cavity of the bolt-mover; then the transferring-fingers are moved down to present the bolt to the bolt-clamp F; and, lastly, they are raised to the position whence they started.

In order to insure the presentation of the bolt accurately to the bolt-clamp, the descending movement of the fingers is stopped by a stop, I^8, and an adjusting-screw, I^9, is provided to permit the finger-arm I^2 and fingers to descend more or less. The lateral adjustment of the fingers is provided for by constructing the finger-arm of two parts, adjustable longitudinally, and capable of being fastened by a screw, I^{10}, when adjusted.

The bolt-clamp F is, in this machine, connected with the turning mechanism for producing the turning movement by which the bolt and nut are screwed together, and also with the leading-cam, by which connections the screw-threads of the nut and bolt are engaged by a movement longitudinally of the bolt.

In the present machine, the rotating shaft B^3, to the head of which the bolt-clamp F is secured, constitutes the turning mechanism, the said shaft being caused to revolve by reason of being connected with the driving-shaft B^3 by means of the cog-wheels C^2 C^3. The leading-cam is the cam J, secured to the main cam-shaft B. This cam operates upon the bolt-clamp through the intervention of the lever J^1, the slide J^2, and the piston-rod J^3, which slides to and fro endwise within the shaft B^2, which is tubular. The same cam, J, is also made use of to close and open the jaws of the bolt-clamp F, and to withdraw the bolt-clamp after a bolt has been nutted to the position for receiving a new bolt from the transferring-fingers I I^1. The cam J is grooved, so that it is capable of moving the lever J^1 in both directions.

In order that the cam may effect the closing of the jaws of the bolt-clamp, the head of the piston-rod J^3 is constructed with two notches, *a*, Fig. 8, whose inner shoulders, being inclined, operate, when moved forward, as a wedge to spread the shanks of the clamp-jaws, and thus compel the jaws to close upon the bolt. In order that the bolt-clamp with the shaft B may not move endwise while such clamping is being effected, a stop-latch, K, is provided to act upon a collar, K^1, of the shaft B^2, and prevent endwise motion of the shaft and bolt-clamp during the clamping. This stop-latch (see Fig. 7) has the form of a bell-crank, and is arranged to swing upon a stud protruding from the stand *a'* of the main frame A. It is pressed toward the shaft B^2 by a spring, K^2, and it is withdrawn from the shaft B^2, and is held back when it is not to operate upon the shaft by means of a cam, K^3, secured to the main cam-shaft B, and operating upon the stop-latch through the intervention of a lever, K^4.

When the stop-latch is permitted to engage with the collar of the shaft B^2 the latter and the bolt-clamp are held from moving endwise until the piston-rod J^3 has been moved sufficiently to effect the clamping of the bolt, after which the latch is withdrawn, whereupon the continued movement of the piston-rod J^3 by the incline of the cam J moves the bolt-clamp bodily forward, or advances it and leads the screw of the bolt into the screw-thread of the nut. When the screw-bolt has been nutted the withdrawing incline of the cam J draws the piston-rod backward. As, however, the bolt is held from moving backward by being screwed into the nut, which is held by the side plate d^2 of the nut-holder, and as the jaws of the bolt-clamp hang on the stem of the bolt the bolt-clamp and shaft tend to retain their forward positions; hence the backward movement of the piston-rod J^3 withdraws the wedge-formed shoulders of its head from between the shanks of the clamp-jaws, thereby permitting those jaws to be opened by the action of the springs f^2 and release the bolt.

When the bolt is released the bolt-clamp is permitted to move back with the shaft B^2 and piston-rod J^3 to the position for receiving a bolt from the fingers I I^1.

After a bolt has been nutted the advancing movement of the nut-mover might push the next nut against the nut of the nutted bolt and eject the last; but in order to discharge the nutted bolt rapidly, and have it out of the way of the next nut and bolt to be connected, the bolt-discharger is provided. This discharger, in the present case, has the form of a swinging arm, L, which is pivoted to the main frame with its upper end in a position to sweep forward across the position occupied by the bolt during nutting. The bolt-discharger is moved forward to cause its upper end to strike the nutted bolt and disengage the nut thereof laterally from the nut-holder by the end of the slide E^2, that operates the nut-mover. The nutted bolt thus discharged drops, and the bolt-discharger is restored to its backward position by means of a spring, L', when the backward movement of the slide E^2 permits this spring L' to move the discharger.

As the slide E^2 is moved by the nut-moving cam E^1 the bolt-discharger is also moved by that cam; but, if preferred, a special cam may be provided for the latter purpose, or to retrograde the nut-discharger, and to permit it to be moved quickly forward by a spring.

