July 29, 1952 J. N. ROSS 2,604,935

GAS FURNACE

Filed March 7, 1949 3 Sheets-Sheet 1

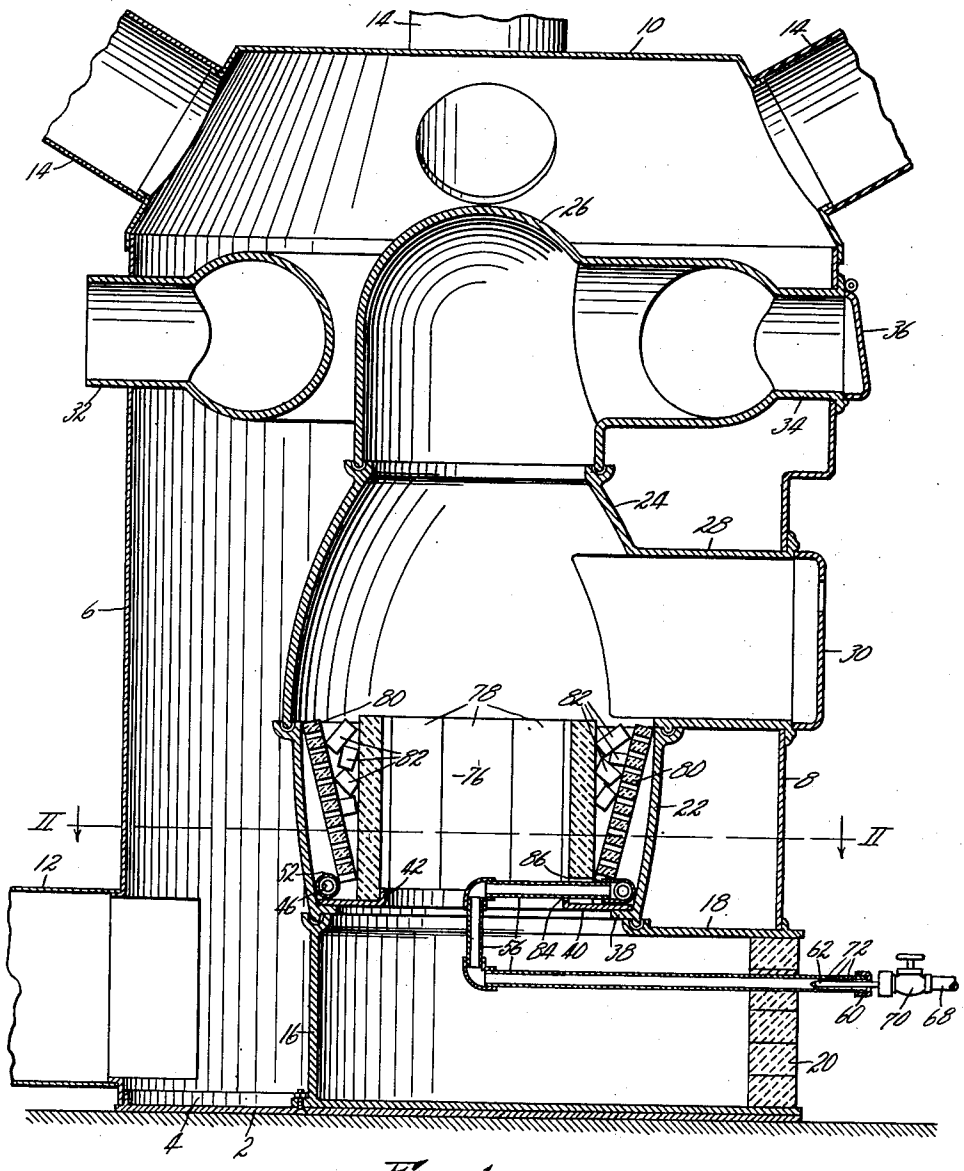


Fig. 1

INVENTOR,
James N. Ross.
BY
Roy E. Hamilton.
Attorney.

