UNITED STATES PATENT OFFICE

2,554,028

TYPEWRITER RIBBON FEED MECHANISM

William F. Helmond, Clinton, Conn., assignor to Underwood Corporation, New York, N. Y., a corporation of Delaware

Application December 11, 1948, Serial No. 64,749

8 Claims. (Cl. 197—151)

1. This invention relates to transfer-ribbon feeding and mounting mechanisms for typewriting machines, and particularly to the kind providing for uniform advances of a great-length ribbon past a printing point incidental to every typing impression made.

In typewriting machines of conventional structure the transfer ribbon is fed by impartation of uniform increments of turns to one or another ribbon spool, but due to the varying amount of ribbon wound on the spools, the actual feed imparted to the ribbon varies greatly.

Such conventional ribbon mechanisms provide for repeat use of the ribbon by repeated reversal of the ribbon feed, and are quite satisfactory for conventional letter writing. However, for imprints of distinct sharpness and of uniform deposit of pigment, it is desirable to use ribbons which are designed to give only one, and in some instances two impressions, off the same ribbon area. For economy of consumption of such ribbons, they must be subjected to the same use for every portion thereof, and this calls for uniform linear feed of the ribbon. Sharpness and uniformity of writing which such ribbons will furnish is highly desirable for quality letter writing, and particularly in the preparation of master sheets for photo-offset or direct-offset duplicating processes. To satisfy the special requirement stated and for a least frequent change of ribbon, this calls for ribbons of great length and for large ribbon reels therefor. Moreover, to avoid wastage of ribbon in between typings impressions, the feed of the ribbon must be uniform and precise at each typing stroke.

Machines for the noted purposes are known in the art and usually employ paper ribbon with an appropriate pigment coating or color on one side for the particular type of work to be done.

It is an object of the present invention to provide a machine for the special requirement stated which is simple in structure, as well as efficient and reliable in operation.

It is another object of the invention to provide in a novel and efficient organization in the same machine, a ribbon mechanism of the conventional type, as well as a ribbon mechanism for the special uses stated, either of the two mechanisms being employable by the operator.

The invention has been worked out in connection with a standard Underwood typewriter.

Referring now to the drawings:

Figure 1 is a left-hand sectional side elevation of an Underwood typewriting machine embodying the invention, the section generally being through the center of the machine except with reference to some parts of the ribbon feeding mechanism.

Figure 2 is an enlargement of a ribbon reel supporting stub shaft and its mounting also shown in Figure 6.

Figure 3 is a plan view showing the ribbon mounting and feeding means of the invention.

Figure 4 shows in plan elevation two conventional ribbon spools and the disposition of a conventional typewriter ribbon in the machine.

Figure 5 is an enlarged end view of a ribbon reel mounting flange, and finally.

Figure 6 is a sectional front elevation depicting the ribbon mounting and feeding means shown in Figure 3.

Directing now particular attention to Figure 1, a main frame 10 of a typewriter is shown to support a track-way 11 for a paper-supporting carriage 12 embodying a platen roller 13 and a front bar 16 having rollers 16a riding in the track-way 11. A complement of type bars 14 are pivotally carried upon a usual segment 15 for individual printing movement against the front side of the platen. Said type bars 14 are selectively operable by operation of type keys carried on levers 17. Links 16 connect the levers 17 to sub-levers 19, and wire links 20 connect the upper ends of the sub-levers 19 to rearwardly and downwardly extending arms of the type bars 14. Incidental to each operation of a key lever 17, its associated type bar 14 swings against the platen, and during a later part of the swinging motion, a heel 21 on the type bar operates a usual curved universal bar 23 having capacity for rearward displacement with respect to the segment 15. The motion given the universal bar 23 is transmitted to a rocker frame 24 by means of a link 25, the rocker frame having a pivot axis at 26 in the framework of the machine, and having below said axis a forwardly reaching arm 27 for actuation of a ribbon feeding drive to be described later. Said rocker 24 and its connected universal bar 23 occupy their normal positions seen in Figure 1 under the influence of a spring 28. In a usual manner, not shown, the rocker 24 is associated with a usual escapement mechanism for the carriage 12, to cause a letter-feed movement of the latter to take place at each actuation of the universal bar 23.

