Dec. 28, 1948. C. C. STEVENS 2,457,743

INTERNAL GRINDING MACHINE

Filed Oct. 3, 1946 2 Sheets-Sheet 1

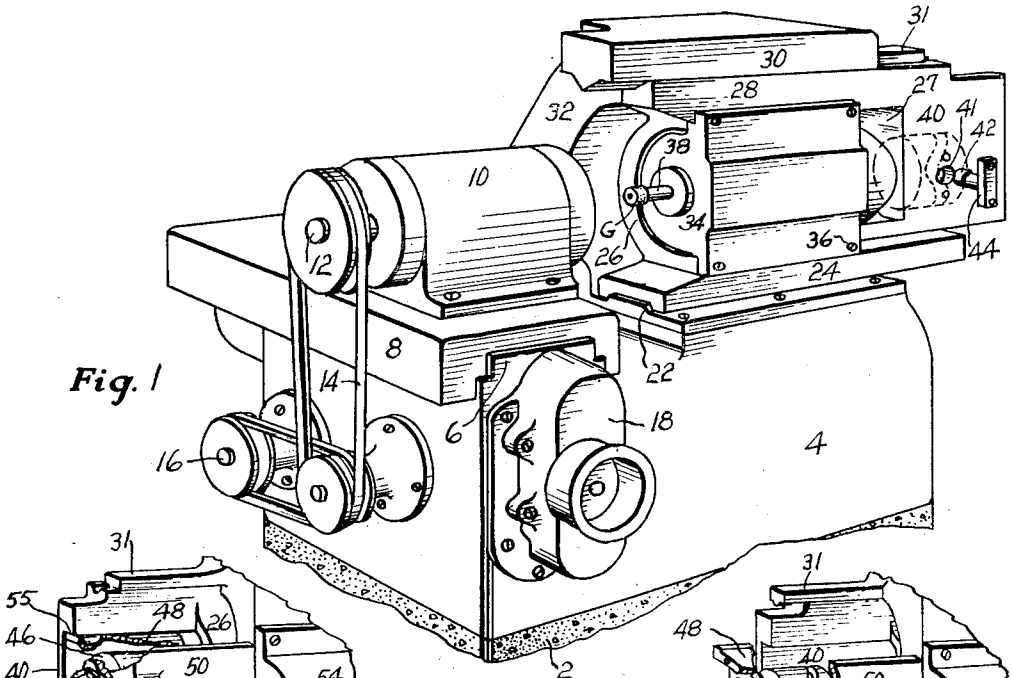


Fig. 1

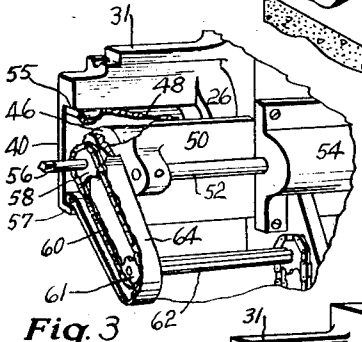


Fig. 3

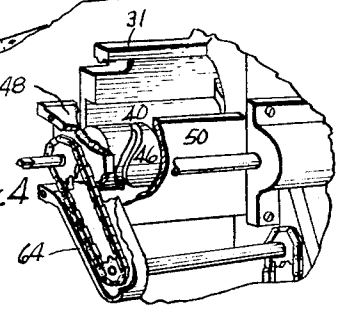


Fig. 4

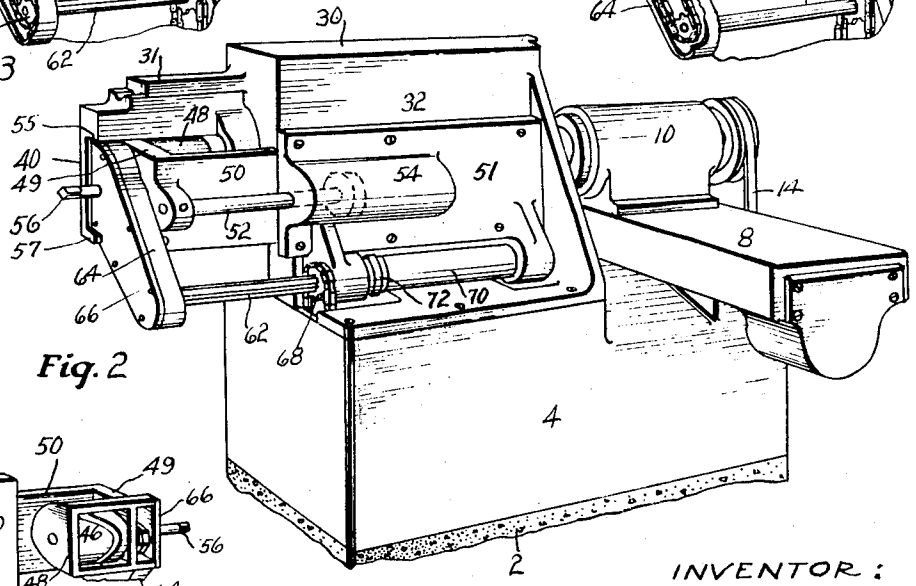


Fig. 2

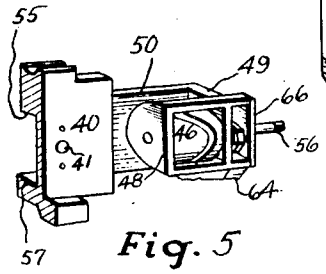


Fig. 5

INVENTOR:
CLARENCE C. STEVENS,
BY Romeyn A. Share
HIS ATTORNEY

Dec. 28, 1948. C. C. STEVENS 2,457,743

INTERNAL GRINDING MACHINE

Filed Oct. 3, 1946 2 Sheets-Sheet 2

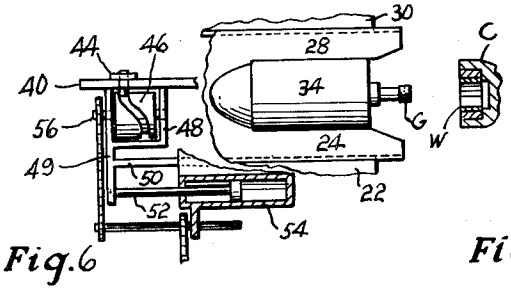


Fig. 6

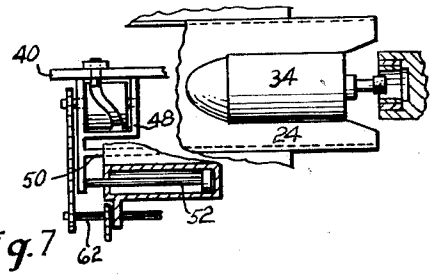


Fig. 7

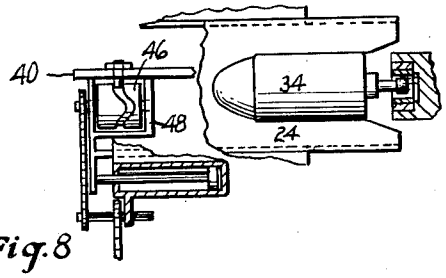


Fig. 8

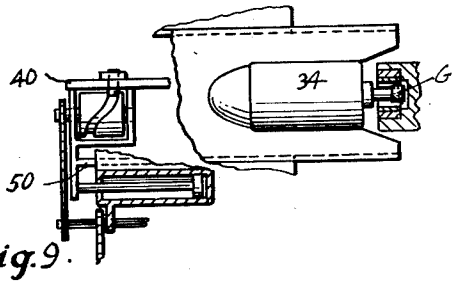


Fig. 9

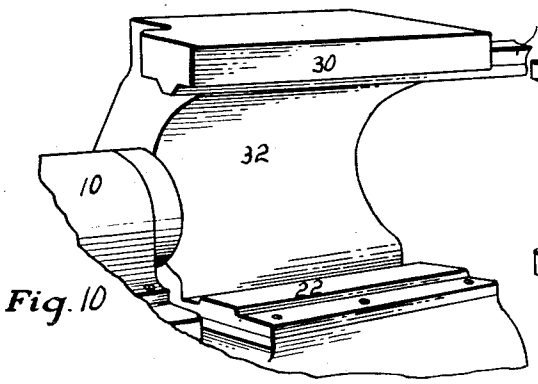


Fig. 10

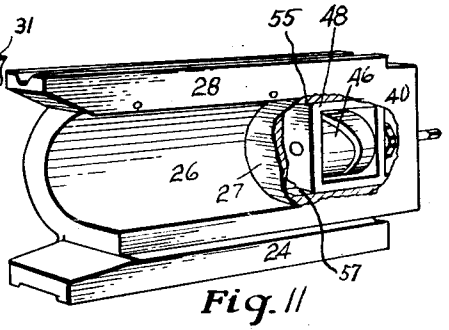


Fig. 11

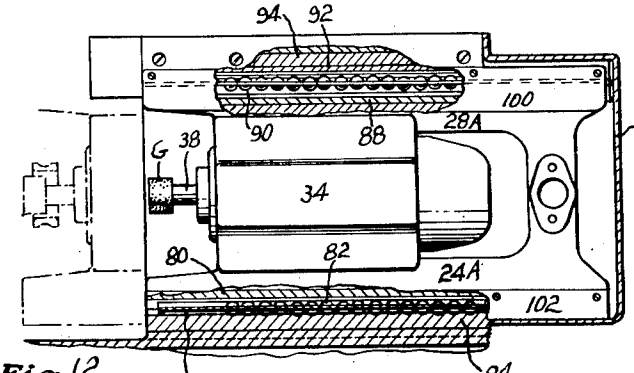


Fig. 12

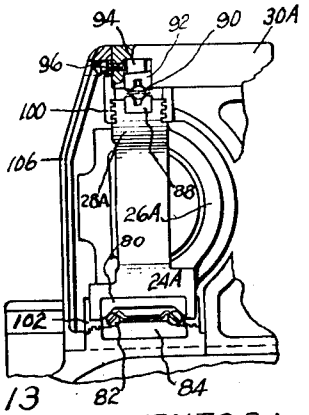


Fig. 13

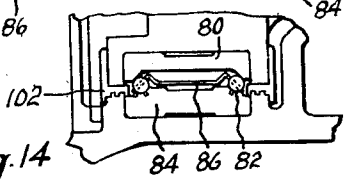


Fig. 14

INVENTOR:
CLARENCE C. STEVENS,
BY Romeyn A. Spare
HIS ATTORNEY.

Patented Dec. 28, 1948 2,457,743

UNITED STATES PATENT OFFICE

2,457,743

INTERNAL GRINDING MACHINE

Clarence C. Stevens, Forestville, Conn., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application October 3, 1946, Serial No. 700,958