July 29, 1952

J. N. ROSS

GAS FURNACE

2,604,935

Filed March 7, 1949

3 Sheets-Sheet 2

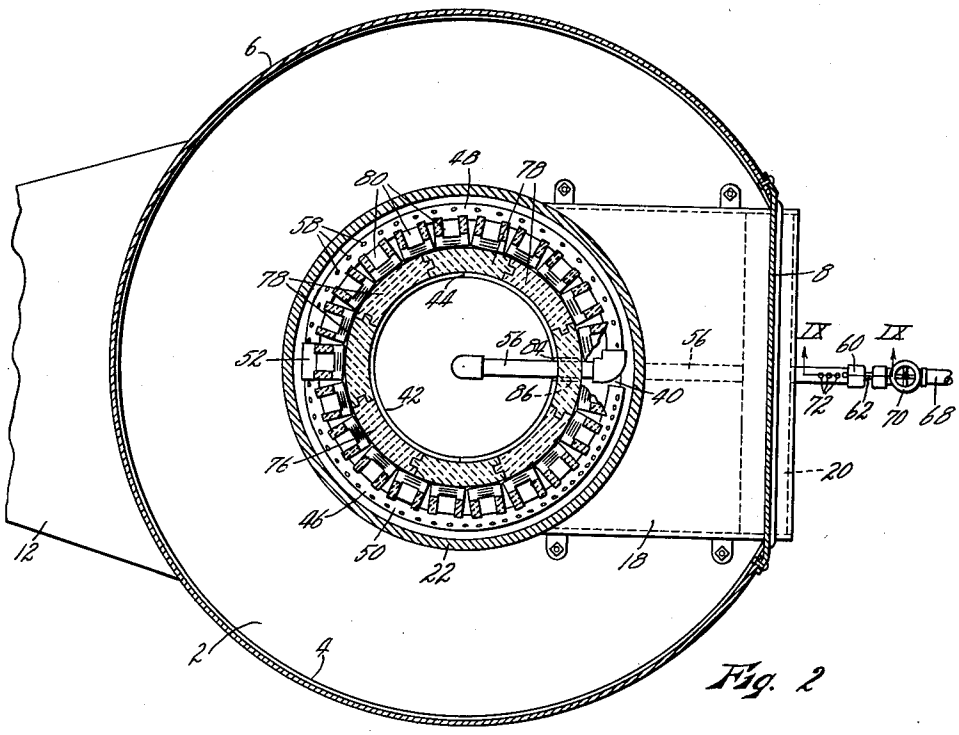


Fig. 2

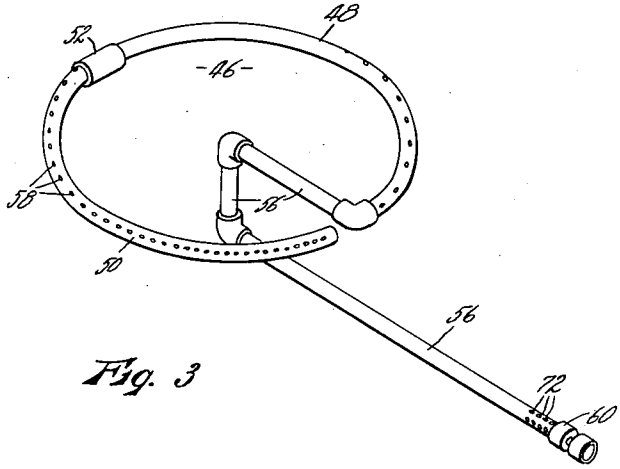


Fig. 3

INVENTOR,
James N. Ross.
BY
Roy E. Hamilton,
Attorney.

