

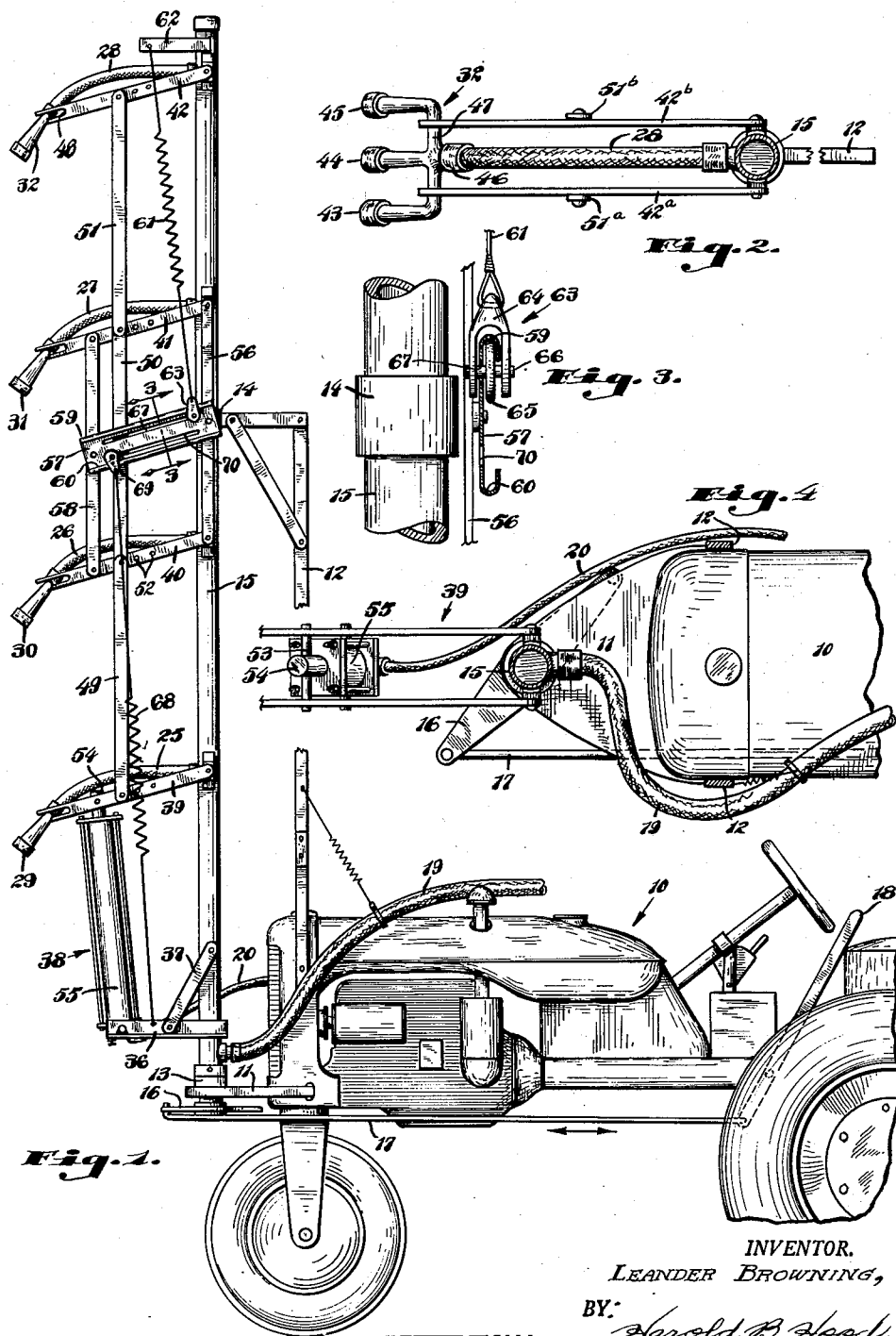
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L. BROWNING
SPRAY BOOM DEVICE

2,574,206

Filed July 16, 1947

2 SHEETS—SHEET 1



INVENTOR.
LEANDER BROWNING,
BY: *Harold B. Hood.*
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2 SHEETS—SHEET 2

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UNITED STATES PATENT OFFICE

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SPRAY BOOM DEVICE

Leander Browning, Greenwood, Ind.