The type bar segment 15 has projecting upwardly therefrom a type guide 30 which gives vertical guiding support to the upper end of a ribbon vibrator 31, in a usual manner, said vibrator reaching upwardly from an arm 32 which in-
2,554,028

3 incidental to each typing stroke imparts an upward vibratory motion thereto temporarily to present a ribbon at the typing point. Inasmuch as the actuating mechanism for the arm 32 is of conventional design, it is not shown. The machine of the invention embodies a mechanism for supporting and feeding a repeat-use typewriter ribbon 33 shown in Figure 4, such repeat-use ribbon consisting of a strip of fabric supported with color matter.

For certain classes of work, as stated hereinbefore, the conventional repeat-use typewriter ribbon is unsuitable in that imprints obtained therefrom are not sufficiently sharp and give insufficiently controlled color deposit, and in such cases, special, such as one-time-use ribbons, are employed. Ribbons intended for one-time use necessarily must be of great length if they are not to be replaced frequently. This calls for ribbon reels of much greater diameter than ordinary ribbon spools 31, such as designated in Figures 1, 3 and 6 by the reference numeral 35. The term “ reel” is used herein throughout to designate the relatively larger spools or reels 36 for the special type ribbon 34, and the term “spool” is used for the spools 37 which are relatively small.

The mechanism for supporting and feeding the conventional ribbon 33 will be described first.

Referring to Figures 3, 4 and 6, there is mounted in usual brackets 38, to each side of the ribbon vibrator 31, in front of the platen 43, a vertical ribbon-spool-supporting and driving shaft 40, each shaft 40 having an end reaching upwardly into a spool-accommodating cup 41. Diagonally to each side of the ribbon vibrator, slightly to the rear of the front bar 45 of the carriage, each cup 41 carries on an ear projecting from the floor 42 of the cup a stud 43 having a ribbon guiding roll 44. When the conventional ribbon 33 is in use, as depicted in Figure 4, it extends from the ribbon vibrator 31 to each side diagonally forward around the front side of the rolls 44 and onto the respective ribbon spools 31, such spools being adapted to be placed in said cups 41, upon the shafts 40. Pins 45 projecting from flanges 47 on the shafts 40 and engaging in perforations in the spools 37 cause the latter to rotate unitarily with the shafts 40.

For driving either of the spool shafts 40, there is turnably supported therebelow in downreaching brackets 48 of the brackets 38 a transverse shaft 31. Said shaft 31 carries two spaced bevel gears 52, each such gear being provided for driving a bevel gear 53 of one of the two shafts 40. The shaft 31 is not only turnable in said bracket branches 48, but is placeable laterally in two positions to select one or the other bevel gear 52 for driving association with the gear 53 on the related ribbon spool shaft 40. A detent device 55 comprising a spring-pressed, pointed plunger 56, cooperating with an annular ridge member 57 on the shaft 31, holds the shaft 31 resiliently in either of the said two lateral positions for establishing bevel gear drive connections with either ribbon spool shaft 40. The detent device 55 is rigidly supported on the bracket 38, as shown. Near the right side of the machine the transverse shaft 31 carries fast thereon a ratchet wheel 58, see Figures 1 and 6.

Said ratchet wheel 58, see particularly Figure 1, has associated therewith a driving pawl 60 carried on an arm 61 that is fast on the right end of a rock shaft 62. The latter is rockably supported in the machine and extends outwardly from the middle thereof, whereat an arm 63 extends rearwardly and upwardly and has a pin-in-fork connection at 64 with the aforementioned arm 21 which is actuated at each typing stroke. It follows, therefore, that incidental to each actuation of a type bar 14 the pawl 60 will ratchet idly down along the toothed periphery of the wheel 58 and that a feeding motion will be imparted to the wheel 58 during the return stroke of the type bar when the universal bar operable rocker 24 is being restored to normal position under the power of the spring 28. Reverse rotation of the wheel 58 and its shaft 61 is prevented by a check pawl 65 which has pivotal support on the shaft 61. The feeding pawl 60 and the check pawl 65 are resiliently maintained in engagement with the ratchet wheel 58 by a spring 66 extending therebetween.

