Aug. 10, 1954

C. E. HALE ET AL

2,686,078

FOLDING TOP CONSTRUCTION

Filed Jan. 19, 1950

3 Sheets-Sheet 1

FIG. 1

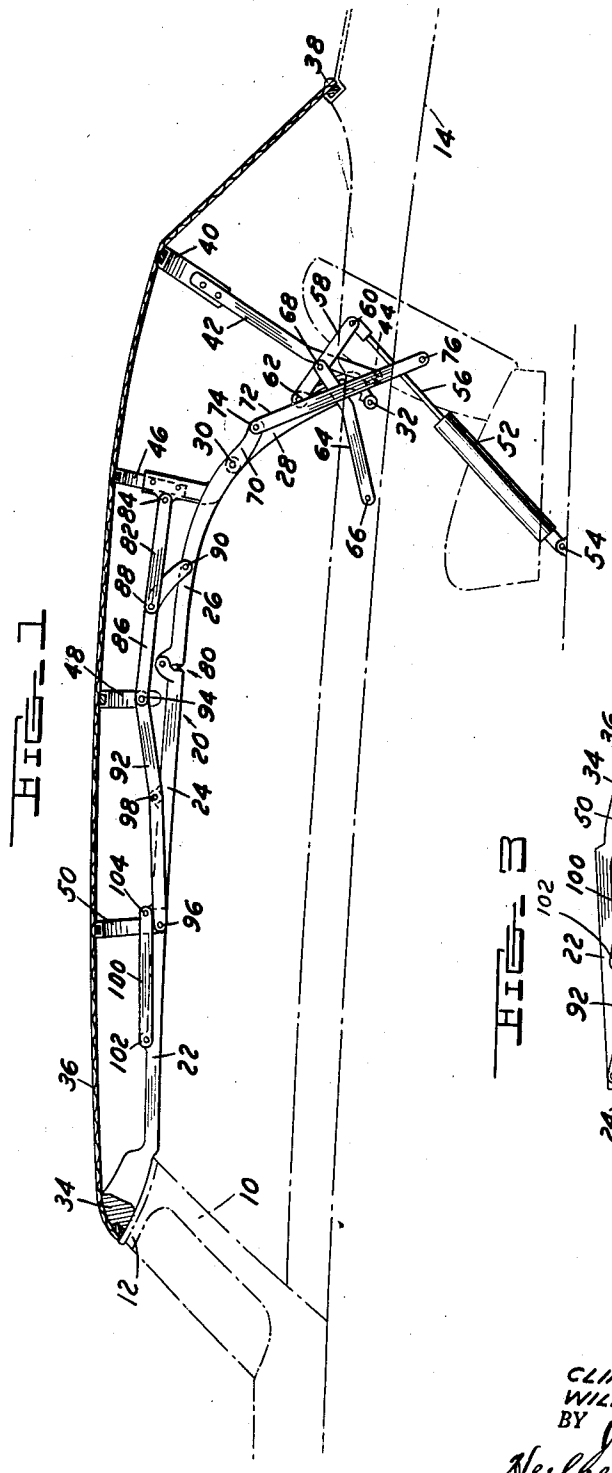
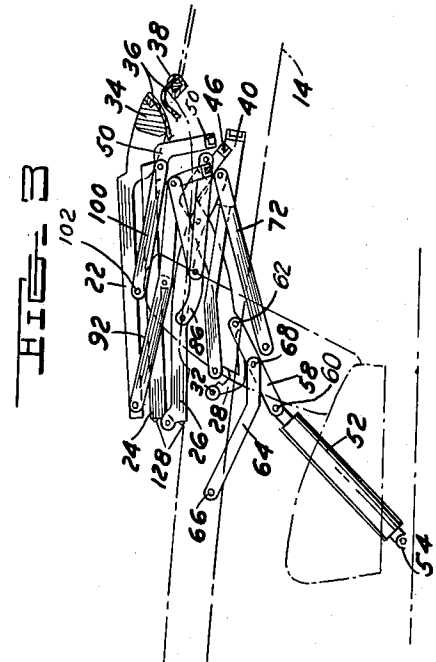


FIG. 3



INVENTORS
CLIFFORD E. HALE
WILLIAM L. Mc KENNA.
BY Whittemore, Hulbert & Belknap
ATTORNEYS