18 Claims. (Cl. 51—50)

1

This invention relates to internal grinding machines and comprises all of the features of novelty herein disclosed. An object of the invention is to provide improved mechanism for actuating a wheel head or a work head as to control approach and retreat for loading and unloading and a relative reciprocation in grinding position. Another object is to provide a construction to allow ready access to various units of a grinding machine so that the units can be readily separated and removed for servicing or replacement. Another object is to provide an improved construction of slides to insure smooth reciprocation and minimize vibration and deflection. Still another object is to improve internal grinding machines so that the wheel head and the work head will be more easily accessible to the operator.

To these ends and also to improve generally upon apparatus of this character, the invention consists in the various matters hereinafter described and claimed. In its broader aspects the invention is not necessarily limited to the specific construction selected for illustrative purposes in the accompanying drawings in which

Fig. 1 is a perspective view of the machine showing the front and one end.

Fig. 2 is a perspective view showing the rear and the other end.

Fig. 3 is a view of a portion of Fig. 2 with parts broken away and a cover removed.

Fig. 4 is a view similar to Fig. 3 with the front slide somewhat advanced.

Fig. 5 is a perspective view showing the rear slide partially pulled out.

Figs. 6, 7, 8 and 9 are diagrammatic views showing the slides in different relations to the work.

Fig. 10 is a perspective view of a guide and associated parts.

Fig. 11 is a perspective view of the front slide with parts broken away.

Fig. 12 is a front view partly in section of a modified form of front slide.

Fig. 13 is an end view of Fig. 12 partly in section.

Fig. 14 is an enlarged view of a portion of Fig. 13.

The numeral 2 indicates a portion of a block of concrete to deaden vibration imparted to a main frame 4 secured thereto. The frame has a guideway 6 for a cross feed slide 8 on which a work head 10 is mounted. A work-carrying spindle 12 journalled in this head has a pulley driven by a vertical belt 14 and pulleys from a power shaft 16. Any suitable gearing in a casing 18 actuates the cross feed slide, the actual movement being short

2

so that the belt 14 is not unduly tightened or loosened.