The structure hereinabove described for feeding the ribbon spool shafts 40 is conventional in Underwood standard typewriters. Such machines also include provision to shift automatically the transverse shaft 51 axially to mesh the gears 52, 53 with respect to either spool shaft 40, this providing for a change in the direction of ribbon feed for use of the ribbon over and over again. This provision to reverse automatically the ribbon feed is only illustrated in part, and includes, see Figures 3 and 6, pivoted on the underside of each ribbon spool cup 41, a ribbon reverse instituting arm 51, and an upreaching fork formation 53 wherethrough the ribbon 53 passes as typing impressions are made. The ribbon 33 includes, near each opposite end, close to each spool core, a control lug, not shown, which as the ribbon becomes exhausted from one spool or the other will swing the related ribbon reversing arm 57 rearwardly. In a manner, not shown, but including usual wheel elements 71 supported in a manner, with the spool body 69 projecting inwardly from typewriter side walls 70.

When the work requires the use of a special ribbon, such as for production of a reduplicate master sheet, or the production of an exceptionally neat, sharp and uniformly typed letter, the ribbon 33 with its spools 31 is removed from the machine, and a one-time-use ribbon of desired characteristic, designated in the drawings by the numeral 34, is placed in the machine.

The supporting and feeding structure for such special ribbon 34 will now be described.

The machine has means at the right hand side thereof for supporting a ribbon reel 35 to supply ribbon upwardly over a diagonal guide 73 which serves to redirect the ribbon into a horizontal plane leftwardly. Said supporting means comprises a rectangular bracket 74 having a vertical portion 75 giving support to a ball bearing 76 for an outwardly reaching short shaft 77, see also Figure 2, a reel 36 for supplying the ribbon 34 being adapted to be placed onto this shaft. Said shaft 77 includes an enlarged hexagon portion 78, wherebetween and a nut 81, inner raceways 82 of the ball bearing 76 are to be clamped. The ball bearing 76 assures substantially frictionless turning of the spool 35, thus assuring a minimum of drag on the ribbon. The rectangular bracket 74 includes a horizontal member 83 reaching inwardly through the adja-
cent side wall 70 of the machine for attachment to the frame flange 66 along with the bracket 38. The vertical portion 75 of the bracket 74 is extended by provision at its lower end of a bracing screw 83 extending therethrough and bearing against the adjacent side wall 70 of the machine. The diagonal guide 73 is part of a bracket 85 which affords support for a ribbed spool guide stud 86 for the ribbon guiding roll 87 situated at the left end of the diagonal guide 73, see Figures 3 and 6. From said guide roll 81 the ribbon 34 is led across the ribbon spool cup 41, through the space otherwise occupied by a spool 37, in a diagonal direction forwardly, said cup having a clearance cut 82 for the ribbon near the guide roller 87 and having another clearance cut 89 adjacent the guide roller 44. Intermediate the guide rollers 44 the ribbon 34 is threaded through the ribbon vibrate roller 31 to take the same course as the conventional ribbon 35. The ribbon 34 is led across the left ribbon spool cup 41 diagonally leftwardly and rearwardly through clearance cuts 89 and 88, the same as provided in cup 41 at the right side of the machine.

A device embodying a large rubber-covered feed roll 90 and another large ribbon drive shaft 51 and said small roll 9 is carried eccentrically fastened thereto, as by rivets 102, a knob 105. The knob 105 has a reduced, threadaxit portion 106 extending through a central portion in the flange 103, whereby, together with the flange 103 it is adapted to be screwed into a central thread cavity 107 provided in the hub 101 of the other flange 100. The ribbon is furnished rolled up on a large-diameter core 108 of lightweight, preferably molded material, the latter fitting over the hub 101, and said hub and core oppositely formed therein a keyway and a key, not shown. From the above it follows that by separation of the two reel flanges 101, 103, old or exhausted rolls of ribbon can be easily replaced by new ribbon rolls.

To retain the reels 36 on their respective shafts 51 and 71 on the two sides of the machine, both shafts are circumferentially notched at 115, see Figures 2 and 6, and the reels 36 are each provided with a locking arm 109 pivotally carried by a stud 110 in concentric reces111. Said locking arm 109 is slightly bowed outwardly so that the head of the stud 110 causes it to bear resiliently against the flat face of the recess 111. Thus the arm 109 when moved into the shaft notch 115, will stay to retain the reel 36. Said locking arm 109 has a finger piece 117 extending outwardly of the recess 111, for convenience of manipulation. A ribbon reel 36 placed and latched upon the shaft 51 at the left-hand side of the machine is adapted to be driven by the shaft 51 through the medium of a slip drive at the place it is paid off at intervals by the rolls 90, 91, in a manner to be described later.

