July 21, 1959 F. G. NICOLAUS 2,895,340

STEPPER WITH BUILT-IN LATCH

Filed April 30, 1956 2 Sheets-Sheet 1

FIG. 1

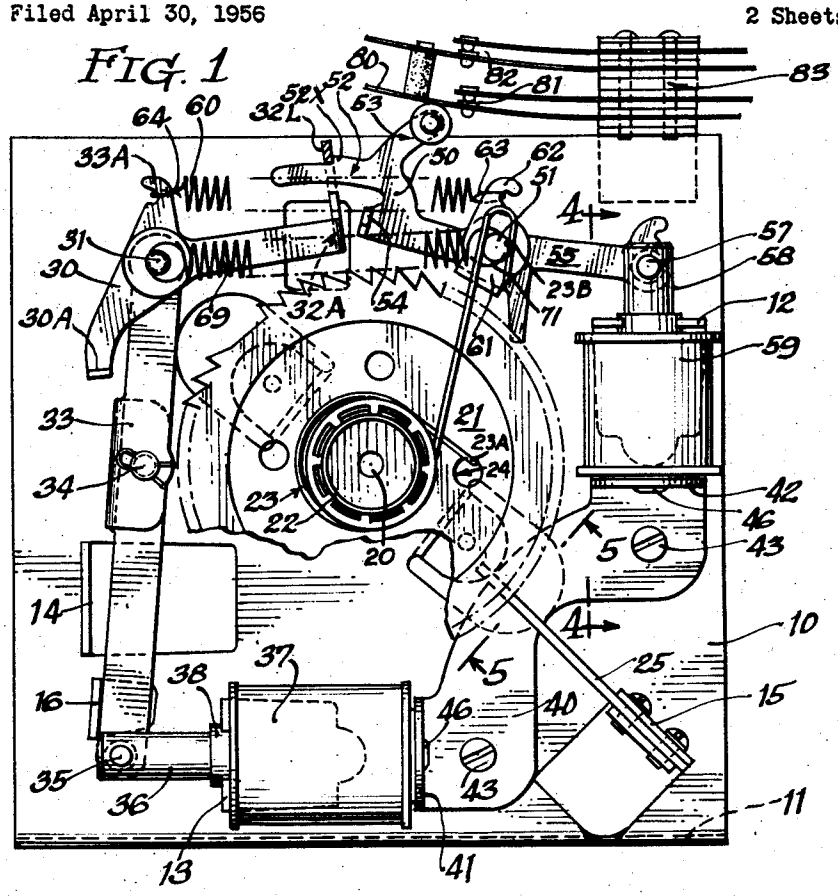

FIG. 2

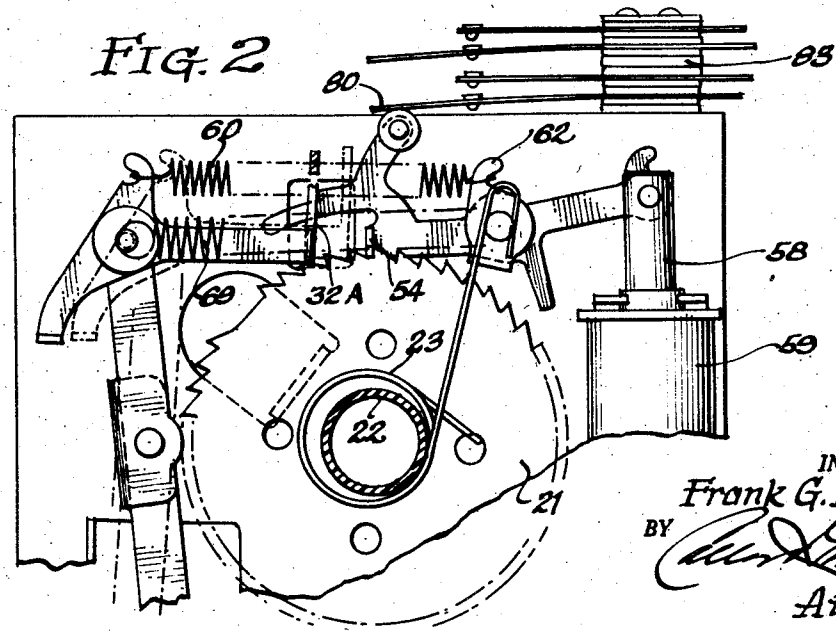

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FIG. 3

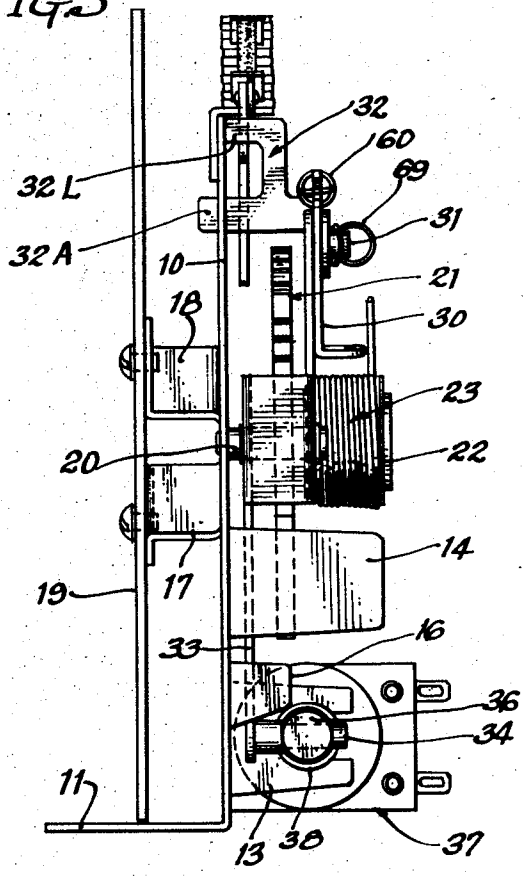


FIG. 4

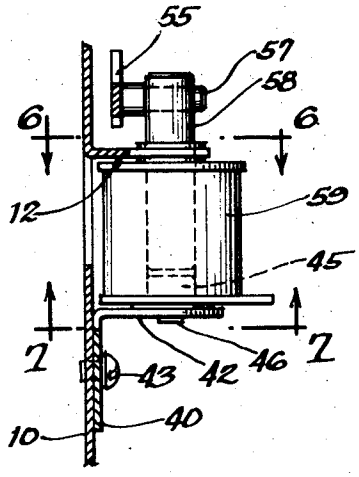


FIG. 6

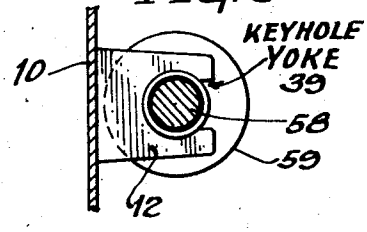


FIG. 5

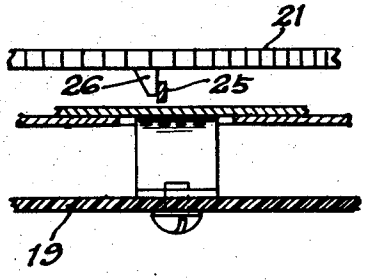
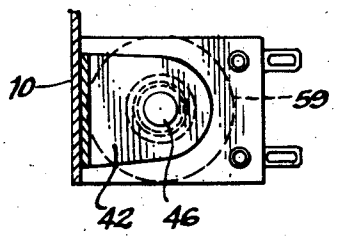


FIG. 7



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United States Patent Office 2,895,340 Patented July 21, 1959

2,895,340

STEPPER WITH BUILT-IN LATCH

Frank G. Nicolaus, Chicago, Ill., assignor to Raymond T. Moloney, Chicago, Ill.; American National Bank and Trust Company of Chicago, executor of said Raymond T. Moloney, deceased

Application April 30, 1956, Serial No. 581,522
7 Claims. (Cl. 74—142)

This invention relates to improvements in pawl and ratchet mechanism, especially the step-by-step type, and has particular, but not exclusive, application to stepping switches.

One of the principal features of the disclosure is the provision of automatic lock-up means on stepping and holding dogs mutually latching these members in a released condition until one of them receives a further actuating impulse.