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The present invention relates to spray boom devices, and the primary object is to provide a mechanism which, when mounted upon a suitable vehicle, can be moved through an orchard, or the like, to spray the trees, from top to bottom, with suitable fluent material. It is customary to use relatively high pressures, to dispense the fluent material through flexible hoses provided with nozzles. Control of the hoses, against the writhing tendencies produced by the fluent material under high pressure, is therefore difficult; and a major object of the present invention is to provide automatic means for moving the spray heads or nozzles through suitable arcs in a substantially vertical plane, while controlling the tendency of the hoses to writhe or whip. A further object of the invention is to provide fluid operated means for so controlling the spray heads, such means being of such character as automatically to move the spray heads continuously through a predetermined arc.

A further object of the invention is to provide means for assisting in the equalization of volume and pressure deliveries to a plurality of spray heads connected, at vertically spaced points, through a common hollow mast. A further object of the invention is to provide a novel fluid motor and novel valving means therefor. A still further object of the invention is to provide novel means for assisting the operation of the fluid motor in the control of the spray heads.

Still further objects of the invention will appear as the description proceeds.

To the accomplishment of the above and related objects, my invention may be embodied in the form illustrated in the accompanying drawings, attention being called to the fact, however, that the drawings are illustrative only, and that change may be made in the specific construction illustrated and described, so long as the scope of the appended claims is not violated.

Fig. 1 is a more or less diagrammatic side elevation of a spray boom device constructed in accordance with my invention;

Fig. 2 is an enlarged fragmental plan of a portion thereof;

Fig. 3 is a transverse section taken substantially on the line 3—3 of Fig. 1, and drawn to an enlarged scale;

Fig. 4 is a fragmental horizontal section taken substantially at the level of the top of the fluid motor;

Fig. 5 is an enlarged longitudinal section through the mast of the present invention, specifically illustrating my means for equalizing pressures and volume deliveries;

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Fig. 6 is an enlarged vertical section through the fluid motor forming a part of the present invention;

Fig. 7 is a similar section of the lower portion of the motor, taken upon a plane 90° removed from the plane of Fig. 6;

Fig. 8 is a transverse section, upon a further enlarged scale, taken on the line 8—8 of Fig. 6;

Fig. 9 is a similar section upon the line 9—9 of Fig. 7; and

Fig. 10 is a similar section upon the line 10—10 of Fig. 6.

Referring more particularly to the drawings, it will be seen that I have illustrated a portion of a conventional automotive vehicle, indicated generally by the reference numeral 10. While I prefer to mount the present device upon such a vehicle, it may obviously be mounted in any other suitable fashion. A bracket 11 projects forwardly from the front end of the vehicle, and a vertical brace 12 cooperates with said bracket in the support of a hollow mast 15 which is mounted for oscillation about its own axis in bearings 13, on the bracket 11, and 14, on the bracket 12. A radial arm 16 is connected to the mast and a suitable linkage 17 provides an operative connection between said arm 16 and a lever 18 mounted adjacent the vehicle operator's seat, so that the operator may conveniently oscillate the mast 15 about its own axis, during transit of the vehicle. Preferably, the arm 16 will be double-ended, as illustrated in Fig. 4.

A hose 19 extends from a source of material to be distributed (not shown) and a second hose 20 extends from a source of air under pressure.

The hose 19 is suitably connected to an inlet port 21 (see Fig. 5) adjacent the base of the mast and communicating with the interior 22 thereof; and the mast is provided with a plurality of outlet ports 23, vertically spaced from each other and opening radially from the mast in a line 180° removed from the inlet port 21. The uppermost of the outlet ports is indicated by the reference numeral 24. Flexible hoses 25, 26 and 27 are connected to the respective outlet ports 23, and a similar hose 28 is connected to the outlet port 24. Obviously, as many outlet ports as may be desired, will be provided.