The feed roll 90 is carried fast on the upper end of a vertical shaft 93 having at its lower end a crown gear 94 in constant mesh with a spur gear 95, the latter being fast on the ribbon-feed drive shaft 51 and of sufficient width for the crown gear to remain in mesh therewith in either lateral position of the shaft 51. The small roll 91 includes a bottom flange and a top flange, both numbered 96, which serve to maintain the ribbon at the precise level of the ribbon guide 44 that also the ribbon guide rollers 44 and 37 have flanges for this purpose. Said small roll 91 is carried on a vertical stud 97 provided upon an arm 98 which under the influence of a spring 99 causes the ribbon to be pinched between the rolls 90, 91 for feed thereby at each typing operation. At each increment of turn imparted to the shaft 51, the feed roll shaft 33, as viewed in Figure 3, receives a clockwise increment of turning motion, resulting in a definite increment of feed for the ribbon 34 in a leftward direction. The magnitude of such feed is uniform at each typing stroke, and is predeterminated by the feeding throw imparted to the pawl 80 each time a type bar 14 recedes from the platen. In machines wherein reduplicate master sheets are to be prepared, the throw of the pawl 65 is preferably of a magnitude to cause the ribbon to be fed a distance equivalent to the width of the typed letters. If a machine is not to be used for reduplicate master sheets, but for high-class, sharply typed work or correspondence, the feed of the pawl 59 may be proportioned to impart to the ribbon a lesser feed, such as corresponds to a half letter-feed advance of the carriage.

Each of said reels 36 comprises a large-diameter flange 100 having a cylindrical hub 101 concentrically fastened thereto, as by rivets 102. Each reel 36 further comprises another large-diameter flange 103 carrying concentrically fastened thereon, as by rivets 104, a knob 105. The knob 105 has a reduced, threaded portion 106 extending through a central portion in the flange 103, whereby, together with the flange 103 it is adapted to be screwed into a central thread cavity 107 provided in the hub 101 of the other flange 100. The ribbon is furnished rolled up on a large-diameter core 108 of lightweight, preferably molded material, the latter fitting over the hub 101, and said hub and core oppositely formed therein a keyway and a key, not shown. From the above it follows that by separation of the two reel flanges 101, 103, old or exhausted rolls of ribbon can be easily replaced by new ribbon rolls.
2,554,028

7 stud 136 carried on the bracket leg 135 serves to direct the ribbon in an appropriate path downwardly from the diagonal guide 32 to the reel 36 as shown below.

The two reels 36 are accommodated in protective, cup-shaped housings 140, the housing on the left side of the machine being united with the brackets 133 and 134 respectively as at 141 and 142. The cup housing 140 at the right side of the machine 38 is similarly united with the brackets 15 and 85. Said housings are provided with passageways 143 for the ribbon to extend outwardly thereof. To conceal the supporting structures for the cup housings 140, the latter have each attached thereto a flat inner wall 139 on one side thereof, a front and a rear wall respectively numbered 144 and 145.

To keep the ribbon 34 properly positioned on the diagonal guides 73, 92, the latter have each hinged thereon a ribbon retaining member 149, see Figure 6, it being understood that when these members 145 are swung away from the guides, they permit the threading of the ribbon conveniently over the latter.

In the conventional Underwood typewriter the arm 61 for the ribbon feed pawl 60 receives a feeding stroke at each typing and at each word-spacing operation. However, it is desired to feed the ribbon only in response to typing impressions. To the end of suppressing a feeding operation of the pawl 60 incidental to word-spacing operation, the usual space bar 141, through its supporting bar 146, operates a bell crank 148, pivoted at 150. This is in order that an arm 151 of the bell crank 148 will throw the feeding pawl 60 temporarily off the ratchet wheel 55. The bar 146b has bent ends 146a by which it is pivotally carried, as at 152, in the opposite side walls 70 of the machine 38. The bell crank 148 is restored by a spring 153 after each operation of the space bar 141, it being noted that the pawl 60 is uninfluenced by the arm 151 during typing operations.

The ribbon 34 is preferably wide enough to give two tracks of use, one above the other, and to this end the mechanism for operating the ribbon vibrator 31 is conditionable to vibrate the ribbon for use of either an upper or lower track. The mechanism and control for conditioning the ribbon vibrating mechanism for use of either track is conventional in structure, and not shown.