July 29, 1952 J. N. ROSS 2,604,935

GAS FURNACE

Filed March 7, 1949 3 Sheets-Sheet 3

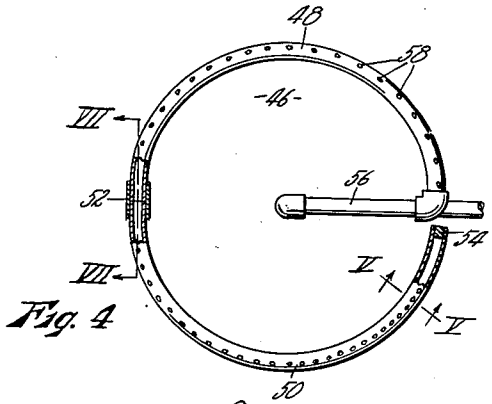


Fig. 4

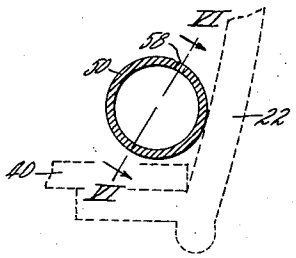


Fig. 5

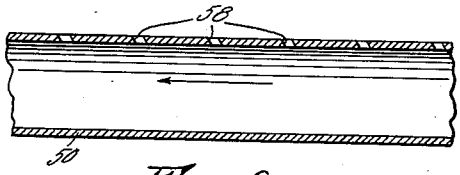


Fig. 6

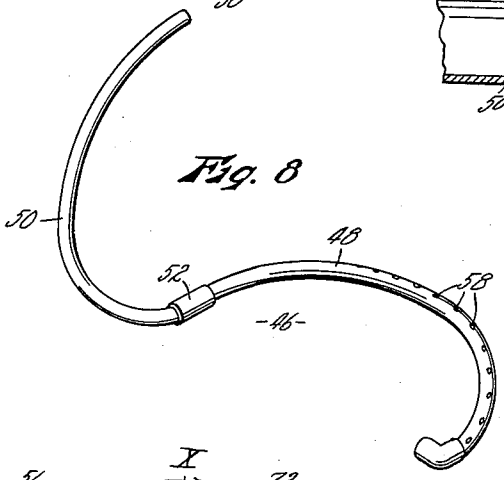


Fig. 8

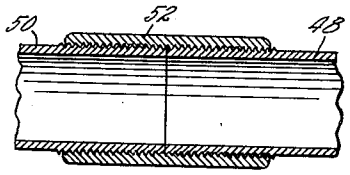


Fig. 7

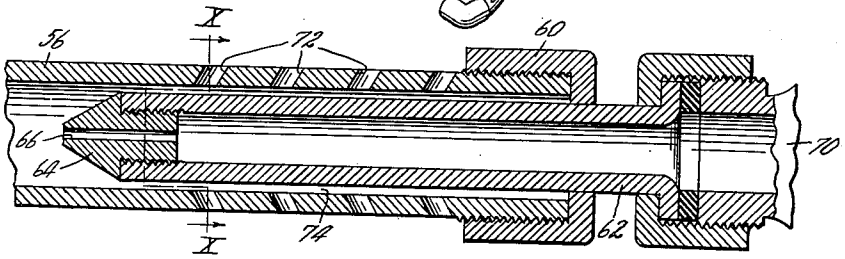


Fig. 9

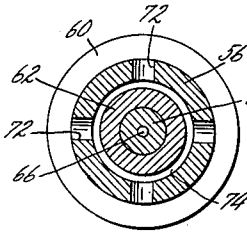


Fig. 10

INVENTOR,
James W. Ross.
BY
Roy E. Hamilton,
Attorney.

Patented July 29, 1952

2,604,935

UNITED STATES PATENT OFFICE

2,604,935

GAS FURNACE

James N. Ross, Kansas City, Mo.

Application March 7, 1949, Serial No. 80,057

7 Claims. (Cl. 158—7)

1

This invention relates to new and useful improvements in gas furnaces, and has particular reference to apparatus for adapting the ordinary coal-burning, warm air furnace to burn gas as a fuel.

The principal object of the present invention is the provision of means for obtaining more efficient use of the heat produced by the burning of gas in a furnace primarily designed for the consumption of coal.

Another object is the provision, in a furnace of the character described, of a gas burner adapted to direct its flame directly against the firepot, and of means for retaining heat and directing it against the walls of the firepot.

A further object is the provision, in a furnace of the character described, of a circular gas burner having substantially the same diameter as the firepot so as to direct its flames directly against the firepot walls, said burner being so constructed as to be passed easily through the fire door of the furnace even though said door is substantially smaller than the firepot.

Other objects are simplicity and economy of construction, ease and convenience of installing the burner without disassembling the furnace, and adaptability of the burner to be used in a wide variety of furnaces.

With these objects in view, as well as other objects which will appear in the course of the specification, reference will be had to the drawing, wherein:

Figure 1 is a vertical mid-section through a furnace embodying the present invention.

Fig. 2 is a section taken on line II—II of Fig. 1, with parts broken away.

Fig. 3 is a perspective view of the burner and supply pipe assembly shown apart from the furnace.

Fig. 4 is a plan view of the burner, with parts broken away.

Fig. 5 is an enlarged section taken on line V—V of Fig. 4, showing a portion of the firepot and supporting disc in dotted lines.

Fig. 6 is a longitudinal section through the burner pipe, taken substantially on line VI—VI of Fig. 5.

Fig. 7 is an enlarged fragmentary section taken on line VII—VII of Fig. 4.

Fig. 8 is a perspective view of the burner with its sections relatively positioned for insertion into the furnace.