Fastened on another part of the frame 4 is a base plate 22 having a longitudinal guideway for a main reciprocating slide comprising a bottom rail or base slide 24 with an upwardly projecting arcuate portion 26 which forms a forwardly open recess for a wheel head. The portion 26 ends at a partition 27 and is joined at the top to a rail or top slide 28 engaging an upper guideway 30 overhanging from an internally arcuate standard 32 integral with the base plate 22. The upper guideway 30 is preferably extended at one end as at 31. In the recess formed by the arcuate portion 26 is mounted a wheel head or housing 34 which is half round, a front upright portion being removably secured by screws 36 to the slide. The slide is generally upright and laterally narrow so that its center line is close to the front of the frame, the wheel head being substantially all within the outline of the slide. The upper and lower guideways embrace the major transverse dimension of the slide and guide it longitudinally. A motor driven spindle 38 projecting from the housing at the center line of the slide carries a grinding wheel G. The mounting of this spindle within the housing and its driving means are preferably constructed as in my allowed patent application Serial No. 503,610 filed September 24, 1943, Patent No. 2,416,886 granted March 4, 1947.

One end of the slide 24 beyond the partition 27 has a generally upright extension 40 of U-shaped cross section with an opening 41 to admit a cam roll 42 rotatable on a stud secured to a plate 44 which is removably fastened to the extension by screws. The cam roll projects into the groove of a barrel cam 46 journalled in a housing 48 carried by an arm 49 on an auxiliary or second slide 50 which is slidable in a guide slot at the back of the standard 32 where it is guided by a removable cover 51. This second slide is parallel to the first slide and is removably attached to a piston rod 52 projecting from a piston and cylinder unit 54 mounted on the cover 51. The two slides are movable as a unit by the piston rod or relatively to one another when the cam is rotated. In the latter case the open front of the cam housing and the rear of the extension 40 have sliding contact. The top and the bottom of the cam housing have flattened portions guided between an upper flange 55 and a lower flange 57 on the rear of the extension 40. The barrel cam is keyed to a shaft 56 squared at the end for manual operation by a crank. The shaft is journalled in end walls of

the housing 48 and is removable endwise therefrom.

A sprocket wheel 58 on the shaft 56 is driven by a sprocket chain 60 from a sprocket wheel 61 keyed on a drive shaft 62. The sprockets and the chain run in an oil bath in a casing 64 which is preferably an extension of the cam housing. A cover 66 is removably attached to the casing by screws. The shaft 62 is splined in a driving sprocket wheel 68 and in a supporting sleeve 70 journalled in lugs on the cover 51 and carrying a cam 72 to control the cross feed slide if desired. The sprocket wheel 68 receives power from a drive shaft and clutch (not shown) housed in the main frame.

It should be understood that the piston and cylinder unit 54 will operate the auxiliary or second slide 50 and the main slide as a unit to bring the grinding wheel up to the work and away from it, this occurring once in each cycle, whereas rotation of the barrel cam causes a reciprocation of the main slide with respect to the second slide. Thus the grinding wheel is given a rapid reciprocation within the work. The cam roller 42 engages the groove in the barrel cam in line with the center of gravity of the main slide and the parts carried thereby. Thus the slide is given a smooth reciprocation without any tendency to skew or cramp it in its upper and lower guides. Fig. 6 shows both slides in retracted position with the grinding wheel remote from the work piece W which is held in a chuck C on the work head. Fig. 7 shows both slides advanced with the wheel about to enter the work. Fig. 8 shows the wheel wholly within the work and Fig. 9 shows the wheel at its extreme inward position.

From the foregoing it will be seen that unit construction facilitates servicing of the machine. The standard 32 constitutes a removable guiding unit with parallel guideways for a front sliding unit and a rear sliding unit. The spindle driving unit 34 is accessible for removal at any time from the front sliding unit. To free the slides from one another, the cam follower roller 42 and its supporting plate 44 are readily removed. Thereupon the rear sliding unit can be moved out as indicated in Fig. 5 to expose the cam housing. The cam shaft 56 is removable endwise to provide for lateral removal of the cam, as to change cams. By releasing the piston rod 52 from the rear sliding unit, the latter is free for complete removal endwise from its guideway together with the attached parts. The front sliding unit with or without the motor driven spindle is then free for endwise removal from its guideway.