One track of the ribbon is used first, and when the ribbon is exhausted from the reel 36 at the right-hand side of the machine it is removed. The reel 36 which has been on the left side of the machine is then removed with its trailing ribbon and substituted for the reel which has been on the right side of the machine. The reel holding the empty core 108 which has been removed from the right side is then placed on the left side of the machine. The ribbon is thereafter threaded appropriately from the full reel leftwardly over the various guides and finally downwardly over the diagonal guide 92 onto the empty reel core 108, whereof it is attached by a piece of adhesive tape or the like. The ribbon vibrator mechanism is then appropriately conditioned for use of the second printing track of the ribbon.

Obviously a narrow, single track ribbon may be used by provision of narrower reels. Inasmuch as a single track ribbon needs no rewinding after its use, the reel 36 at the left-hand side of the machine may be omitted entirely in such machine.

Variations may be resorted to within the scope of the invention, and portions of improvements may be used without others.

What is claimed is:

1. In a typewriting machine having a frame and having a carriage-carried platen; a supporting and feeding mechanism on the frame for a transfer ribbon, comprising, a ribbon vibrator at a printing point, a ribbon feed-roll turnable on a substantially vertical axis, and situated substantially at the level of the printing point, to one side of the ribbon vibrator, a roll associated for ribbon feeding contact with said first roll, means to turn at least one of said rolls a definite increment of a turn at each typing stroke, thereby to impart uniform feeding movements to the ribbon, means at each side of the machine for mounting on a horizontal axis a ribbon reel, a diagonal direction-changing guide for the ribbon directly above each reel mounting means, substantially at the level of said rolls and said vibrator, the ribbon intermediate said diagonal guides being adapted to be threaded through said vibrator and fed by said rolls, and a slip-drive associated with one of the mounting means to drive one reel positively at each typing stroke and thereby to wind whatever ribbon is paid off by said rolls incidental to each feeding action thereof.

2. In a typewriting machine having a frame and a platen; a supporting and feeding mechanism on the frame for a transfer ribbon, comprising, a ribbon reel mounting means at each lateral end of the machine, and means to guide the ribbon from the reel on one to the reel on the other mounting means, including a ribbon vibrator in front of the platen, a ribbon guide to each side diagonally in front of said vibrator, and another ribbon guide farther to the side of each of said first guides and diagonally to the rear thereof, said guides and said vibrator providing for the guidance of the ribbon laterally across the machine in front of the platen in a zig-zag course.

3. In a typewriting machine having a frame and a platen; a ribbon reel mounting means at each lateral end of the frame, and means to guide and feed the ribbon from the reel on one to the reel on the other mounting means, including a ribbon vibrator in front of the platen, a ribbon guide to each side diagonally in front of said vibrator, a ribbon guide farther to the side of one of said first guides, a pair of feed-rolls to the side of the other one of said first guides to guide, grip and feed the ribbon, and means to turn said first rolls a definite increment of a turn at each typing stroke, thereby to impart uniform feeding movements to the ribbon, said guides, said feed-rolls and said vibrator providing for the guidance of the ribbon in front of the platen across the machine in a zig-zag course.

4. In a typewriting machine having a frame and a platen; a ribbon reel mounting means at each lateral end of the frame, and means to guide and feed the ribbon from the reel on one to the reel on the other mounting means, including a ribbon vibrator in front of the platen, a ribbon guide to each side diagonally in front of said vibrator, a ribbon guide farther to the side of one of said first guides, a pair of feed-rolls to the side of the other one of said first guides to guide, grip and feed the ribbon, and means to turn said first rolls a definite increment of a turn at each typing stroke, thereby to impart uniform feeding
2,554,028

movements to the ribbon, said guides, said feed-rolls and said vibrator providing for the guidance of the ribbon in front of the platen across the machine in a zig-zag course, and a slip-drive associated with one of the mounting means to turn one of the reels impotomstly at each typing stroke and thereby to wind whatever ribbon is payed off by said rolls incidentally to the feeding action thereof.