Fig. 9 is an enlarged fragmentary section taken on line IX—IX of Fig. 2.

Fig. 10 is a section taken on line X—X of Fig. 9.

Like reference numerals apply to similar parts throughout the several views, and the numeral 2 applies to a substantially circular base plate supported on the floor and having an upright peripheral flange 4 to which is secured the lower

2

edge of a substantially cylindrical furnace casing 6. A front plate 8 is securely attached to and forms the forward wall of casing 6, and a bonnet 10 closes the upper end of the casing. A cold air duct 12 communicates with the lower portion of said casing, and hot air ducts 14 communicate with said casing through bonnet 10. An ash chamber 16 is secured to base plate 2 substantially centrally within casing 6, and is provided with a forward extension 18 which extends through front plate 8, and is normally provided at its outer end with a closure door. In the present application, however, said forward extension is sealed with a wall 20 of firebrick through which the gas supply pipe extends as hereinafter described.

Said ash chamber supports a firepot 22, said firepot supports a combustion dome 24, and said combustion dome supports a heat radiator 26, all in the manner of a standard coal furnace. Combustion dome 24 is provided with a forward tubular extension 28 through which coal is normally introduced into the firepot, said extension projecting through front plate 8 and being closed at its outer end by fire door 30. Extension 28 is of substantially smaller cross-sectional dimensions than firepot 22. Radiator 26 is provided with a rearward extension 32 which projects through casing 6 for connection with a suitable flue pipe, not shown, and a forward extension 34 which projects through front plate 8 and is normally closed at its outer end by clean-out door 36. Firepot 22 is circular and slightly tapered, being larger at its upper end. It is provided at its lower end with an inwardly projecting annular flange 38 normally adapted to carry a grate for supporting a firebed.

The structure so far described is standard in coal fired warm air furnaces. Air entering the ash chamber passes upwardly through the firebed where it supplies oxygen for combustion. The gaseous products of combustion then rise through the combustion dome and pass through the radiator and out the flue connection. Air entering casing 6 through duct 12 is heated by contact with the heated walls of the firepot, combustion dome, and radiator, and flows upwardly through hot air ducts 14.

Conversion of this type of furnace to burn gas has not been very successful, for various reasons. The passageways for the gaseous combustion products from the firepot to the flue are necessarily relatively large and unrestricted in a coal furnace, since coal requires a larger amount of air for proper burning and requires a more powerful draft. Gas is burned and liberates its heat much more rapidly with the consumption of a much smaller quantity of air, and the tendency is therefore for the hot burned gases to pass so rapidly to the flue that its heat can not be ef-

ficiently extracted by contact with the walls of the combustion dome and radiator. This results in a high stack temperature and low efficiency. Also, gas burners which are sufficiently small to be introduced into the firepot without disassembling the furnace necessarily produce flames which are substantially spaced apart from firepot walls, which reduces the speed with which the heat of the flames is transferred from the combustion chamber.

According to the present invention, after the grate is removed, an annular support disc **40** is inserted into the firepot and rested on flange **38** which formerly supported the grate. Said disc is of such diameter as to fit snugly within the lower portion of the firepot, and is provided around its inner edge with an upright flange **42**. Said disc may be diametrically split as indicated at **44** in Fig. 2 to facilitate insertion of said disc through extension **28** of combustion dome **24**.

The burner **46**, best shown in Figs. 3 to 8, is substantially circular, being tubular and comprising two substantially semi-circular sections **48** and **50**. Said burner is of such diameter as to rest snugly in the lower portion of the firepot, resting either on disc **40** or on the converging walls of the firepot itself. Sections **48** and **50** are connected at the rearward side of the furnace by threaded coupling **52**, as best shown in Fig. 7. Section **50** is sealed at its forward end with a plug **54**, and section **48** is interconnected at its forward end with a radially inwardly extending gas supply pipe **56**. Coupling **52** provides that sections **48** and **50** of the burner may be turned relatively as shown in Fig. 8 to facilitate insertion into the furnace. When so positioned, one end section of the burner may be inserted through extension **28** of the combustion dome, and when inside it may be turned in such a manner as to permit the other end section of the burner to follow, said sections being gradually brought into coplanar relation as the second section enters the furnace. In this manner a burner having a diameter substantially equal to that of the firepot, and greater than the largest cross-sectional dimension of combustion dome extension **28**, may be inserted into the furnace. After it is inserted, it is lowered into position in the firepot as previously described. It will be noted in Fig. 7 that burner sections **48** and **50** abut firmly within coupling **52** when the sections are brought into coplanar relation. In this manner a substantially gas-tight seal is obtained, although a slight leakage at this point would not be objectionable.