Spray heads 29, 30, 31 and 32 are connected to the respective hoses. I prefer to install within the mast 15 a supplemental conduit 33 having an inlet port 34 adjacent its base and an outlet port 35 adjacent its upper end. The port 34 registers with the mast inlet port 21 and the port 35 registers with the uppermost outlet port

24. The outside diameter of the conduit 33 is considerably less than the inside diameter of the mast 15, so that fluent material may circulate freely within the mast and past the conduit 33; yet a substantial quantity of such fluid, supplied to the mast at pressures on the order of six hundred pounds per square inch, will enter the conduit 33 through the port 34 and will be discharged therefrom through the port 35. I have found that this arrangement very materially improves the delivery of fluid from the uppermost outlet port 24. In some instances, it may be desirable to provide two or more outlet ports for the conduit 33, respectively registering with the two or more mast outlet ports nearest the top of the mast. The inclination of the conduit 33 within the mast 15, as illustrated in Fig. 5, minimizes the interference of said conduit with flow of fluent material to the lower outlet ports 23.

Fixed to the mast 15 adjacent the base thereof is a forwardly projecting bracket 36 supported by a suitable brace 37. A fluid motor 38 has one element pivotally anchored to the bracket 36. At points substantially coincident with the elevations of the outlet ports 23 and 24, lever pairs 39, 40, 41 and 42 are pivotally secured to the mast 15. Throughout the claims, and to some extent in the specification, such a lever pair will be referred to as a lever; but preferably each such unit will be of the general character of the unit 42, illustrated in plan in Fig. 2. It will be seen that the unit 42 comprises a lever 42a and a lever 42b, pivoted upon a common axis transverse to the axis of the mast 15. Similarly, each spray head or nozzle will preferably be of the character illustrated at 32 in Fig. 2, comprising three or more discharge spouts 43, 44 and 45, connected to a common header 47 fed by a single inlet 46. The levers 42a and 42b are preferably bifurcated at their outer ends, as at 48, to engage the header 47, whereby the spray head 32 is supported for movement with, and with respect to, the lever 42.

Links 49 connect the levers 39 and 40, links 50 connect the levers 40 and 41, and links 51 connect the levers 41 and 42. Preferably, each such link will be double, comprising two elements such as 51a and 51b, respectively connected to the a and b elements of the lever units, in the manner illustrated in Fig. 2. Thus, all of the levers will swing synchronously. It will be clear that, as they move upwardly from the positions illustrated in Fig. 1, the hoses 25, 26, 27 and 28 will be straightened more and more, until the levers come into horizontal positions, whereafter further movement of the levers in the same direction will flex the hoses upwardly.

Preferably, but not necessarily, each of the levers is formed with a plurality of longitudinally spaced perforations, such as 52, whereby the connecting links may be secured thereto at varying distances from the pivotal anchorages of the levers. Optionally, the links may be connected to the respective levers at different spacings from the mast, so that the respective levers will move through different arcs.

The lever 39 is provided with a cross bar 53 to which may be connected the plunger or stem 54 of the motor 38. As shown, the cross bar 53 passes through a transverse opening in the stem 54. If, now, the cylinder 55 of the motor 38 is anchored upon the bracket 36, it will be

seen that operation of the motor will oscillate the levers 39, 40, 41 and 42.

At a suitable point in the height of the mast an upright 56 is secured to the mast and provides a pivotal anchorage for a lever 57, the outer end of said lever being connected mid-point to a link 58 whose opposite ends are connected to the levers 40 and 41 respectively. The lever 57 is formed to provide two trackways 59 and 60 extending longitudinally thereof. A coiled spring 61 has one end anchored upon a stationary bracket 62 at the upper end of the mast 15, and has its other end anchored to a slide 63 which may preferably comprise a housing 64 carrying a roller 65 mounted upon an axle 66 which projects through a slot 67 in the lever 57, the housing 64 straddling said lever. A second coiled spring 68 has one end anchored upon the bracket 36 and its other end anchored upon a slide 69, substantially identical with the slide 63, and engaged in the guideway 60 in a similar manner, the axle for the roller of the slide 69 extending through a slot 70 in the lever 57.