In Figs. 12, 13 and 14, a modification is shown. The slide 24A is recessed at the bottom to receive a raceway plate 80 having spaced inclined raceways engaging two rows of balls 82 which also engage spaced raceways on a plate 84 set in recess of the frame. A separator 86 extends between the plates and has pockets for spacing the balls. The upper rail of slide 28A is recessed at the top to receive a raceway plate 88 engaging a single row of balls 90 which also engage an upper raceway plate 92 set in a recess of the guideway 30A. The balls are preferably spaced by a separator plate. The upper side of the plate 92 is inclined laterally and is engaged by a wedge 94 which is adjustable laterally by a screw 96 to force the plate 92 downwardly thereby to preload the three rows of balls and prevent play in the main slide as it reciprocates. Pressure of the grinding wheel on the work does not displace the slide when the balls are preloaded. The exclude grit

from the bearings, the front and the rear of the upper rail or slide 28A has a series of grooves and ribs fitting ribs and grooves in sealing plates 100 on the overhanging guide member 30A. Similar sealing plates 102 with ribs and grooves at the bottom are interposed between the slide 80A and the base. A cover 104 protects the rear end of the slide and a cover 106 protects the front.

I claim:

1. In a bore grinding machine having a work head and a wheel head, a slide supporting one of the heads, a second slide behind the first and movable parallel thereto, a barrel cam and a cam engaging roller, one mounted on the second slide and the other on the first slide to connect the slides for simultaneous movement, means connected to one slide for actuating both slides as a unit to bring the grinding wheel and the work into and out of proximity, and means for rotating the cam to cause reciprocation of the first slide with respect to the second and a consequent relative traversing movement between the work and the wheel throughout the bore of the work.

2. In a bore grinding machine having a work head and a wheel head, a slide supporting one of the heads, a second slide movable parallel to the first slide, a barrel cam and a cam roller, one mounted on the second slide and the other on the first slide to connect the slides for simultaneous movement, means for actuating both slides as a unit, means for rotating the cam to cause reciprocation of the first slide with respect to the second, and the cam roller being located in line with the center of gravity of the first slide.

3. In a bore grinding machine having a work head and a wheel head, a slide supporting the wheel head and movable longitudinally of the work, a second slide parallel to the first, a barrel cam mounted for rotation on the second slide and having a groove, a cam engaging roller removably mounted on the first slide and projecting into the groove to connect the slides for simultaneous travel, means connected to the second slide to actuate both slides as a unit to move the grinding wheel into and out of proximity to the work, and means for rotating the cam to reciprocate the first slide and traverse the grinding wheel back and forth along the length of the work.

4. In a bore grinding machine, a frame, a work head, a standard secured to the frame and having both a lower guideway and an upper guideway, a slide between the upper and lower guideways, a wheel head secured to the slide and having a driven spindle with a grinding wheel, a second slide behind the first and movable parallel thereto, means for advancing and retracting the second slide, means for connecting the slides for simultaneous movement, said last named means including a cam rotatable to cause a reciprocation of the first slide with respect to the second.

5. In a bore grinding machine, a frame, a work head, an internally recessed standard secured to the frame and having both a lower guideway and an overhanging upper guideway, an internally recessed slide within the recess of the standard and engaging the upper and lower guideways, a wheel head removably secured in the recess of the slide and having a motor driven spindle and grinding wheel, a second slide movable longitudinally with respect to the standard, means mounted on the standard and connected to the second slide for advancing and retracting the latter, a barrel cam and a cam roller, one mounted on the second slide and the other on the first slide to connect the slides for simultaneous movement, and means

for rotating the cam to cause a reciprocation of the first slide with respect to the second to give the grinding wheel a traversing reciprocation from one end of the work to the other.

6. In a bore grinding machine, a frame, a work head, a wheel head, a slide for supporting and axially reciprocating one of the heads, the slide being substantially upright and arranged near the front of the frame, the supported head being substantially all within the outline of the slide, upper and lower guideways for the slide, and means for reciprocating the slide, said reciprocating means having a power transmitting connection with the slide in line with the center of gravity of the slide and the head supported thereon.