Burner sections **48** and **50** are provided with a series of longitudinally spaced apart holes **58** through which gas escapes and is burned. It will be noted that said holes are relatively widely spaced at the forward end of section **48**, and relatively closely spaced at the forward end of section **50**. This compensates for the reduction of flow pressure in the burner tube as a portion of the gas escapes at each hole, thus providing for substantially uniform consumption of gas around the burner ring, and thereby for even heating of the firepot wall. As shown in Fig. 5, holes **58** are inclined outwardly so as to direct the flames directly against the firepot, and as shown in Fig. 6 are inclined in the direction of flow of the gas as indicated by the arrow. This forward inclination of the holes provides that when gas passing through one of the holes adjacent the forward end of section **48** is ignited by a suitable pilot means, not shown, the flame will ignite gas escaping from the next hole, and so on around the entire burner.

Gas supply pipe **56** which is connected with the burner after it is positioned in the furnace, extends horizontally to the center of the burner, downwardly into ash chamber **16**, and horizontally forwardly through firebrick wall **20**. At its outer end it is provided with a cap **60** through which an injector tube **62** extends. Said injector tube is provided at its inner end with a nozzle **64** having an orifice **66**, as best shown in Figs. 9 and 10, and is connected at its outer end with gas line **68** through valve **70**. Gas passing through nozzle **64** creates a suction which draws air into pipe **56** through holes **72** formed through the walls of said pipe behind the nozzle of the injector tube. The air-gas ratio depends on the ratio between the area of the annular passage **74** between pipe **56** and tube **62**, and the area of orifice **66**, and may be varied to provide the best possible combustion in any particular installation.

A hollow cylindrical wall **76** of refractory material is supported on disc **40** adjacent the inner edge thereof, being positioned by flange **42** of said disc, as best shown in Fig. 1. Said wall is comprised of longitudinal segmental sections **78** having tongue and groove joints therebetween as shown in Fig. 2, and extends upwardly to the top of firepot **22**. A plurality of open-work bars **80** of refractory material are disposed between wall **76** and the firepot walls, each of said bars resting at its lower end between burner **46** and wall **76**, and being inclined outwardly to rest at its upper end against the firepot wall substantially at the top thereof. Sufficient bars are employed to extend entirely around the firepot, as shown in Fig. 2. The space between wall **76** and bars **80** is filled with broken lumps **82** of refractory material. Flange **42** is notched as at **84**, and the lower edge of wall **76** is notched as at **86**, to accommodate gas supply pipe **56**.

Since burner **46** directs its flames directly against the firepot walls, and since refractory wall **76** and bars **80** further deflect the heat outwardly against said firepot, the firepot walls are maintained at a very high temperature, which promotes a high rate of heat transfer to the air flowing through furnace casing **6**, and consequently a more efficient use of the heat. Furthermore, refractory members **76**, **80**, and **82** absorb and retain a large amount of heat until it can be transferred through the combustion chamber walls.

What I claim is:

1. In a furnace of the class described having a circular firepot, a gas burner disposed in the lower portion of said firepot and comprising a tube of substantially circular form having an outer diameter substantially equal to that of said firepot, means for supplying gas to one end of said burner tube, said tube having longitudinally spaced holes formed therein adapted to direct flames against the walls of said firepot, said holes being inclined upwardly and outwardly and forwardly inclined in the direction of gas flow in said burner tube, and progressively more closely spaced in the direction of gas flow.

2. For use in combination with a furnace of the class described having a combustion chamber with a firepot forming the lower portion thereof and having an access opening to said combustion chamber, the greatest dimension of said opening being smaller than the diameter of

said firepot, a substantially circular gas burner comprising two substantially semi-circular sections of tubing, said burner being adapted to rest in said firepot and having an outer diameter substantially equal to the inner diameter of said firepot, and means interconnecting a pair of corresponding ends of said burner sections for relative axial oscillation, whereby said burner may be relatively positioned for insertion into the furnace through said access opening.