5. In a typewriting machine having a frame and a platen, ribbon-vibrator means in front of the platen at a printing point, spool-mounting means diagonally to each side in front of said vibrator means to receive a spool for a relatively short transfer ribbon, a ribbon guide neighboring closely each one of the spool-mounting means between the spaces for said spools, for training said ribbon to take a constant course between said guide and said vibrator, the ribbon extending from each spool around the front of the neighboring guide at an angle, means to impart ribbon feeding movements to one or the other of said spools, means to mount a ribbon reel at each side of the machine for a relatively long ribbon, said latter ribbon being adapted to be threaded to extend to each side of the said vibrator means around the front of the same said ribbon guides which are adapted to serve also the short ribbon, and across the spaces for said spools onto said reels, and a device at one side of the machine between one of said spool-mounting means and one of said reels to feed said long ribbon a definite increment at each typing action of the machine.

6. In a typewriting machine having a frame and a platen, ribbon-vibrator means in front of the platen at a printing point, spool-mounting means diagonally to each side in front of said vibrator means to receive a spool for a relatively short transfer ribbon, a ribbon guide neighboring closely each one of the spool-mounting means between the spaces for said spools, for training said ribbon to take a constant course between said guides via said vibrator, the ribbon extending from each spool around the front of the neighboring guide at an angle, means to impart ribbon feeding movements to one or the other of said spools, means to mount a ribbon reel to turn on a transverse axis at each side of the machine for supplying and receiving a relatively long ribbon, said latter ribbon being adapted to be threaded to extend to each side of the said vibrator means around the front of the same ribbon guides which are adapted to serve also the short ribbon, and across the spaces for said spools, a diagonal guide above each ribbon reel substantially at the level at which the spools are received, to give said long ribbon a direction in the plane of the reels at each side of the machine laterally of said spools, and a device at one side of the machine between one of said spool-mounting means and one of said reels to feed said long ribbon a definite increment at each typing action of the machine.

7. In a typewriting machine having a frame and a platen, the combination with a ribbon vibrator at the front side of the platen, a substantially vertical ribbon-spool supporting and driving shaft diagonally to each side in front of said vibrator, a shaft extending transversely of the machine below said spool supporting shafts, means to turn said transverse shaft incidental to each typing impression a definite increment of a turn, and means to render either of said spool shafts operatively connected with said transverse shaft for ribbon winding action, ribbon from spools placed on said supporting shafts being adapted to be fed from either spool to the other, of means to mount at one side of the machine, co-axially with said transverse shaft, a large-diameter ribbon reel for receiving ribbon supplied across the machine from the opposite side, a feed-roll shaft in geared association with said transverse shaft and mounted to extend upwardly therefrom intermediate said ribbon reel and the vertical spool shaft on the same side of the vibrator, a feed-roll on the upper end of said feed-roll shaft, a spring-pressed roll associated with said feed-roll for ribbon feeding coaction therewith, a diagonal guide to lead the ribbon payed off by the rolls downwardly to the said reel, and slip-drive means for said reel, actuated by said transverse shaft, for winding whatever ribbon is payed off by said rolls.

8. In a typewriting machine having a frame and having a platen, the combination with a ribbon vibrator at the front side of the platen, a substantially vertical ribbon-spool supporting and driving shaft diagonally to each side in front of said vibrator, a shaft extending transversely of the machine below said spool supporting shafts, means to turn said transverse shaft incidental to each typing impression a definite increment of a turn, and means to render either of said spool shafts operatively connected with said transverse shaft for ribbon winding action, transfer ribbon from spools placed on said supporting shafts being adapted to be fed from either spool to the other, of means to mount at one side of the machine, to mount, and drive impotomstly, on said transverse shaft, a large-diameter ribbon reel for receiving and winding a long ribbon supplied across the machine from the opposite side, a feed-roll shaft in geared association with said transverse shaft and mounted to extend upwardly therefrom intermediate said ribbon reel and the vertical spool shaft on the same side of the vibrator, a feed-roll on the upper end of said feed-roll shaft, a spring-pressed roll associated with said feed-roll for ribbon feeding coaction therewith, and a diagonal guide to lead the ribbon payed off by the rolls, downwardly to the said reel, the impotomst means for driving said reel providing for the winding of whatever ribbon is payed off by the said rolls.

WILLIAM F. HELMOND.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>952,281</td>
<td>Secor</td>
<td>Mar. 15, 1910</td>
</tr>
<tr>
<td>2,127,812</td>
<td>Gabrielson</td>
<td>Aug. 23, 1938</td>
</tr>
</tbody>
</table>