

Aug. 21, 1934.

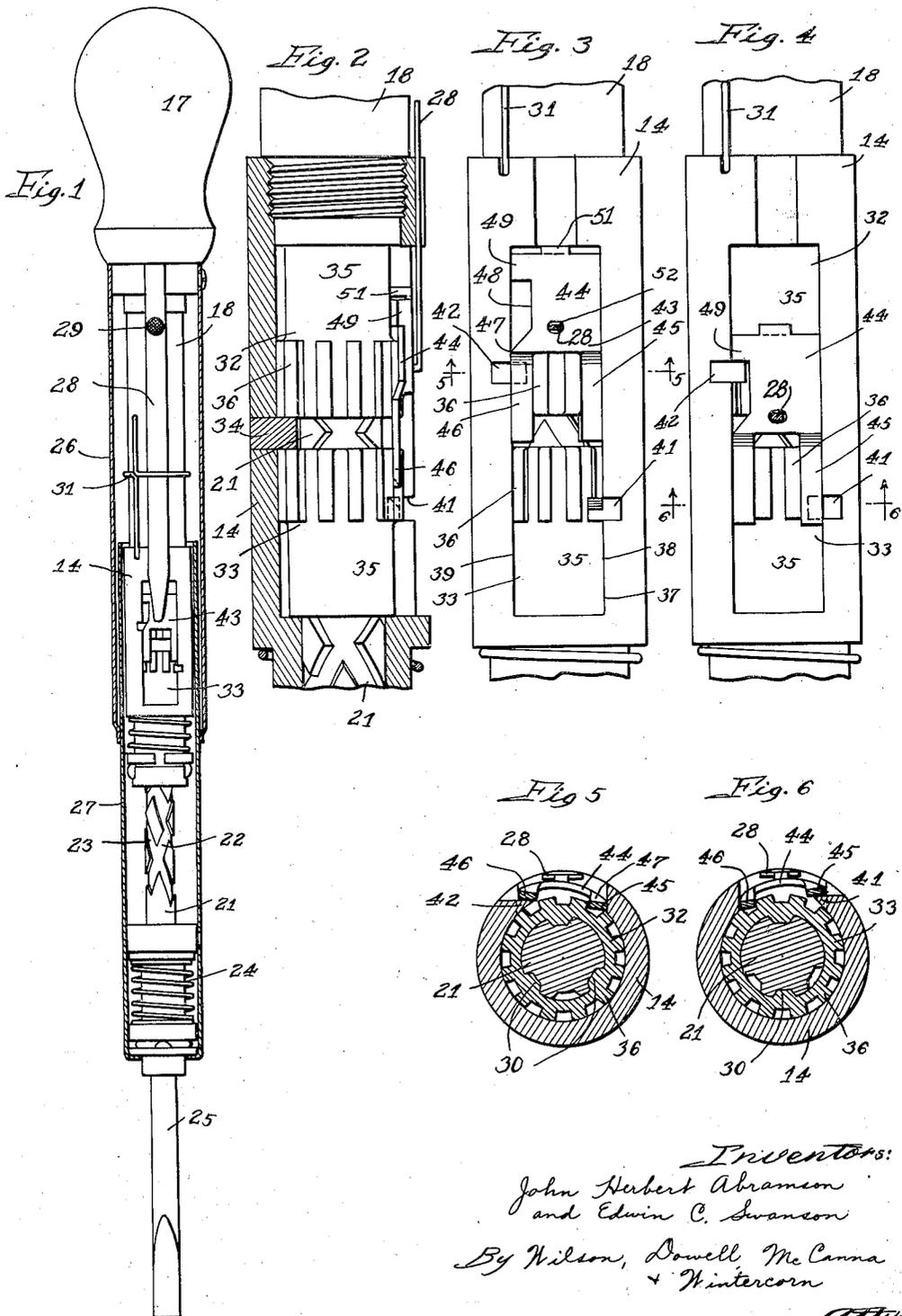
J. H. ABRAMSON ET AL

1,971,290

RATCHET MECHANISM

Filed June 10, 1933

2 Sheets-Sheet 1



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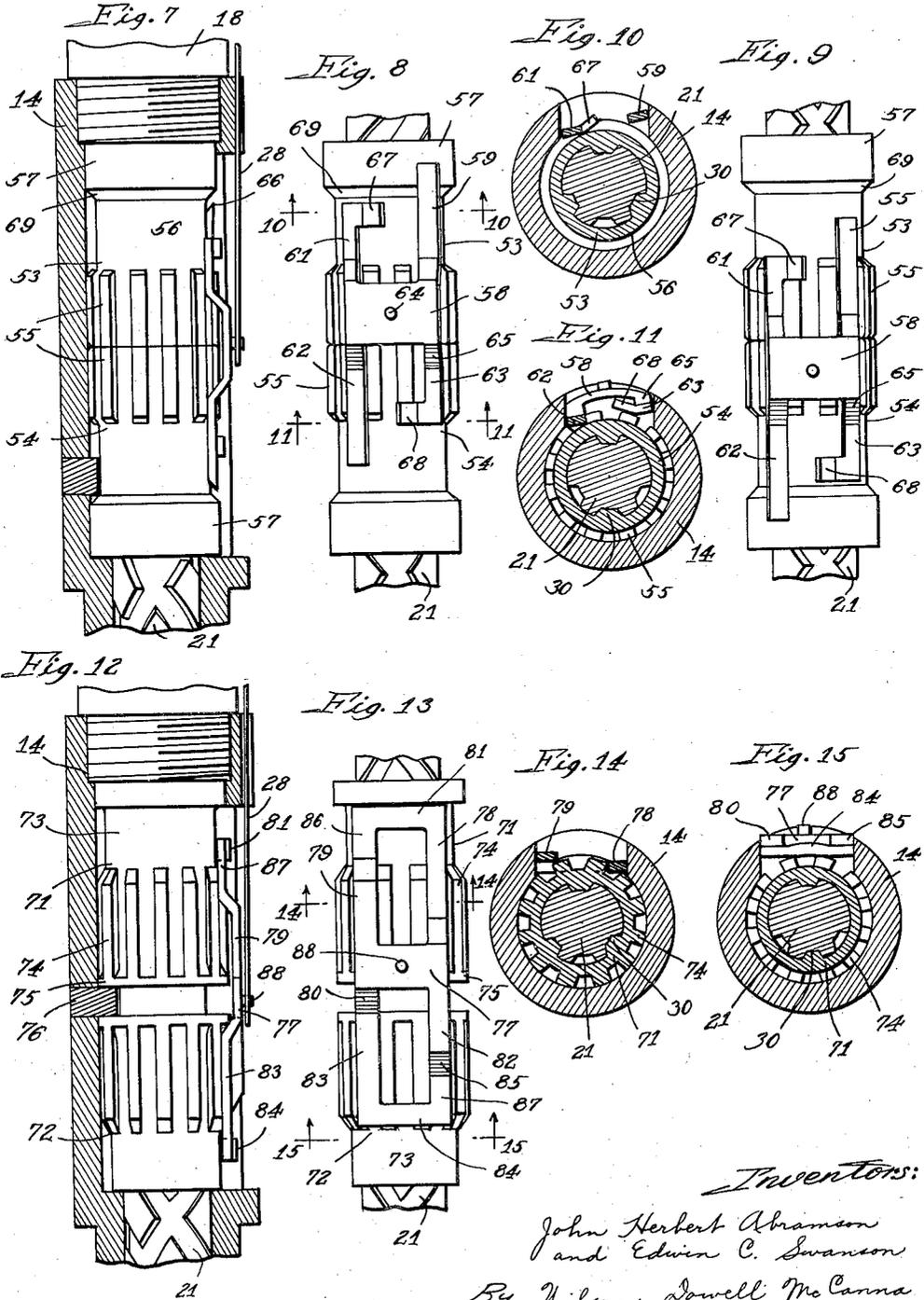
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UNITED STATES PATENT OFFICE

1,971,290

RATCHET MECHANISM

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Application June 10, 1933, Serial No. 675,176

21 Claims. (Cl. 145—54)

This invention relates to ratchet mechanisms and more especially to ratchet means of particular advantage in spiral ratchet screw drivers.