Another important object is the provision of a supervisory switch means and circuit actuated by one of the dogs in said mutually latched-up condition.

A further feature is the provision of a novel mounting means for a switch panel and the solenoids driving said pawls or dogs, and includes certain integral formations on a base plate for the stepping unit, together with certain cooperative bracket means for locating and securing said parts in operating position.

Additional objects and aspects of novelty and utility will appear as the following specification proceeds in view of the annexed drawings, in which:

Fig. 1 is a front elevational view showing the holding dog latched in releasing condition;

Fig. 2 is a fragmentary view similar to Fig. 1 but showing the holding dog unlatched and in normal operative position;

Fig. 3 is a side view;

Fig. 4 is a sectional detail with parts seen in elevation, looking in the direction of lines 4—4 of Fig. 1 and illustrating the solenoid mounting features;

Fig. 5 is a fragmentary sectional detail of a portion of the integral, panel-mounting spider means;

Fig. 6 is a fragmentary sectional detail of another part of the solenoid mounting as seen along lines 6—6 of Fig. 4;

Fig. 7 is a rear elevational and sectional view of the structure seen along lines 7—7 of Fig. 4.

As depicted in Fig. 1, the step-up mechanism includes a metal base plate **10** having an offset bottom portion affording a mounting foot **11** (Fig. 3) and certain punched projections including two solenoid-mounting yokes **12** and **13**, switch seats **14** and **15**, stop **16**, and (in Fig. 3) two panel-mounting spider legs **17** and **18** struck out from the opposite face of the base plate to support a contact panel **19** or the like.

Staked into the base plate (as in Figs. 1 and 3) is a stud spindle **20** upon which is journalled a ratchet wheel **21** carrying upon its hub **22** a coil return spring **23**, one end **23A** of which hooks into a perforation **24** molded on the wheel, and the other end **23B** of which is hooked to engage a pin **51** on which the holding dog oscillates, as will further appear.

Mounted on the integral bracket **15** is a long spring buffer blade **25** (Fig. 1) which is engaged by molded stud **26**, Fig. 5, on the rear of the ratchet wheel to provide a yieldable, shock-absorbing stop for the latter upon return to starting position by the spring **23**.

Means for advancing the ratchet step-by-step includes a stepping or advancing pawl **30** pivotally mounted on a pin **31** staked into a driving lever **33**, an end portion of the pawl being offset to provide a dog of the somewhat U-shaped configuration seen in Fig. 3, the lower arm **32A** of which is the actual dog engaging in the ratchet teeth, while the upper arm **32L** is a latching member, as will further appear, the lower dog arm **32A** projecting through the base plate, as in Fig. 3, and serving also as limiting stop for this pawl.

The stroke or driving lever **33** oscillates on a pin **34** staked into the base plate, the lower end engaging the integral stop **16** and being pivotally connected as at **35** to the plunger **36** of a driving solenoid **37** provided with an extended neck **38** on its brass core tube which seats in a keyhole slotting **39** (Fig. 3 and compare Fig. 6) formed in the integral solenoid yoke **13**, whereby the forward end of the driving solenoid is secured in position.

The rearward end of the driving solenoid **37** is positioned by a special bracket **40** (Fig. 1) having upset flanges **41**, **42** at opposite ends thereof and respectively lying in planes which are at right angles to each other. This bracket is secured on the base plate by screws **43** with the flange **41** confronting the rear of solenoid **37**, there being shown in dotted lines in Fig. 4 the attachment of one of the two heel plugs **45** which are respectively staked into each of said flanges, as at **46**, and which respectively fit snugly into the rearward ends of the solenoid cores which they confront, thereby holding the solenoids in operative position cooperably with their respective yokes **12** and **13**. The stepping or advancing means is completed by certain spring means to be described hereinafter.

Means for releasably holding the advance or gain of the ratchet wheel includes a holding pawl **50** (Fig. 1) pivoted on a pin **51** staked into the base plate, the inner end of said pawl having a peculiarly somewhat Y shaped formation including a tripping and latching arm **52** projecting toward the stepping pawl, and a somewhat upwardly projecting switch-operating arm **53** engageable with a switch blade **80**, and a further offset dog **54** normally engaging in the teeth of the ratchet wheel.