Aug. 10, 1954

C. E. HALE ET AL

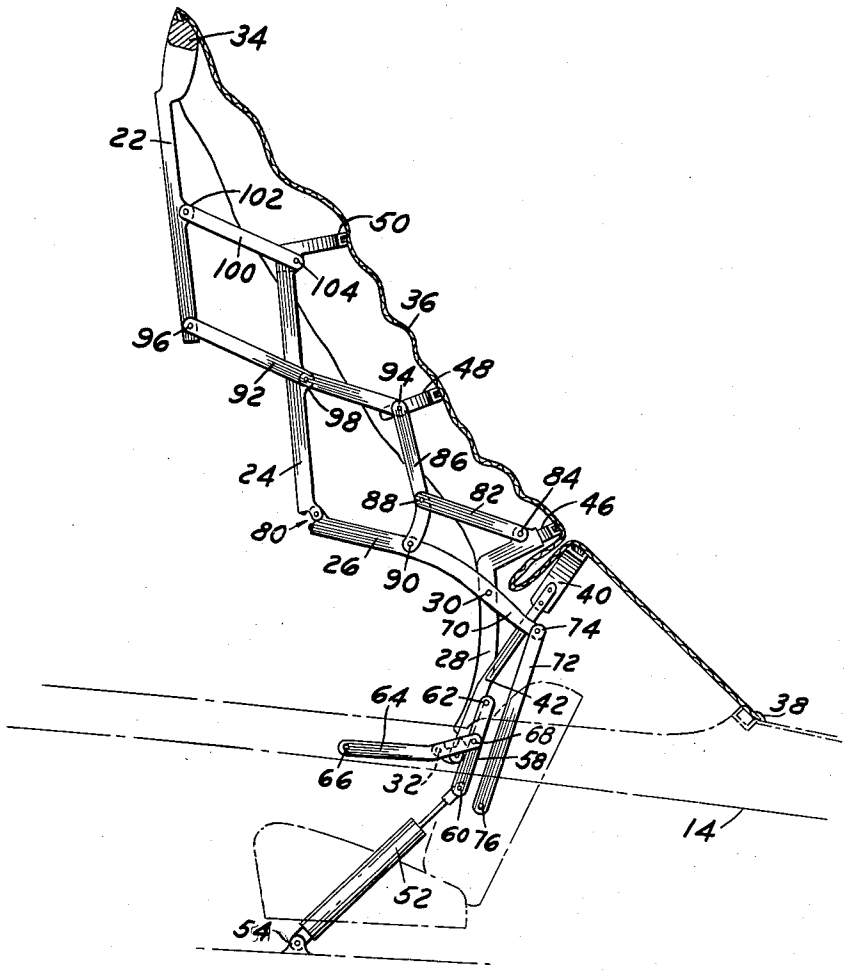
2,686,078

FOLDING TOP CONSTRUCTION

Filed Jan. 19, 1950

3 Sheets-Sheet 2

FIG. 2



INVENTORS
CLIFFORD E. HALE
WILLIAM L. McKENNA
BY Whittemore Hulbert and Belknap
ATTORNEYS