A source of annoyance and delay in the operation of conventional spiral screw drivers is the fact that when the screw being inserted thereby is driven to the full extent possibly by reciprocation of the handle, it is necessary to run the spindle completely into the body and lock the same in this collapsed position in order to finish the insertion of the screw. While such screw drivers can be locked at any point in the stroke against inward movement of the spindle, that alone is not sufficient since in such locked position the spindle can move outward. This means that when pressure is applied to the handle, the handle will back up along the spiral on the spindle and also rotate in the direction in which the handle is being turned, thus making it necessary, should the screw become too difficult to turn at a point when the spindle is partly extended, to remove the screw driver from the screw, run the spindle into the body and lock the same before the screw may be tightened.

An object of the invention is the provision of a generally improved spiral ratchet screw driver wherein at any point in the stroke the spindle may be locked against movement and the driver used as a fixed driver.

A further object of the invention is the provision of a screw driver of variable length.

A primary object of the present invention is the provision of improved ratchet mechanism for locking the ratchet wheels against rotation in either direction.

We have also aimed to provide ratchet means wherein the pawl and associated parts are formed to provide positive and smooth action and wherein the pawl is moved longitudinally to select the various operating trains and means are provided for tilting the pawl responsive to such movement to engage the fingers thereof.

Other objects and attendant advantages will become apparent to those skilled in the art from the following description and the accompanying drawings, in which—

Figure 1 is a side view of a screw driver embodying our invention, the enclosing sleeves being shown in section;

Fig. 2 is a fragmentary section through the ratchet cage showing the pawl in a position to lock the ratchet wheels against movement in either direction;

Fig. 3 is a face view of the ratchet cage show-

ing a pawl in a position for ratcheting of one ratchet wheel;

Fig. 4 is a view similar to Fig. 3 showing a pawl in a position for ratcheting of the other wheel;

Fig. 5 is a section on the line 5—5 of Fig. 3;

Fig. 6 is a section on the line 6—6 of Fig. 4;

Fig. 7 is a section through the ratchet cage showing a second embodiment of our invention, the pawl being in a position to lock both ratchet wheels against movement in either direction;

Fig. 8 is a top view of the ratchet wheels and pawl shown in Fig. 7, showing the pawl in a position for ratcheting of one wheel;

Fig. 9 is a view similar to Fig. 8 showing the pawl in a position for ratcheting of the other wheel;

Fig. 10 is a section on the line 10—10 of Fig. 8;

Fig. 11 is a section on the line 11—11 of Fig. 8;

Fig. 12 is a section through the ratchet cage showing a third form of our invention, the pawl occupying a position to prevent rotation of the ratchet wheels in either direction;

Fig. 13 is a top view of the ratchet wheels and pawl shown in Fig. 12, the pawl occupying a position for ratcheting of the upper wheel;

Fig. 14 is a section on the line 14—14 of Fig. 13, and

Fig. 15 is a section on the line 15—15 of Fig. 13.

The present invention contemplates a screw driver wherein movement of the ratchet control button locks the spindle against movement in the body so that the screw driver is virtually converted to a fixed screw driver for completing the driving of a screw. The invention also contemplates a screw driver wherein by actuation of the ratchet control the screw driver may be converted to a fixed screw driver of variable length. Also within the contemplation of the invention is ratchet mechanism of general application but of particular value in a screw driver wherein a pawl cooperates with a pair of ratchet wheels, the pawl being shaped to lock the wheels against rotation in either direction.

The invention is illustrated as incorporated in a screw driver such as shown and described in our copending application, Serial No. 675,175, filed June 10, 1933 the numeral 17 designating a handle carrying a body consisting of a tube 18 and a ratchet cage 14. A spindle 21 having helical right and left hand grooves 22 and 23 is supported in the body for reciprocation therein. The outer end of the spindle carries a chuck 24 for holding a bit 25. A sleeve 26 surrounds the body, and a sleeve 27 telescoping therewith is supported on

the chuck and surrounds the spindle. A spring 28 carrying a button 29, which projects through the sleeve 26, extends from the handle to the ratchet cage and is held against the tube 18 by means of a clip 31.