The motor 38 is illustrated in detail on sheet 2 of the drawings. The ends of the cylinder 55 are closed by blocks 71 and 72, held in place by closure plates 73 and 74 connected by tie rods 75. Reciprocally mounted in the cylinder 55 is a piston 76 rigidly connected to the stem 54, and abutting a heavy coiled spring 77 confined between said piston and the block 71, and continuously urging the piston 76 toward the block 72. The block 72 is formed with an inlet port 78 guarded by a reciprocating valve 79 which is positioned to move in a line parallel with the axis of the cylinder 55, and which is resiliently urged toward closing relation to the port 78 by a coiled spring 80. Said valve is provided with an actuating stem 81 projecting into the cylinder 55. The block 72 is further formed with an outlet port 82 with which cooperates a manually adjustable needle valve 83, and which is primarily controlled by an outlet valve 84 mounted for reciprocation in a line substantially parallel to the axis of the cylinder 55.

A guard tube 85 is associated with the valve 79 and its port and projects toward the opposite end of the cylinder; and a similar tube 86 is similarly associated with the outlet port 82.

Reciprocally mounted in the cylinder 55, between the piston 76 and the ports 78 and 82, is a spider-like carriage 87. Fixed to said carriage and movable therewith is a plunger 88 having guiding engagement in the tube 85, and having a reduced valve-actuating extension 89 which extends into cooperative relation with the stem 81 of the valve 79. A spring 90 surrounds the projection 89 within the tube 85 and is confined between the plunger 88 and a fixed abutment 91 within the tube 85.

The carriage 87 similarly supports a second plunger 92 having guiding engagement in the tube 86 and having a reduced extension 93 which, within the tube 86, carries at its lower end a coupling element 94 in which is engaged the stem 95 of the outlet valve 84. Said stem is formed with an elongated slot 96 in which engages a pin 97 carried by the coupler 94; and a coiled spring 98 surrounds the valve stem 95 and is confined between the valve 84 and the coupling 94. It will be obvious that this arrangement holds the valve 84 resiliently in its position most remote from

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the couplind 94, but permits some telescoping of the stem 95 relative to the coupling 94.

A latch lever 99 is pivotally mounted at its lower end upon the block 72, as at 100, and projects into cooperative relation with the carriage 87. A leaf spring 101 carried on said latch lever engages the wall of the cylinder 55 and continuously urges the upper end of said lever to swing inwardly. Near its upper end, the lever is formed with a notch 102, and said lever is movably projected through a suitable slot 103 formed in the carriage 87. When said carriage is in registry with the notch 102, the spring 101 urges the lever into a position such as to engage the carriage within said notch to hold the carriage against downward movement, as is clearly illustrated in Fig. 7. At a point beyond the notch 102, the lever is provided with an inwardly projecting cam finger 104, for a reason which will appear hereinafter.

A second latch lever 105 is similarly pivotally mounted at 106, upon the block 72, at a point preferably 180° removed from the pivotal mounting 100. A leaf spring 107 is carried by said lever 105 to engage the wall of the cylinder 55 to urge said lever continuously inwardly. Near its upper end, the lever 105 is formed with a notch 108 for engagement with the carriage 87, when said carriage is in registry with said notch, to hold said carriage against upward movement. The lever projects through, and is movable in, a suitable slot 109 formed in the carriage 87.

Depending from the piston 76 and projecting through the carriage 87 so that one portion thereof is located between the piston 76 and the carriage 87 and another portion thereof is located between the carriage 87 and the valves 79 and 84, is a stem 110, fixed to the piston for movement therewith. Upon the first mentioned portion of said stem is secured a release cam 111 for cooperation with the cam finger 104. Fixed to the nose of the cam 111 and projecting therebeyond, is a coiled spring 112. At the lower end of the stem 110 is carried an upwardly facing cam 113 for cooperation with the cam finger 115 on the lever 105, and a coiled spring 114 projects beyond the nose of the cam 113.

The operation of the motor 38 is as follows: In the illustrated positions of the parts, the piston 76 is moving downwardly under the influence of the spring 77. The rate of movement thereof, of course, will depend upon the setting of the needle valve 83, which controls the rate of escape of air from the interior of the cylinder 55. As the piston moves downwardly, the spring 112 will engage, and be compressed against, the upper surface of the carriage 87; and after such compression has been accomplished, the cam 111 will strike the cam finger 104 to shift the lever 99, against the tendency of the spring 101, in a clockwise direction as viewed in Fig. 7. Thereby, the notch 102 will be disengaged from the carriage, and the carriage will be smartly moved downwardly under the influence of the expanding spring 112.