It may happen in practice that the transferring-fingers may fail to take the bolt from the bolt-mover, in which event the bolt-mover, by its backward or return movement, would tend to return such bolt beneath the bolt-holder. In order to prevent such return the bolt-guard N, Figs. 3 and 10, is provided. This bolt-guard is arranged to slide up and down at the side of the bolt-holder with its lower end crossing the track in which the bolt is carried by the bolt-mover. The lower end or head of the bolt-guard is inclined at the side facing the bolt-holder, but is flat at its opposite side. Consequently, when a bolt is moved away from the bolt-holder, its stem, bearing against the inclined side of the bolt-guard, pushes the

latter upward, and when the bolt has passed the bolt-guard the latter drops behind it. If, however, the bolt remains in the bolt-mover during its return movement the stem of the bolt strikes against the flat side of the bolt-guard, which stops its return, while the bolt-mover, continuing its return, withdraws from beneath the bolt, permitting it to drop.

It may happen in practice that a blank nut (or nut without a screw-thread) may sometimes be entered into the nut-holder, and it may also happen that a bolt-blank (or unscrewed bolt) may be accidentally entered into the bolt-holder. In either or both of these cases the bolt could not enter the nut, and the stoppage or breakage of the machine must ensue unless some provision were made to prevent such results.

In order to prevent either, the head *c* of the piston-rod J^3 is made of uniform size from the outer corners of its inclined shoulders backward, so that if a sufficient resistance be offered to the forward movement of the bolt to make the jaws of the bolt-clamp slip upon the bolt-stem, the head of the piston-rod will slide forward between the shanks of the clamp-jaws instead of moving the bolt-clamp forward. This combination of the head of the piston-rod of uniform size with the clamp-jaws therefore operates as a safety device to prevent breakage.

The channels of the nut-holder and of the bolt-holder of the machine are made of the proper sizes for the nuts and bolts to be operated upon, and the leading-cam J has its leading incline of the proper slope to force the screw-threads of the bolt and nut to engage when one of the two is turned.

These devices, as well as the others of the machine, are adapted to the sizes of the screw and nut to be connected together, and to the pitch of the screw-thread.

The nut-holder and the bolt-holder are charged with nuts and bolts by hand, or they may be charged by some of the automatic devices in use on machines for tapping nuts and screwing bolts.

When the machine is at work the following operations are performed: The bolt-mover H moves a bolt sidewise from the lower end of the bolt-holder G within the range of the transferring-fingers I I^1. These latter descend, seize the bolt by its stem, and ascend with the bolt, leaving the bolt-mover free to move back beneath the bolt-holder and receive a new bolt. Then the transferring-fingers descend and insert the bolt-stem between the open jaws of the bolt-clamp F, which is then in its backward position. Next the piston-rod J^3 moves forward, thereby compelling the jaws of the bolt-clamp to clamp the bolt, which is then not only clamped, but is turned on its axis by the revolution of the shaft B^2, and is also pushed endwise forward or advanced toward the nut-holder. Meanwhile the nut-mover E has advanced, thereby pushing forward the lowest nut of the column in the nut-holder D to the position opposite the advancing end of the bolt. Hence by the time the point of the bolt is advanced to the position of the nut the latter is there to receive it, and the bolt and nut are engaged by the turning and advance of the shaft B^2, and are screwed together by the continued turning of that shaft, during which the screw-thread of the nut draws the bolt into the latter—in other words, the bolt is nutted. When this is effected the withdrawal of the piston-rod J^3 and bolt-clamp F releases the nutted bolt, which is thereupon discharged by the forward movement of the bolt-discharger L. The machine then repeats its operations.

If deemed best, the devices of the machine may be arranged to enter and turn the bolt in the nut while the latter stands at the lower end of the column of nuts in the nut-holder. In this case the nut may be pulled out of the nut-holder, after the bolt is nutted, by pulling back the bolt; or the nutted bolt may be moved sidewise by the nut-mover, whose cam must then be set to operate at the right time for the purpose.

If deemed best, the stop-latch K may be arranged to operate upon the shaft B^2 twice for each bolt nutted—viz., to stop the forward movement of that shaft until the piston-rod J^3 has moved far enough forward to effect the griping of the bolt, and to stop the backward movement of that shaft while the piston-rod is moved backward far enough to permit the jaws to release the bolt. The changes of the latch-cam K^3 and of other parts of the machine for this purpose must be obvious to the skilled mechanic, and need not be described.

In place of using springs to produce the backward movements of the several devices above described, such movements may be effected by cams provided for the purpose. The machine may also be varied in many other ways without ceasing to embody some of my combinations. Parts of the invention may be used without others, and the work of said others be done by hand or by mechanical means differing substantially from mine. Thus the bolt-holder may be omitted, and the bolts placed by a child one at a time in the bolt-mover. In like manner the nut-mover may be omitted, and the nuts placed by a child one at a time in the nut-holder at the place where the screwed end of the bolt enters it. If the bolts should be placed one at a time in the bolt-mover, it may remain at rest, and the lateral movement which is now given to it may be given to the transferring-fingers by causing them to vibrate laterally on their arm by means of a suitable cam and spring.

I claim as my invention—

1. The combination, substantially as before set forth, of the nut-holder, constructed with a cross-channel for the nuts, the nut-mover, and the bolt-discharger.