Ratchet mechanism, carried in the cage 14, serves to control the relative movement between the body and the spindle and may take a number of forms, three of which are shown in the drawings, Figures 1 to 6, inclusive, showing one form, Figs. 7 to 11 a second form, and Figs. 12 to 15 a third form.

Referring first to the form shown in Fig. 1-6, ratchet wheels 32 and 33 are positioned on the spindle 21 within the ratchet cage 14 and are spaced apart by a spacer 34 pressed into the walls of the cage. Splines 30 on the inner surface cooperate with the grooves 22 and 23 on the spindle in the usual manner. The ratchet wheels are each provided with a hub 35 and teeth 36, the teeth preferably projecting above the cylindrical surface of the hub 35 and the toothed ends of the two wheels being in adjacent relationship. The cage 14 has a slot 37 provided with longitudinally parallelly disposed side edges 38 and 39. Ledges 41 and 42 are formed on the cage at the edges 38 and 39 and project into the slot, the ledges being formed in any convenient manner as by swedging the metal at these points. A pawl designated generally by the numeral 43 has a body portion 44 which is preferably, though not necessarily, curved laterally and with a pair of fingers 45 and 46 at one end bent downwardly, as shown at 47, to lie in a lower plane than the body 44. The body of the pawl is slotted, as shown at 48, to provide a stop 49 and the rear end of the body 44 is provided with a depending finger 51 arranged to contact the hub 35 of the wheel 32. The body 44 is also provided with an opening 52 for the reception of the forward end of the spring 28 so that by manipulation of the button 29, the pawl may be moved longitudinally between the positions shown in Figs. 2, 3 and 4.

The fingers 45 and 46 bear against the side edges 38 and 39, respectively, and serve to guide the pawl in its longitudinal movement. The ledges 41 and 42 are so spaced longitudinally of the cage that when the finger 45 approaches the ledge 41 the slot 48 will coincide with the ledge 42, thereby permitting the fingers 45 and 46 to drop downward against the gear teeth 36 of both wheels, as shown in Fig. 2. In this position, the inner edges of the fingers 45 and 46 are received between the teeth 36 while the outer edges bear against the side edges 38 and 39 of the slot 37, opposite ends of the fingers engaging the teeth on opposed wheels. In this position, relative longitudinal movement between the spindle 21 and the cage 14 becomes impossible since neither of the gears are permitted to rotate in either direction in the cage 14. Movement of the button 29 rearwardly from its intermediate position moves the pawl 43 into the position shown in Fig. 3. During this movement, the finger 46 rides up onto the ledge 42, tilting the finger 46 out of engagement. Simultaneously, the fingers 45 and 46 are moved longitudinally so that the ends of the fingers cannot be engaged with the wheel 33. When the button 29 is moved forward from its central position, the pawl is moved into the position shown in Fig. 4. During this longitudinal movement, the fingers 45 and 46 are moved away from the gear 32 and over the gear 33. Simultaneously with such movement the forward end of the finger 45 rides up onto the ledge 41, thus tilting the

pawl so that the finger 45 is lifted out of engagement and the finger 46 is moved into engagement. In this position, the wheel 33 is prevented from rotating in a counterclockwise direction, facing Fig. 6, whereas in the position shown in Fig. 3, the wheel 32 is prevented from clockwise rotation facing Fig. 5. When the pawl moves into the position shown in Fig. 4, the stop 49 engages the ledge 42 to determine this forward position. Thus, the longitudinal movement of the pawl is a selective movement and serves to select the wheels which are to be engaged while the ledges 41 and 42 serve to tilt the pawl to bring the fingers into the desired engagement corresponding with the selection made by the longitudinal movement of the pawl. In the positions shown in Figs 3 and 4, the fingers which are not to be engaged, are positively held out of engagement so that there is no possibility of their engagement with the wheels through accident. In this manner, the operation of the ratchet mechanism is rendered positive.