Aug. 10, 1954 C. E. HALE ET AL 2,686,078

FOLDING TOP CONSTRUCTION

Filed Jan. 19, 1950

3 Sheets-Sheet 3

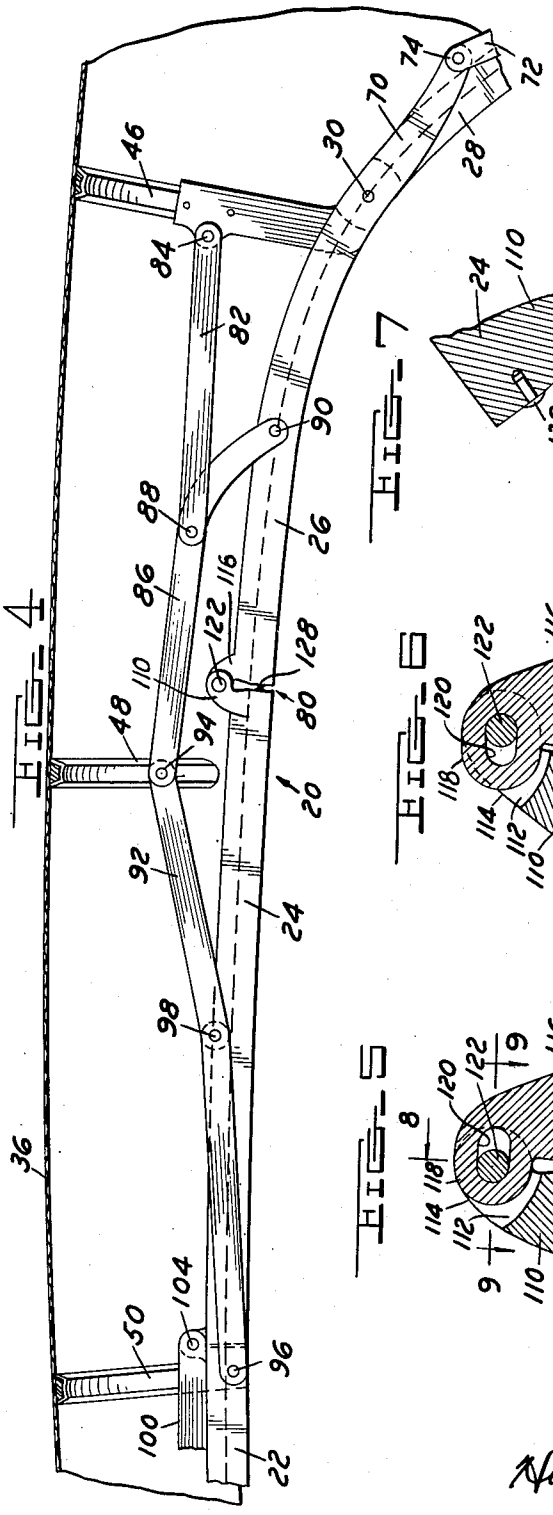


FIG. 4

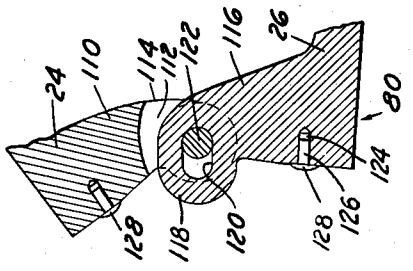


FIG. 7

FIG. 6

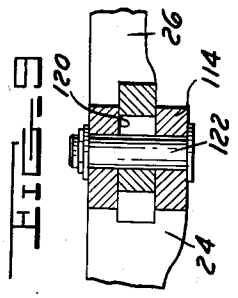


FIG. 9

FIG. 5

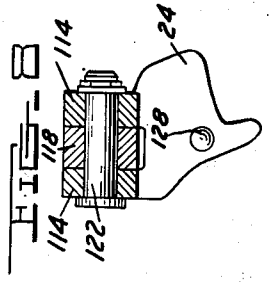


FIG. 8

INVENTORS
CLIFFORD E. HALE
WILLIAM L. McKENNA
BY Whittemore, Hulbert & Belknap
ATTORNEYS

Patented Aug. 10, 1954

2,686,078

UNITED STATES PATENT OFFICE

2,686,078

FOLDING TOP CONSTRUCTION

Clifford E. Hale, Ann Arbor, and William L. McKenna, Ypsilanti, Mich., assignors to Detroit Harvester Company, Detroit, Mich., a corporation of Michigan

Application January 19, 1950, Serial No. 139,364

5 Claims. (Cl. 296—116)

1

The present invention relates to folding top construction for a motor vehicle.

Folding tops for motor vehicles comprise essentially side rails, each of which is composed of a plurality of sections, cross bows for supporting the fabric top, and suitable linkage and pivot connections for interconnecting the sections of the side rails.

Due to space considerations links which are intended to apply forces to side rail sections must necessarily be placed so that they operate with a relatively small mechanical advantage.

It is an object of the present invention to provide means for improving the mechanical advantage of the linkage for effecting opening and closing movement of folding top constructions.

More specifically, it is an object of the present invention to provide a novel pivot connection between side rail sections adapted to increase the mechanical advantage of the actuating linkage at the precise moment when the maximum effort is required to effect opening or closing movement.

It is a further object of the present invention to provide a pivot connection between adjacent sections of a side rail of a folding top construction comprising a pin and slot connection between said sections in combination with a pair of cooperating abutments at the adjacent ends of said sections, the parts being arranged such that initial swinging or rocking movement between the sections takes place about a pivot axis established by the contact between said abutments, this motion being accomplished by relative sliding between the pin and slot, and further swinging or rocking movement between the sections takes place about the pin after the pin has reached one end of the cooperating slot.