7. In a bore grinding machine, a frame, a work head, a wheel head having a spindle with a grinding wheel, a slide for supporting the spindle near the front of the frame and in line with the longitudinal axis of the slide, said slide being laterally narrow with its greatest transverse dimension upright, a standard having upper and lower guideways near the front of the frame, the guideways being spaced apart vertically to embrace the major transverse dimension of the slide and guide it longitudinally, and means for reciprocating the slide.

8. In a bore grinding machine, a frame, a work head, a wheel head, a slide for axially reciprocating one of the heads, the slide being substantially upright and arranged near the front of the frame, upper and lower guideways for the slide, a rotary cam for reciprocating the slide, and a cam roller mounted on the slide and engaging the cam in line with the center of gravity of the slide.

9. In a bore grinding machine, a frame, a standard having a base portion secured to the frame and provided with a lower guideway close to the front of the frame, the standard having an overhanging portion provided with an upper guideway above the lower guideway, a reciprocating slide engaging the guideways and having a greater dimension vertically than laterally, and a head secured to the slide and having a rotary spindle journalled therein.

10. In a bore grinding machine, a frame, a standard having a base portion secured to the frame and provided with a lower guideway, the standard having an overhanging portion provided with an upper guideway above the lower guideway, a reciprocating slide engaging the upper and lower guideways, a wheel head mounted on the slide and having a spindle journalled therein, and means acting in line with the center of gravity of the slide for giving it a reciprocation.

11. In a bore grinding machine, a frame, a standard having a forwardly open recess formed between a base portion and an overhanging portion, upper and lower guideways on the base portion and the overhanging portion, a slide between the guideways and having a forwardly open recess, a motor driven head removably secured in the recess of the slide, and means for reciprocating the slide.

12. In a bore grinding machine, a guiding unit comprising a standard having guideways for two slides, a first sliding unit and a second sliding unit slidable in the guideways and removable endwise therefrom, and a spindle driving unit detachably secured to one of the sliding units and removable laterally therefrom.

13. In a bore grinding machine, a pair of parallel guideways, a first sliding unit and a second sliding unit slidable in the guideways and removable endwise therefrom, a spindle driving unit secured to one of the sliding units, one of the sliding units having a rotatably driven cam and the other sliding unit having a cam follower engaging the cam to provide for reciprocation of one sliding unit with respect to the other, and the cam follower being detachably secured to its sliding unit to provide for endwise removal of the other sliding unit from its guideway.

14. In a bore grinding machine, a pair of parallel guideways, a first sliding unit and a second sliding unit slidable in the guideways and removable endwise therefrom, a spindle driving unit secured to one of the sliding units, a cam housing on the other sliding unit and having a cam shaft removable endwise therefrom, a cam on the cam shaft and removable laterally from the housing, and a cam engaging follower removably secured to said one sliding unit.

15. In a bore grinding machine, a substantially upright slide, a head on the slide and having a driven spindle, two spaced rows of rolling elements supporting the slide at the bottom and a single row of rolling elements supporting the slide at the top, and means for preloading the rolling elements to prevent displacement of the slide when the spindle is subjected to lateral load.

16. In a bore grinding machine, a substantially upright slide, a head on the slide and having a driven spindle, a row of rolling elements supporting the slide at the bottom and a row of rolling elements supporting the slide at the top, means for preloading the rolling elements to prevent lateral displacement of the slide when the spindle is subjected to lateral load, said means comprising a wedge for forcing one row of rolling elements towards the other.

17. In a bore grinding machine, a substantially upright slide, a head on the slide and having a driven spindle, a support having upper and lower raceway plates, upper and lower raceway plates secured to the slide, upper and lower rows of rolling elements engaging the plates, a movable wedge engaging one of the raceway plates, and the engaging surfaces being laterally inclined to load the rolling elements upon movement of the wedge.

18. In a bore grinding machine, a substantially upright slide, a head on the slide and having a driven spindle, a support having upper and lower guideways for the slide, the slide and the support having mating series of longitudinal ribs and grooves to exclude grit from the guideways.

CLARENCE C. STEVENS.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,373,193	Lamsden	Mar. 29, 1921
1,902,279	Evans	Mar. 21, 1933
2,253,687	Carlson	Aug. 26, 1941
2,270,525	Johnson	Jan. 20, 1942

FOREIGN PATENTS

Number	Country	Date
20,465	Great Britain	Sept. 2, 1910