We have shown in Figs. 7-11, inclusive, a second form of the invention wherein the ratchet wheels, designated generally by the numerals 53 and 54, are provided with gear teeth 55 extending above the cylindrical surface of hubs 56, the teeth being positioned at one end of the wheels and the wheels being positioned with said ends in abutting relationship, as shown in Fig. 7. Peripheral shoulders 57 are formed on the opposite ends of the wheels spaced from the teeth 55. A pawl, shown to best advantage in Fig. 8, consists of a body portion 58 preferably curved, as shown in Fig. 11, having outwardly extending fingers 59 and 61 at one end and 62 and 63 at the opposite end, the fingers bearing along their sides against the side edges 38 and 39 of the cage slot 37 shown and described in connection with the modification of Figures 1 to 6. A pin 64 in the body is received in the spring 28 for actuation of the pawl by means of the button 29. The fingers are each bent downwardly, as shown at 65, directly adjacent the body 58 so as to lie in a lower plane than the body 58. The fingers 59 and 62 at diagonally opposed corners of the body 58, are longer than the fingers 61 and 63 and may, if desired, have their ends beveled outwardly from bottom to top, as shown at 66, (Fig. 7). The fingers 61 and 63 have laterally extending projections 67 and 68 at their outer ends, the projections being bent upward, as shown in Fig. 10.

When the button 29 occupies its intermediate position, the pawl occupies the position shown in Fig. 7, wherein the portions of the fingers nearest the body 58 rest between the teeth 55 of the wheels, the fingers 59 and 61 engaging the wheel 53 to prevent its rotation in either direction and the fingers 62 and 63 engaging the wheel 54 and likewise preventing its rotation. When the button 29 is moved to its rearmost position, the pawl is moved longitudinally into the position shown in Fig. 8, the outer end of the finger 59 moving up the sloping edge 69 of the shoulder 57 and the lateral projection 68 on the finger 63 moving up the sloping ends of the teeth on the wheel 54. This movement tilts the pawl laterally about a longitudinal center, lifting the fingers 59 and 63 out of engagement with the wheels and maintaining the finger 62 in engagement with the wheel 54. The longitudinal movement of the pawl brings the finger 61 over the hub 63 so as to be free of the teeth on the wheel 53. Upon rotation of the wheels in this position, the finger 59 rides on the hub 57 and the lateral projection 68 of

the finger 63 rides over the teeth of the gear 54, thus positively preventing engagement of either the finger 59 or 63. When the button 29 is moved forward from its central position, the pawl is moved into the position shown in Fig. 9, wherein the fingers 61 and 62 are raised out of engagement and the finger 59 is brought into engagement with the teeth of the gear 53. Here again, longitudinal movement of the pawl serves to select the type of movement between the ratchet cage and the spindle, whereas the lateral tilting of the pawl serves to bring the proper fingers into engagement with the wheels. In the form shown in Figures 1-4, tilting movement of the pawl is brought about through means positioned on the ratchet cage, whereas in the present form the pawl completely rides upon the ratchet wheels and the tilting movement is brought about by means on the ratchet wheels.

A third form of the invention is shown in Figs. 12-15, inclusive, wherein the ratchet wheels are designated by the numerals 71 and 72 having hubs 73 and teeth 74 extending above the cylindrical surface of the hubs. End flanges 75 have a cylindrical surface of the same radius as the outer surfaces of the teeth 74. The ratchet wheels are placed with the flanges in adjacent spaced relation, the wheels being spaced by a spacer 76 secured in the wall of the cage 14. The pawl consists of a body 77 having fingers 78 and 79 at one end connected by a cross-member 81 and fingers 82 and 83 at its opposite end also connected by a cross-member 84 the cross-members 81 and 84 being preferably bent upward intermediate their ends, the cross-member 84 being shown in Fig. 15. The fingers 78 and 83 are bent downwardly, as shown at 80, directly adjacent to the body 77, while the fingers 79 and 82 are bent downwardly intermediate their ends, as shown at 85, providing portions 86 and 87 which lie in substantially the same plane as the fingers 78 and 83. A pin 88 on the body serves to receive the spring 28 for holding the pawl in engagement and permitting longitudinal movement thereof by means of the button 29.