At its opposite end, the holding pawl includes an extension **55** pivotally connecting as at **57** with the plunger **58** of a releasing solenoid **59**.

Projecting upwardly from the holding pawl is an upper lug **62** to which is attached one end **63** of a long coil spring **60** the opposite end **64** of which is anchored on the upper end lug **33A** of the driving lever, said spring thereby normally urging the lever in a clockwise sense to the normal (for the lever part only) resting position shown in Fig. 1 while urging the holding pawl **50** in a counterclockwise sense to the normally lowered holding position shown in Fig. 2.

The actual driving or advancing force for stepping pawl is derived from a second long coil spring **69** which is a driving spring, one end **70** of which is attached to the pin **31** on the advancing lever, and the opposite end **71** of which is anchored to the pin **51** for the holding pawl. When the driving solenoid **37** is pulsed lever **33** will first rock counterclockwise, increasing the tension in said driving spring **69**, and upon deenergization of this solenoid the driving spring will pull the driving pawl toward the rght in Fig. 1 with the dog **32A** engaged in the ratchet teeth (as in Fig. 2) thereby advancing the latter the distance of one tooth, in the usual case, this gain being automatically held by the holding dog **54**.

In order to restore the ratchet wheel to its starting position it is necessary to energize the reset solenoid **59** in its condition shown in Fig. 2 to produce the condition shown in Fig. 1, wherein the holding pawl is in the released, elevated position with the dog part **54** fully withdrawn from the ratchet teeth so that the return coil spring **23** can turn the ratchet wheel back to the starting position determined by the stop means **25**, **26**.

An important incident of the foregoing release action is an automatic latching of both dogs in released condition, owing to an interlocking of the latch part **32L** with

small locking projection or shoulder 52X on dog arm 52, which is positioned angularly with respect to the latch dog 32L so that the effort of the springs 60 and 69 effects a stable, mutually-interlocking action between the two pawls to hold them firmly in the released conditions shown in Fig. 1, wherein it will be observed that the operating arm 53 springs the switch blade 80 upwardly to close contacts 81 and 82 on the supervisory stack switch 83 and maintain this condition until further release action occurs.

Release of the pawls from locked-up condition will occur at the first subsequent energization of the stepping solenoid 37, or manually as by lifting the lug 30A on the stepping pawl. When this happens, the latching dog 32L moves away from the shoulder 52X permitting the holding dog to drop forward and down to the position of Fig. 2, and the supervisory switch means is also permitted to return to normal position.

It is to be understood that stepping mechanisms of the general type depicted are old in the art with respect to the use of stepping and holding pawls and electromagnetic means for actuating them. Moreover, it is known to employ interengagement of holding and advancing pawls for the purpose of having the holding pawl, when released, also release the advancing pawl so as not to interfere with return of the ratchet wheel. Examples of the latter type pawl mechanisms are to be found in U.S. Patents Nos. 2,281,262 and 2,410,708.

The present improvements relate more particularly to the provision of the automatic interlocking means and actions as at parts 32L, 50, 50X, and the angular disposition and shape by which the unlocking action is made to follow the first subsequent stepping action of the stepping mechanism, together with the improvements relating to the operation of a supervisory switch means 83 by the holding pawl and to the means for mounting the solenoids and contact panel.

I claim:

1. In a step-up ratchet mechanism, a ratchet wheel including spring means urging the same to a normal starting position; a step-up pawl oscillable to advance said wheel step-by-step; a holding dog yieldingly urged to engagement with said wheel to hold the gain thereof; interengaging parts on both dogs acting in the released condition of the holding dog to move the stepping dog out of engagement with said wheel when the holding dog is releasably moved beyond a predetermined amount from holding position; and a latch formation on one of said dogs automatically engaging a part on the other dog in the disengaged condition of both dogs and integral therewith to lock-up the same in mutually holding relation in said disengaged condition, said mutually holding relation being broken and released responsive to a stepping motion of the stepping dog.