2. The combination, substantially as before set forth, of the nut-holder, the bolt-holder, transfer mechanism, the bolt-clamp, and the turning mechanism.

3. The combination, substantially as before set forth, of the nut-holder, the bolt-holder, transfer mechanism, the bolt-clamp, the turning mechanism, and the leading-cam, the whole combined by suitable connecting mechanism.

4. The combination, substantially as before set forth, of the nut-holder, the bolt-holder, the nut-mover, transfer mechanism, the bolt-clamp, and the turning mechanism.

5. The combination, substantially as before set forth, of the nut-holder, the bolt-mover, transfer mechanism, the bolt-clamp, and the turning mechanism.

6. The combination, substantially as before set forth, of the nut-holder, the bolt-holder, the bolt-clamp, the turning mechanism, the transfer mechanism, and the leading-cam, the whole combined by suitable connecting mechanism.

7. The combination, substantially as before set forth, of the nut-holder, the bolt-holder, the nut-mover, the bolt-clamp, the turning mechanism, the transfer mechanism, and the leading-cam, the whole combined by suitable connecting mechanism.

8. The combination, substantially as before set forth, of the nut-holder, the bolt-holder, the nut-mover, the bolt-mover, transfer mechanism, the bolt-clamp, and the turning mechanism.

9. The combination, substantially as before set forth, of the nut-holder, the bolt-holder, the bolt-clamp, and the transfer mechanism.

10. The combination, substantially as before set forth, of the nut-mover, the bolt-mover, the bolt-clamp, and the transfer-fingers.

11. The combination, substantially as before set forth, of the nut-mover, the bolt-mover, transfer mechanism, the bolt-clamp, the turning mechanism, and the leading-cam, the whole combined by suitable connecting mechanism.

12. The combination, substantially as before set forth, of the nut-mover, the bolt-mover, transfer mechanism, the bolt-clamp, the turning mechanism, the leading-cam, and the piston-rod having a head of uniform size in the rear of its shoulders, the whole combined by suitable connecting mechanism.

13. The combination, substantially as before set forth, of the nut-holder, the bolt-holder, the bolt-clamp, the turning mechanism, and the transfer mechanism.

14. The combination, substantially as before set forth, of the nut-holder, the bolt-holder, transfer mechanism, the bolt-clamp, the turning mechanism, the leading-cam, and the bolt-discharger, the whole combined by suitable connecting mechanism.

15. The combination, substantially as before set forth, of the nut-holder, the bolt-holder, transfer mechanism, the bolt-clamp, the turning mechanism, the leading-cam, and the piston-rod having a head of uniform size in the rear of its shoulders, the whole combined by suitable connecting mechanism.

16. The combination, substantially as before set forth, of the nut-holder, the bolt-holder, the bolt-mover, the bolt-clamp, the turning mechanism, the transfer mechanism, and the leading-cam, the whole combined by suitable connecting mechanism.

17. The combination, substantially as before set forth, of the nut-holder, the bolt-mover, the bolt-clamp, the turning mechanism, the transfer mechanism, and the leading-cam, the whole combined by suitable connecting mechanism.

18. The combination, substantially as before set forth, of the bolt-clamp, leading-cam, and connecting mechanism, the same operating to close said clamp, to move it forward to advance the bolt carried by said clamp into the nut, to permit said clamp to open, and to move it back.

19. The combination, substantially as before set forth, of the bolt-clamp, the turning mechanism, the leading-cam, and the stop-latch.

20. The combination, substantially as before set forth, of the nut-holder, the bolt-holder, transfer mechanism, the bolt-clamp, the turning mechanism, the leading-cam, and the stop-latch, the whole combined by suitable connecting mechanism.

21. The combination, substantially as before set forth, of the nut-mover, the bolt-mover, transfer mechanism, the bolt-clamp, the turning mechanism, the leading-cam, and the stop-latch, the whole combined by suitable connecting mechanism.

22. The combination, substantially as before set forth, of the nut-holder, the bolt-holder, the nut-mover, the bolt-mover, transfer mechanism, the bolt-clamp, the turning mechanism, the leading-cam, and the stop-latch, the whole combined by suitable connecting mechanism.

23. The combination, substantially as before set forth, of the transferring-fingers, the bolt-clamp, the turning mechanism, the leading-cam, and the stop-latch, the whole combined by suitable connecting mechanism.

24. The combination, substantially as before set forth, of the bolt-holder, the bolt-mover, the bolt-guard, and the transferring-fingers.

25. The combination, substantially as before set forth, of the bolt-holder, the bolt-mover, the bolt-guard, the transferring-fingers, and the bolt-clamp.

26. The combination, substantially as before set forth, of the bolt-holder, the bolt-mover, the bolt-guard, the transferring-fingers, the bolt-clamp, the nut-holder, and the turning mechanism.

In witness whereof I have hereto set my hand this 5th day of March, A. D. 1878.

SAMUEL LORD WORSLEY.

Witnesses:

LAWRENS N. FRANCIS,

JULIA SAMPSON.