When the button 29 occupies its intermediate position, the pawl occupies the position shown in Fig. 12, in which the fingers 78 and 83 and the portions 86 and 87 of the fingers 79 and 82 engage the teeth of both gears, thereby preventing rotation of either gear in either direction. When the button is removed rearwardly from its intermediate position, the pawl is moved into the position shown in Fig. 13. During such movement the finger 83 rides up onto the flange 75 of the wheel 72, and the cross piece 84 rides up onto the teeth of the wheel 72 to the position shown in Fig. 5, thereby lifting the fingers 82 and 83 out of engagement and tilting the pawl to maintain the fingers 78 in engagement. During this movement, the portion 86 of the finger 79 also moves out of engagement with the wheel 71. Movement of the button 29 forward from its intermediate position engages the finger 83 in the same manner, the cross piece 81 then riding on the teeth of the wheel 71. Thus, in this form of the invention, longitudinal movement of the pawl serves to select the type of engagement and tilting of the pawl serves to engage the fingers with the ratchet wheels to bring about proper engagement.

Attention is directed to the fact that through these pawl and ratchet wheel constructions, it becomes possible to lock the spindle with respect to the body of the screw driver at any point in

its reciprocation so that when the operator drives in a screw to the point where it is no longer feasible to use the spiral, it becomes only necessary to manipulate the button 29 after which the screw may be tightened by use of the screw driver as a conventional fixed screw driver. Because of the fact that the ratchet wheels in the locked position of the pawl are prevented from movement in either direction there is no tendency for the body to climb up along the spindle, as in conventional types of ratchet screw drivers.

Furthermore, through this construction, we have provided what is equivalent to a fixed screw driver of variable length. That is, by extending the spindle to bring the screw driver to the desired length and by placing the button 29 in the locked position, it is possible to have a fixed screw driver of any length within the range of the tool.

Attention is directed to the fact that in each construction, the pawl is of one piece simple construction and the inactive fingers of the pawl in its various positions are positively held out of engagement so that there is no possibility of accidental engagement of these fingers. In one form of construction, the pawl is caused to ride on the ratchet cage; in the second form of the invention, the pawl is caused to ride on the shoulders and teeth of the ratchet wheels which serve to accomplish the tilting of the pawl, whereas in the third form of construction, the pawl is caused to ride on the teeth of the wheel, which are instrumental in bringing about the tilting of the pawl.

While we have thus described and illustrated a specific embodiment of our invention, we are aware that numerous alterations and changes may be made therein without departing from the spirit of the invention or the scope of the appended claims, in which—

We claim:

1. The combination in a ratchet tool, of a spindle, a pair of ratchet wheels mounted on the spindle, a ratchet cage enclosing the wheels having a longitudinal slot, a longitudinally movable pawl in said slot having parallelly disposed fingers abutting opposite side edges of the slot arranged for reception between the side edges of the slots, means for moving the pawl longitudinally between wheel selecting positions, and means for tilting the pawl into selective engagement in said wheels upon such movement.

2. A ratchet wheel comprising a spindle, a pair of ratchet wheels carried by the spindle, a handle supporting the spindle, a ratchet cage on the handle receiving the ratchet wheels and having a slot, a ratchet pawl in said slot contacting said wheels, said pawl having opposed parallelly disposed fingers adjacent the sides of the slots, means for moving the pawl longitudinally, and means engaging the fingers upon such movement to tilt the pawl about a longitudinal axis to selectively engage said fingers with the wheels.

3. The combination in a ratchet mechanism, of a spindle, a pair of ratchet wheels mounted on the spindle, a ratchet cage enclosing the wheels having a slot forming longitudinal parallelly disposed side walls, a pawl in the slot having fingers movable along said walls, means for moving the pawl longitudinally between a central locked position and opposed ratcheting positions, and means for tilting opposed edges of the pawl upon longitudinal movement to selectively engage the fingers with the wheels.