More specifically, it is an object of the present invention to provide a folding top construction in which a novel pivot connection is provided intermediate adjacent rail sections, the pivot connection being effective to increase the mechanical advantage of actuating linkage interconnecting the sections upon movement toward and from fully extended position.

Other objects and features of the invention will become apparent as the description proceeds, especially when taken in conjunction with the accompanying drawings, wherein:

Figure 1 is a vertical section through the folding top construction showing the top in open or fully extended position.

Figure 2 is a view similar to Figure 1 illustrating the top in partially open position.

Figure 3 is a view similar to Figure 1 illustrating the top in completely folded position.

2

Figure 4 is an enlarged sectional view illustrating the novel pivot connection between the side rails and the linkage interconnected thereto.

Figure 5 is a vertical section through the specific pivot connection illustrating the side rail sections in fully extended position.

Figure 6 is a view similar to Figure 5 illustrating the side rail sections in the position which they occupy after limited relative pivotal movement.

Figure 7 is a view similar to Figure 5 illustrating the side rail sections in an intermediate position.

Figure 8 is a sectional view on the line 8—8, Figure 5.

Figure 9 is a sectional view on the line 9—9, Figure 5.

Referring now to Figures 1, 2 and 3 there is illustrated a folding top construction for a motor vehicle. Portions of the motor vehicle are indicated in dot and dash lines such for example as the windshield frame 10, the windshield header 12, and portions of the body 14. The folding top construction comprises side rails indicated generally at 20, each of the side rails being composed of a front section 22, an intermediate section 24, and a rear section 26. The rear side rail section 26 is pivoted to a pillar casting 28, the pivot being indicated at 30. The pillar casting 28 is in turn mounted on a fixed pivot 32 which constitutes the main pivot support for the entire folding top construction. The forward end of the front sections 22 of the side rails are interconnected by a transversely extending header bar 34 to which is secured the forward end of the flexible top 36, the latter being formed of a water-proof fabric or other suitable material. The flexible top 36 at its rear end is connected to the body of the vehicle as indicated at 38. Intermediate the forward and rear ends of the flexible top are a plurality of cross bows adapted to support the top in desired position when the folding top construction is fully extended.

A rear bow 40 is provided carried by arms 42 which are mounted on fixed pivots 44. The cross bow 40 is not connected by linkage and it assumes its raised position as indicated in Figure 1 when the fabric top 36 is tensioned. Upon closing or collapsing of the folding top the bow 40 may remain in the position shown in Figure 1 until it is pushed to the folded position illustrated in Figure 3 by the rearward movement of the balance of the top construction.

Intermediate cross bows 46, 48 and 50 are pro-

vided and are connected to elements of the top construction as will subsequently be described.

In order to effect controlled guided movement of the top construction between closed and open position, a power device herein illustrated as a hydraulic cylinder 52 is provided which is pivoted as indicated at 54 within the body of the vehicle. Within the cylinder 52 is a piston connected by a piston rod 56 to a power link 58, the pivot connection between the piston rod 56 and the power link 58 being indicated at 60. The power link at its opposite end is pivotally connected to the pillar casting 28 by a pivot connection illustrated at 62. In order to effect guided movement of the parts actuated thereby, the power link 58 is pivotally connected intermediate its ends to a guide link 64, the opposite end of the guide link being mounted on a fixed pivot as indicated at 66. The movable end of the guide link 64 is provided with a pivot connection 68 to the power link.

At their forward ends the pillar castings 28 are interconnected by the cross bow 46 previously referred to.

The rear side rail sections 26 have rearwardly extending arms 70 which are pivoted to the movable ends of balance links 72, the pivot connection between these parts being illustrated at 74. The balance links 72 at their opposite ends are provided with fixed pivot mountings 76.