3. For use in combination with a furnace of the class described having a combustion chamber with a firepot forming the lower portion thereof, and having an access opening to said combustion chamber, the greatest dimension of said opening being smaller than the diameter of said firepot, a substantially circular gas burner comprising two substantially semi-circular sections of tubing, said burner being adapted to rest in said firepot and having an outer diameter substantially equal to the inner diameter of said firepot, and a threaded coupling interconnecting a pair of corresponding ends of said burner sections for relative axial oscillation, whereby said burner sections may be disposed angularly to each other for insertion into the furnace through said access opening.

4. For use in combination with a furnace of the class described having a combustion chamber with a firepot forming the lower portion thereof, and having an access opening to said combustion chamber, the greatest dimension of said opening being smaller than the diameter of said firepot, a substantially circular gas burner comprising two substantially semi-circular sections of tubing, said burner being adapted to rest in said firepot and having an outer diameter substantially equal to the inner diameter of said firepot, and a threaded coupling interconnecting a pair of corresponding ends of said burner sections for relative axial oscillation, whereby said burner sections may be disposed angularly to each other for insertion into the furnace through said access opening, the ends of said burner sections normally abutting within said coupling to form a gas seal.

5. The combination, with a furnace of the class described having an ash chamber provided with an access opening, a circular firepot having downwardly convergent walls supported on said ash chamber and having a support flange at the lower end thereof, and a combustion dome supported on said firepot and having an access opening smaller than the minimum diameter of said firepot, of a circular gas burner carried by said support flange and comprising two substantially semi-circular tubular sections and having an outer diameter substantially equal to the minimum diameter of said firepot, said burner being adapted to direct flames against the walls of said firepot, means connecting a corresponding pair of ends of said burner sections for relative oscillation whereby said burner may be extended for insertion into the furnace through the access opening of said combustion dome, and a gas supply pipe removably connected to the opposite end of one of said burner sections and extending into said chamber and outwardly through the access opening thereof.

6. The combination, with a furnace of the class described having an ash chamber provided with an access opening, a circular firepot having downwardly convergent walls supported on said ash chamber and having a support flange at the lower end thereof, and a combustion dome supported on said firepot and having an access opening smaller than the minimum diameter of said firepot, of an annular support disc carried horizontally on said support flange, a circular tubular gas burner carried on said disc and having a diameter substantially equal to the inner diameter of said firepot, said burner being adapted to direct flames against the walls of said firepot, means for supplying gas to said burner, a vertically disposed cylindrical refractory wall disposed within said burner, said wall being supported at its lower end by said disc and extending the full height of said firepot, and a plurality of refractory bars each having its lower end resting between said burner and said wall and having its upper end resting against the firepot wall.

7. The combination, with a furnace of the class described having an ash chamber provided with an access opening, a circular firepot having downwardly convergent walls supported on said ash chamber and having a support flange at the lower end thereof, and a combustion dome supported on said firepot and having an access opening smaller than the minimum diameter of said firepot, of an annular support disc carried horizontally on said support flange, a circular tubular gas burner carried on said disc and having a diameter substantially equal to the inner diameter of said firepot, said burner being adapted to direct flames against the walls of said firepot, means for supplying gas to said burner, a vertically disposed cylindrical refractory wall disposed within said burner, said wall being supported at its lower end by said disc and extending the full height of said firepot, a plurality of refractory bars each having its lower end resting between said burner and said wall and having its upper end resting against the firepot wall, and lumps of refractory material filling the space between said wall and said bars.

JAMES N. ROSS.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
442,863	Cox, Jr.	Dec. 16, 1890
470,679	Jenks	Mar. 15, 1892
642,055	Ridgway	Jan. 23, 1900
734,201	Thornton	July 21, 1903
884,309	Biglar	Apr. 7, 1908
964,902	Fall	July 19, 1910
1,181,674	Korn	May 2, 1916
1,217,551	Armor	Feb. 27, 1917
1,578,210	Schrader	Mar. 23, 1926
1,667,133	Schrader	Apr. 24, 1928
1,705,168	Young	Mar. 12, 1929
1,799,902	Hoff	Apr. 7, 1931
1,912,254	Calhoun	May 30, 1933
1,936,950	Pauloo	Nov. 28, 1933
1,946,791	Hagan	Feb. 13, 1934
1,950,470	Bellamy	Mar. 13, 1934
2,025,089	Bulger	Dec. 24, 1935
2,210,551	Lengyel	Aug. 6, 1940

FOREIGN PATENTS

Number	Country	Date
149,539	Great Britain	Aug. 19, 1920
333,269	Great Britain	Aug. 11, 1930