4. The combination in a ratchet mechanism, of a spindle, a pair of ratchet wheels mounted on the spindle, a ratchet cage enclosing the wheels having a longitudinal slot, a pawl in the slot having parallelly disposed fingers, means for moving the pawl longitudinally, and means carried on the cage for tilting one of the fingers into engagement with each wheel for ratcheting or both fingers into engagement with both wheels to lock the same.
5. The combination in a ratchet mechanism, of a spindle, a pair of ratchet wheels mounted on the spindle, a ratchet cage enclosing the wheels having a slot forming longitudinal parallelly disposed side walls, a pawl in the slot having fingers movable along said walls, means for moving the pawl longitudinally between a central locked position and opposed ratcheting positions, means for tilting opposed edges of the pawl upon longitudinal movement thereof to selectively engage the fingers with the wheels, and stop means on the pawl for determining said ratcheting positions.
6. The combination in a ratchet mechanism, of a spindle, a pair of ratchet wheels mounted on the spindle, a ratchet cage enclosing the wheels having a slot forming longitudinally parallelly disposed side walls, a pawl in the slot having a body and a pair of fingers at one end thereof movable along said walls, means for moving the pawl longitudinally between a central position with said fingers engaging both of said wheels and opposed ratcheting positions, and means for tilting the pawl about its longitudinal axis upon said longitudinal movement to engage and disengage said fingers.
7. The combination in a ratchet mechanism, of a spindle, a pair of ratchet wheels mounted on the spindle, a ratchet cage enclosing the wheels having a slot forming longitudinal parallelly disposed side walls, a pawl in the slot having a body and a pair of fingers at one end thereof movable along said walls, means for moving the pawl longitudinally between a central position with said fingers engaging both of said wheels and opposed ratcheting positions, and ledges on said cage overhanging said side walls arranged to selectively tilt the edges of the pawl by cam action upon longitudinal movement thereof to engage and disengage said fingers.
8. In a ratchet mechanism having a ratchet cage and a pair of ratchet wheels, a pawl for controlling relative movement therebetween comprising a body and a pair of parallel fingers integral with one end of the body and lying in a lower plane than the body.
9. A pawl for ratchet mechanism, comprising an arcuate body having parallelly disposed fingers of substantially equal length integral with the body at one end, the fingers lying in a lower plane than the body, and a stop element integral with said body.
10. The combination in a ratchet mechanism, of a spindle, a pair of ratchet wheels each having a hub at one end and teeth extending thereabove at the other end, the wheels being mounted on the spindle with the toothed ends adjacent, a ratchet cage enclosing the wheels having a longitudinal slot, a pawl in the slot having a body, a pair of fingers at one end thereof supported over the toothed ends of the wheels, and a depending projection on the other end of the body arranged to contact the hub of the wheel to guide the pawl, means for moving the pawl longitudinally between a central locked position with said fingers engaging both of said wheels and opposed ratcheting positions, and means for tilting the pawl about its longitudinal axis upon said longitudinal movement to engage and disengage said fingers.
11. The combination in a ratchet mechanism, of a spindle, a pair of ratchet wheels mounted on the spindle, a ratchet cage enclosing the wheels having a slot, a pawl in the slot having a body and a pair of fingers at opposite ends thereof movable along said walls, means for moving the pawl longitudinally between a central locked position and opposed ratcheting positions, and cooperating means carried by the pawl and wheels for tilting the pawl about a longitudinal axis upon longitudinal movement thereof to selectively engage the fingers with the wheels.
12. The combination in a ratchet mechanism, of a spindle, a pair of ratchet wheels on the spindle having upwardly extending shoulders at their outer ends, a pawl in the slot having a body, each end thereof having a long and a short finger for engagement with the wheels, the longer fingers being at diagonally opposed corners of the body, means for moving the pawl longitudinally between a central locked position in which all of said fingers engage said wheels and opposed ratcheting positions in which one of said fingers engages one of said wheels, said long fingers riding onto said shoulders during said longitudinal movement to tilt the edges of the pawl.
13. The combination in a ratchet mechanism, of a spindle, a pair of ratchet wheels mounted on the spindle, a ratchet cage enclosing the wheels having a longitudinal slot, a pawl in the slot having a body, each end thereof having a pair of fingers for engagement with the wheels, means for moving the pawl longitudinally between a central locked position in which all of said fingers engage said wheels and opposed ratcheting positions in which one of said fingers engages one of said wheels, and cam means on the ends of the wheels operative upon longitudinal movement of the pawl to tilt the pawl about a longitudinal axis and bring the fingers into and out of engagement.
14. The combination in a ratchet mechanism, of a spindle, a pair of ratchet wheels on the spindle having upwardly extending shoulders at their outer ends and upstanding teeth on their inner ends, a pawl in the slot having a body, each end thereof having a long and a short finger for engagement with the wheels, the long finger being at diagonally opposed corners of the body, means for moving the pawl longitudinally between a central locked position on which all of said fingers engage said wheels, and opposed ratcheting positions in which one of said fingers engages one of said wheels, said long fingers riding onto said shoulders during said longitudinal movement to tilt one edge of the pawl, and lateral projections on said short fingers arranged to ride on said teeth to support the opposite end of the pawl.
15. In a ratchet mechanism, a pawl comprising a body, long and short parallelly disposed fingers on each end of the body depressed from the plane of the body, the long fingers being diagonally opposed, and a lateral projection on the end of each of the short fingers.
16. The combination in a ratchet mechanism, of a spindle, a pair of ratchet wheels mounted on the spindle having upstanding teeth, a ratchet cage enclosing the wheels having a slot forming longitudinal parallelly disposed side walls, a pawl in the slot comprising a body having parallel fingers on each end connected by a transverse