2. In a pawl and ratchet mechanism, the combination, with a stepping pawl and a holding pawl movable in a releasing direction to withdraw the stepping pawl from the ratchet, of improvements comprising, to wit: mutually interlocking latch parts on the stepping and holding pawls for engagement to hold both of the pawls withdrawn from the ratchet responsive to movements of the holding pawl a predetermined amount away from the ratchet in the direction of releasing movement of said holding pawl, said latch parts being released from interlocked condition by movement of the stepping pawl a predetermined amount away from the holding pawl in response to at least a partial stepping action thereof when in interlocked condition.

3. In a pawl and ratchet step-up mechanism: a ratchet wheel, a stepping pawl therefor, a holding pawl therefor, and mutually adjacent and engageable latch parts on said pawls acting to interlock in response to withdrawal of the holding pawl a predetermined amount from the ratchet wheel to engage the stepping pawl and move the latter out of engagement with the stepping wheel and thereby effect an interlock of said parts effective to hold both pawls in withdrawn condition, said stepping pawl being capable of subsequent movement in a direction away from the holding pawl an amount sufficient to break and release said interlock.

4. In a stepping ratchet mechanism: a base plate, a ratchet wheel rotatably carried on said plate; stepping and holding pawls mounted on the plate for movement into and out of engagement with said wheel for stepping, holding and releasing coaction therewith; separate solenoid means for actuating said pawls in their respective stepping and releasing functions; means mounting said solenoids on said plate and comprising an integral yoke bracket for each solenoid struck up from said plate and having an opening to receive a neck portion at one core end of a corresponding one of the solenoids; and a dual end bracket on the plate and common to said solenoids and havng two plugs each disposed to fit into the heel end of the core of one of the solenoids as aforesaid to prevent separation of the latter from their respective yokes.

5. In a stepping switch, a base plate and a ratchet wheel journalled thereon; stepping and holding pawls mounted on the plate to cooperate with said wheel; electromagnetic driving means for each pawl; and means for securing a panel-like member in operative position on said plate and comprising at least two spider legs integral with said base plate in a plane normal to the axis of said wheel and struck out therefrom on substantially opposite sides of the rotative axis of said ratchet wheel on a side of the base plate opposite from said wheel.

6. In a stepping switch, a base plate, a ratchet wheel journalled thereon, stepping and holding pawls mounted on said plate to coact with said wheel, an operating solenoid for each of said pawls; and means for mounting the solenoids and panel in predetermined operative positions on the base plate and comprising integral portions of said plate struck out therefrom, at least two of said struck-out portions supporting said panel in a plane approximately normal to the rotative axis of said wheel; and at least two others of said portions each respectively supportably engaging one axial end portion of one of said solencids; and bracket means removably secured to said plate with offset end portions struck up and each supportably engaging a remaining axial end portion of one of said solenoids whereby the latter are secured on the plate in operative relation to said wheel.

7. In an electromagnetic step-up mechanism of the type having a ratchet wheel with cooperative holding and stepping pawls respectively engageable therewith to advance the ratchet wheel step-by-step and to hold the advanced gain of the wheel, and spring means normally acting to return the wheel from an advanced back to a starting position, together with electrically controlled means for separately actuating said pawls, and mutually engaging coupling parts on said pawls acting to disengage the stepping pawl from the wheel whenever the holding pawl is disengaged therefrom, improvements comprising, namely: interlock means on said pawls including a notched formation near said coupling part on one pawl interfitting with a complementary portion near the said coupling part on the other pawl so located and shaped relative one to the other to interlock when both pawls are disengaged from said wheel in a certain position such that each pawl holds the other from reengaging the ratchet wheel until one of said pawls is subsequently moved by the aforesaid actuating means.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,895,340 July 21, 1959

Frank G. Nicolaus

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 3, lines 50 and 51, strike out "and integral therewith" and insert the same after "said dogs" in line 49; column 4, lines 27 and 28, strike out "in a plane normal to the axis of said wheel" and insert the same after "plate" in line 26, same column.

Signed and sealed this 16th day of February 1960.

(SEAL)

Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents

UNITED STATES PATENT OFFICE

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