Such downward movement of the carriage 87 will shift the valve 84 into closing relation with its seat, to stop flow of air from the cylinder, and thereby arrest downward movement of the piston 76. At the same time, the rod 89 will strike the stem 81 and shift the valve 79 away from its seat, whereupon air will flow, from the source, through the hose 20 and inlet port 78, to the interior of the cylinder 55.

As the carriage 87 moves downwardly under the

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influence of the spring 112, it comes into registry with the notch 108 in the lever 105; and the spring 107 will move said lever in a clockwise direction, whereby engagement of the notch 108 with the carriage 87 will hold said carriage against upward movement. Thus, as air flows into the cylinder 55, the piston 76 will be moved upwardly against the tendency of the spring 77, but the carriage 87 will be held in its lowermost position, whereby the valve 79 will be held open and the valve 84 will be held closed. This condition will continue until the spring 114 engages the lower surface of the carriage 87 and is compressed thereagainst, whereafter the cam 113 will strike the cam finger 115 to shift the lever 105 in a counter-clockwise direction, thereby releasing the carriage 87. The carriage will now move smartly upwardly under the influence of the expanding spring 114, to permit closure of the valve 79 by the spring 80, and to move the valve 84 away from its seat. As the carriage moves upwardly, it comes into registry with the notch 102 in the lever 99, and the spring 101 returns said lever to its illustrated position.

This cycle will be continued for so long as air is supplied to the hose 20.

As the piston 76 moves upwardly, the plunger 54 swings the levers 39, 40, 41 and 42 in their clockwise direction. This movement is assisted by the strong tendency of the high pressure fluid flow through the hoses 25, 26, 27 and 28 to straighten the flexible hoses. Such movement is resisted by the spring 69, whose upper end is anchored to the slide 69 currently positioned near the outer end of the lever 67. As the levers 39, 40, 41 and 42 pass through horizontal positions, their further clockwise movement is rather violently resisted by the flow of material through the hoses, which flow tends to hold said hoses against flexure. But the moment the lever 57 passes the horizontal, the trackway 60 becomes inclined toward the bracket 56 and toward the pivotal mounting of the lever 57, whereupon the slide 69 will almost instantly move to a position closely adjacent the pivotal mounting of said lever. The result of that movement of the slide 69 is almost entirely to remove the tendency of the spring 68 to resist clockwise movement of the lever 57, since the lever arm against which the spring operates has been reduced almost to zero. Concurrently, since the slide 59 is now inclined upwardly and outwardly, the slide 63 moves to the outer end of its guideway, thereby applying the force of the spring 61 against the lever 57 at a substantial radial distance from the pivotal mounting of said lever, and lending the assistance of said spring 61 to the effort of the motor 38 to continue clockwise movement of the lever 57, and so, of the levers 39, 40, 41 and 42.

Obviously, a converse shift will occur, as the lever 57 passes through the horizontal position, during downward movement of the piston and the hose-controlling levers.

I claim as my invention:

1. In combination, a hollow mast, a plurality of nozzles supported upon said mast at separate levels for movement in vertical planes relative to said mast, means for supplying fluent material under pressure to the interior of said mast, each of said nozzles having communication with the interior of said mast, a reciprocating fluid motor supported adjacent said mast and operatively connected to shift said nozzles in said planes, spring means resisting upward movement of said

nozzles, other spring means resisting downward movement of said nozzles, an element supported from said mast to swing in an arc in synchronism with said nozzles, means providing an operative connection between said element and said nozzles, anchorage means connecting each of said spring means with said element, said anchorage means for said respective spring means being independently movable relative to said element toward and away from the center of such arc to vary the resistive effect of said respective spring means upon said nozzles as said nozzles pass through an intermediate position, and means for supplying fluid under pressure to said motor.