The rear side rail sections 26 are connected to the intermediate side rail sections 24 by pivot connections indicated generally at 80, which pivot connections are of special design to carry into effect the objects of the present invention and will be described subsequently in considerable detail. Extending forwardly from adjacent forward ends of the pillar casting 28 are links 82, the links being pivoted to the pillar casting as indicated at 84 at one end and being pivoted at their forward ends to links 86, the pivot connections being illustrated at 88. Cross bow 46 is connected at its ends to the ends of pillar castings 28. The links 86 at their forward ends carry the cross bow 48 and at their rear ends are pivotally connected to the rear side rail sections 26, these pivot connections being illustrated at 90. Links 92 are provided which are pivoted at their rear ends to the forward ends of the links 86, the pivot connections being illustrated at 94. At their forward ends the links 92 are pivotally connected to the rear ends of the front side rail sections 22, the pivot connections being illustrated at 96. Intermediate their ends the links 92 are pivotally connected to the intermediate side rail sections 24, the pivot connections being indicated at 98. A link 100 is provided interconnecting the front side rail sections 22 and the intermediate side rail sections 24, this link having a pivot connection 102 at its forward end to an intermediate portion of the front side rail section 22, and a pivot connection 104 at its rear end to the forward end of the intermediate side rail section 24. The forward ends of the intermediate side rails 24 are interconnected by the cross bow 50 previously referred to.

Experience has indicated that a maximum force is required to effect initial movement of the top construction towards folded position from fully extended position as shown in Figure 1. In other words, the maximum effort is required when the adjacent ends of the side rail sections are moving out of substantial alignment.

The initial force required to "break" the joints

or pivot connections between adjacent ends of the side rail sections includes the link 82 which operates in tension upon initial movement of the parts from the position shown in Figure 1. The link 82 operates directly on the link 86 which in turn is connected to the link 92 to apply folding or collapsing force to the intermediate side rail section 24. Thus the requirement for initial folding movement of the top is to effect a clockwise rotation of the side rail section 24 about the pivot connection 80 relative to the rear side rail section 26. Obviously, the line of action of the power transmitting linkage is relatively close to the pivot 80 and this position is dictated by space considerations which cannot be changed.

According to the present invention however, the pivot 80 is so constructed that initial movement between the side rail sections 24 and 26 from open position, or final movement of these side rail sections into fully extended position, is accomplished about an axis which is removed from the line of the actuating linkage by as great a distance as possible. Thus, the force applied through the linkage is more effective due to its substantially increased lever arm which results from employing the specific pivot connection 80.

Referring now to Figures 5, 6, 7, 8 and 9, the detailed construction of the pivot connection 80 is illustrated. At the rear end of the intermediate side rail section 24 there is provided an upstanding projection 110 which is slotted as indicated at 112 to provide spaced ears 114. The forward end of the rear side rail section 26 is provided with an upwardly extending projection 116 having a forwardly extending portion 118 adapted to enter into the space between the ears 114. The portion 118 is provided with an elongated slot 120 which receives a pin 122 carried at its opposite ends by the ears 114.

The end surfaces of the side rail sections 24 and 26 are each provided with recesses 124 into which headed inserts 126 are inserted, these headed inserts having rounded heads 128 as best seen in Figure 7 and preferably being of hardened steel to provide long wearing bearing surfaces. In order to reduce the weight of the parts making up the folding top construction the side rail sections are preferably formed of aluminum or other light metal and accordingly the headed inserts of hardened steel 126 are desirable to avoid excessive wear which would otherwise occur.

Referring first to Figure 5 the side rail sections 24 and 26 are illustrated in fully open position at which time the heads 128 of the inserts 126 are in engagement and the pin 122 is at the left hand end of the slot 120. Accordingly, initial relative rocking movement between the sections 24 and 26 takes place about a pivot determined by the engagement between the abutments or heads 128, this motion being accompanied by movement of the pin 122 toward the right hand end of the slot 120. In Figure 6 there is illustrated a limiting condition when relative rocking movement between the sections 24 and 26 has taken place to such an extent that the pin 122 has reached the right hand end of the slot 120. It will be observed that at this time further rocking motion between the sections 24 and 26 will take place about a pivot axis determined by the location of the pin 122 at the right hand end of the slot 120, this condition being illustrated in Figure 7.

Referring now to Figure 4 and reviewing the operation of the special pivot connection 80, it

will be observed that the linkage has a line of action which is necessarily relatively close to the axis of the pin 122 and accordingly it is effective to exert a very small mechanical advantage. However, by providing the abutments 128 substantially below the axis of the pins 122, the mechanical advantage of the link is multiplied two or three times. By the time the side rail sections 24 and 26 have reached the position illustrated in Figure 6, the link 86 will have swung upwardly about its pivot connection 90 to an extent where the linkage has attained a substantial mechanical advantage with respect to further rocking movement between the sections 24 and 26 about the axis of the pin 122.