member at their outer ends, one pair of diagonally opposed fingers being bent downward adjacent the body and the other pair being bent down adjacent the outer end, and means for moving the pawl longitudinally between a central position with all of said fingers engaging said wheels, and opposed ratcheting positions, said transverse members riding onto said teeth to tilt the pawl and bring the fingers into and out of engagement.

17. In a ratchet mechanism, a pawl comprising a body, a finger on diagonally opposed corners of the body, laterally extending cross elements on the ends of said fingers opposite the body, and short fingers on the ends of the cross elements paralleled with the first mentioned fingers, the fingers and cross elements being depressed below the plane of the body.

18. In a ratchet mechanism, a pawl comprising a thin section rectangular open center frame having a cross bar intermediate its ends, the ends and portions of each side of the frame being depressed from the plane of the body throughout two diagonally opposed sides of the frame.

19. The combination in a ratchet tool, of a spindle, a pair of ratchet wheels mounted on the spindle, a ratchet cage enclosing the wheels and having a longitudinal slot, and a pawl in said slot movable between a locked position and separate ratcheting positions to control the rotation of the wheels, the pawl being shaped and supported to engage both wheels at annularly spaced points when in the locked position to prevent rotation of either wheel, and to engage one of said wheels in each ratcheting position.

20. The combination in a ratchet mechanism, of a spindle, a pair of ratchet wheels mounted on the spindle, each having an annular row of teeth, a longitudinally movable pawl having two fingers, the pawl being movable to selectively engage each finger with a row of teeth for ratcheting in opposite directions and to engage both fingers with both rows of teeth to lock the wheels against rotation, and means for holding the pawl against lateral displacement.

21. The combination in a ratchet mechanism, of a spindle, a pair of ratchet wheels mounted on the spindle, each having an annular row of teeth, a longitudinally movable pawl having four fingers, the pawl being movable to selectively engage one finger in either row of teeth for ratcheting in opposite directions, and to engage two fingers in each row of teeth to lock the wheels against rotation, and means for holding the pawl against lateral displacement.

JOHN HERBERT ABRAMSON.
EDWIN C. SWANSON.

30	105
35	110
40	115
45	120
50	125
55	130
60	135
65	140
70	145
75	150

CERTIFICATE OF CORRECTION.

Patent No. 1,971,290.

August 21, 1934.

JOHN HERBERT ABRAMSON, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, lines 22 and 23, claim 18, strike out the words "throughout two diagonally opposed sides of the frame"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 25th day of September, A. D. 1934.

Leslie Frazer

Acting Commissioner of Patents.

(Seal)