2. In combination, a hollow mast, a plurality of nozzles supported upon said mast at separate levels for movement in vertical planes relative to said mast, means for supplying fluent material under pressure to the interior of said mast, each of said nozzles having communication with the interior of said mast, means for shifting said nozzles in said planes, spring means resisting upward movement of said nozzles, other spring means resisting downward movement of said nozzles, an element supported from said mast to swing in an arc in synchronism with said nozzles, means providing an operative connection between said element and said nozzles, and anchorage means connecting each of said spring means with said element, said anchorage means for said respective spring means being independently movable relative to said element toward and away from the center of such arc to vary the resistive effect of said respective spring means upon said nozzles as said nozzles pass through an intermediate position.

3. In combination, a mast, a lever pivotally mounted on said mast for oscillation relative thereto in a plane parallel with the axis of said mast, spring means resisting movement of said lever in one direction, other spring means resisting movement of said lever in the other direction, anchorage means connecting each of said spring means with said lever, said anchorage means for said respective spring means being independently movable relative to said lever toward and away from the pivotal axis thereof to vary the resistive effect of said respective spring means upon said lever as said lever passes through an intermediate position, and means for oscillating said lever.

4. In combination, a mast, a lever pivotally mounted on said mast for oscillation relative thereto in a plane parallel with the axis of said mast and having two longitudinally extending guides thereon, a slide movably associated with one of said guides, a contractile spring having one end anchored near one end of said mast and its other end secured to said slide, a second slide movably associated with the other of said guides, a second contractile spring having one end anchored near the other end of said mast and its other end fixed to said second slide, and means for oscillating said lever.

5. In combination, a conduit, means for supplying liquid under heavy pressure to said conduit, a nozzle, a flexible hose connecting said nozzle with said conduit, and means for oppositely flexing said hose to move said nozzle through an arc comprising a lever pivotally mounted at one end near the point of connection of said hose with said conduit and operatively engaging said nozzle at its other end, power-delivery

means operatively connected to said lever to swing the same through an arc, and supplementary power means operatively connected with said lever and resisting movement of said lever toward its median position in which said hose is straight, but assisting movement of said lever from its median position toward either of its opposite extreme positions in which said hose is flexed, said supplementary means comprising a spring having one end anchored at one side of the lever pivot and a second spring having one end anchored at the other side of said lever pivot, and anchorage means for the opposite ends of said springs, each comprising an element shiftably supported on said lever and independently movable relative to said lever toward and away from said lever pivot.

6. In combination, a conduit, means for supplying liquid under heavy pressure to said conduit, a nozzle, a flexible hose connecting said nozzle with said conduit, and means for oppositely flexing said hose to move said nozzle through an arc comprising a lever pivotally mounted at one end near the point of connection of said hose with said conduit and operatively engaging said nozzle at its other end, power-delivery means operatively connected to said lever to swing the same through an arc, a second lever pivotally mounted upon an axis parallel with the pivotal axis of said first-named lever, linkage means cooperating with said two levers to maintain the same always in substantial parallelism, a longitudinally-extending guide on said second lever, a slide movably associated with said guide, a contractile spring having one end anchored on said slide and its other end anchored at a point spaced from said second lever substantially in the plane of movement of said second lever, a second guide on said lever substantially parallel with said first guide, a second slide movably associated with said second slide, and a second contractile spring having one end anchored on said second slide and its other end anchored at a point oppositely spaced from said second lever substantially in said plane.

7. The combination of claim 6 in which said first-named power-delivery means is a reciprocating fluid motor and in which means is provided for supplying fluid under pressure to said motor.

LEANDER BROWNING.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
963,199	Alden	July 5, 1910
1,468,109	Howard	Sept. 18, 1923
1,534,241	Nichols	Apr. 21, 1925
1,786,963	Schoenberger	Dec. 30, 1930
1,890,623	Scott	Dec. 13, 1932
1,900,837	Mills	Mar. 7, 1933
2,057,364	Bystricky	Oct. 13, 1936
2,086,474	Giell	July 6, 1937
2,237,687	Parsons et al.	Apr. 8, 1941
2,324,947	Paradise	July 20, 1943
2,363,776	Dale	Nov. 28, 1944
2,365,755	Griffith	Dec. 26, 1944
2,366,777	Farley et al.	Jan. 9, 1945
2,392,540	Lyman	Jan. 8, 1946
2,411,964	Grass	Dec. 3, 1946
2,439,356	Arens	Apr. 6, 1948