In actual practice it is of course apparent that the power which must be applied through the hydraulic cylinder 52 is determined by the power which is required to move the side rail sections into or out of fully extended position. Initial movement from folded position takes place with very considerable mechanical advantage and relatively small power is required. In a corresponding way movement of the folding top construction from a position in which the top has begun to fold takes place with considerable mechanical advantage.

According to the present invention a construction is provided which reduces the power necessary to move the elements of the folding top construction out of fully extended position by a very substantial factor and accordingly permits the use of a power cylinder 52 having correspondingly less power.

The present construction therefore has the effect of reducing the power requirements for moving the folding top construction between its extended and collapsed position without requiring modification of the actuating linkage, the construction and dimensions of which are substantially limited by considerations of the space available for this mechanism.

The drawings and the foregoing specification constitute a description of the improved folding top construction in such full, clear, concise and exact terms as to enable any person skilled in the art to practice the invention, the scope of which is indicated by the appended claims.

What we claim as our invention is:

1. In a folding top construction for motor vehicles, a pair of side rails, each of said rails comprising a pair of elongated sections, pivot means connecting the adjacent ends of said sections providing for relative swinging movement therebetween, an actuator connected to one of said sections having a line of action close to the adjacent ends of said sections, said pivot means comprising ears extending laterally from the adjacent ends of said sections at the side thereof toward which said sections move in folding from aligned position, a pin and slot connection between said ears, said slot being disposed generally longitudinally of the side rail established by bringing said sections into alignment, abutment members at the adjacent ends of said sections spaced substantially from said pin and slot connection, said abutments and said pin and slot connection being constructed and arranged to provide for initial swinging movement from aligned position to take place about a first axis established by the contact between said abutments and to be accompanied by sliding of said pin in said slot, and further swinging movement after the pin has reached an end of said slot to take place about the axis of said pin.

2. Structure as defined in claim 1 in which the extended position of said sections is determined by engagement between said pin and the other end of said slot, and engagement between said abutments.

3. Structure as defined in claim 2 in which said abutments have convexly rounded engaging surfaces to provide rolling contact therebetween.

4. In a folding top for a vehicle body, side rail sections pivotally connected at one end to said body arranged in substantially longitudinally aligned relationship when the top is in an open position and adapted to swing angularly relative to each other as the top is moved towards a folded position, link means extending lengthwise closely along said aligned rail sections operatively connected to a forward rail section adapted to exert pull on the forward section to initiate angular movement of one rail section relative to the other during folding of the top, a lost motion pivotal connection between adjacent ends of said rail sections, said lost motion connection permitting initial angular movement of the sections without said connection forming a pivoting abutment, abutment means at adjacent ends of the rail sections engaging each other at a point located further from the link means than said lost motion pivotal connection about which the rail sections pivot during initial angular swinging movement of the side rail sections as a result of pulling action of the link means, and said lost motion pivotal connection providing a second pivoting abutment after predetermined angular movements of the side rail sections.

5. In a folding top for a vehicle body, a series of hinged side rail members pivotally connected at one end to said body arranged in substantially aligned relationship when the top is in an open position and adapted to swing angularly relative to each other as the top is moved towards a folded position, a series of hinged link members extending lengthwise along and closely adjacent said rail members and operatively connected to a forward rail member for exerting pull thereon to initiate hinged movements of the members relative to each other during folding of the top, a pin and slot connection between adjacent ends of one pair of said members with a major dimension of the slot disposed generally parallel to the length of the members, and abutment means at adjacent ends of the same pair of members engaging each other at a point located further from the members of the other series than said pin and slot connection whereby said pair of members pivot initially about said abutment means and said pin and slot connection provides a second pivoting abutment after a predetermined angular movement of the members.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
206,226	Butler	July 23, 1878
472,622	Linkletter	Apr. 12, 1892
1,257,187	Carr	Feb. 19, 1918
1,337,817	Bode	Apr. 20, 1920
2,016,598	Field	Oct. 8, 1935
2,042,886	Ferguson	June 2, 1936

FOREIGN PATENTS

Number	Country	Date
253	Great Britain	Jan. 5, 1903
439,050	France	June 4, 1912