Feb. 24, 1953 W. F. MILBURN 2,629,152

HOT TOP

Filed Jan. 12, 1950

Fig. 1

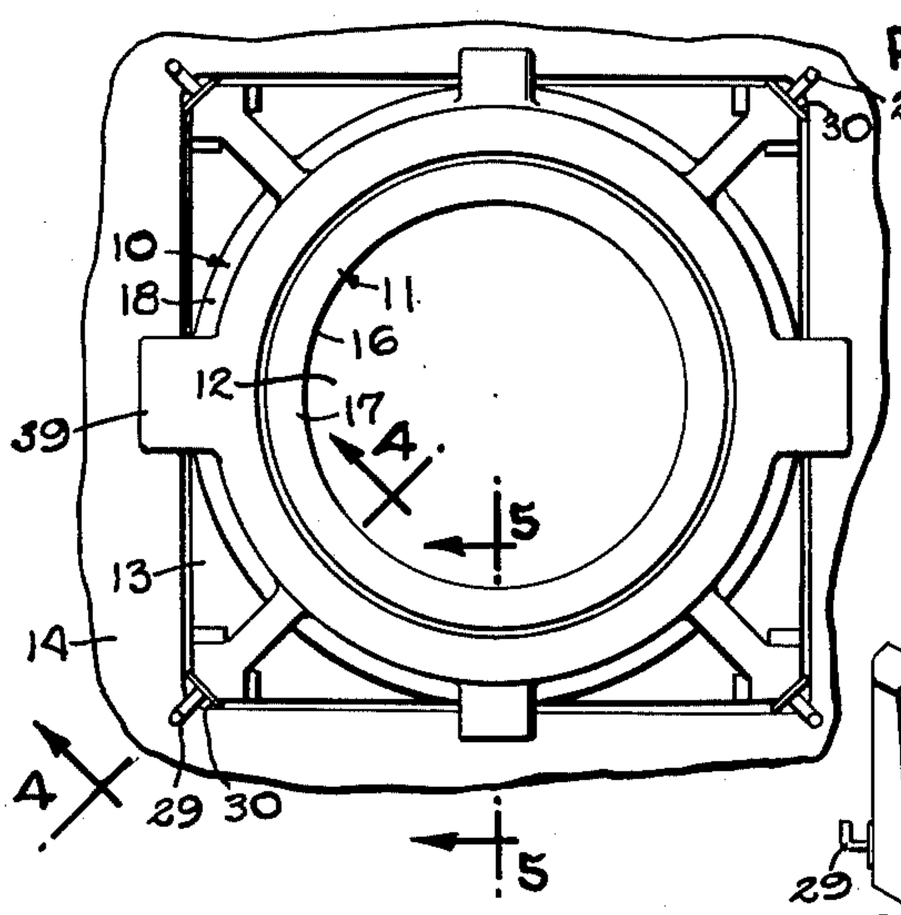



Fig. 2

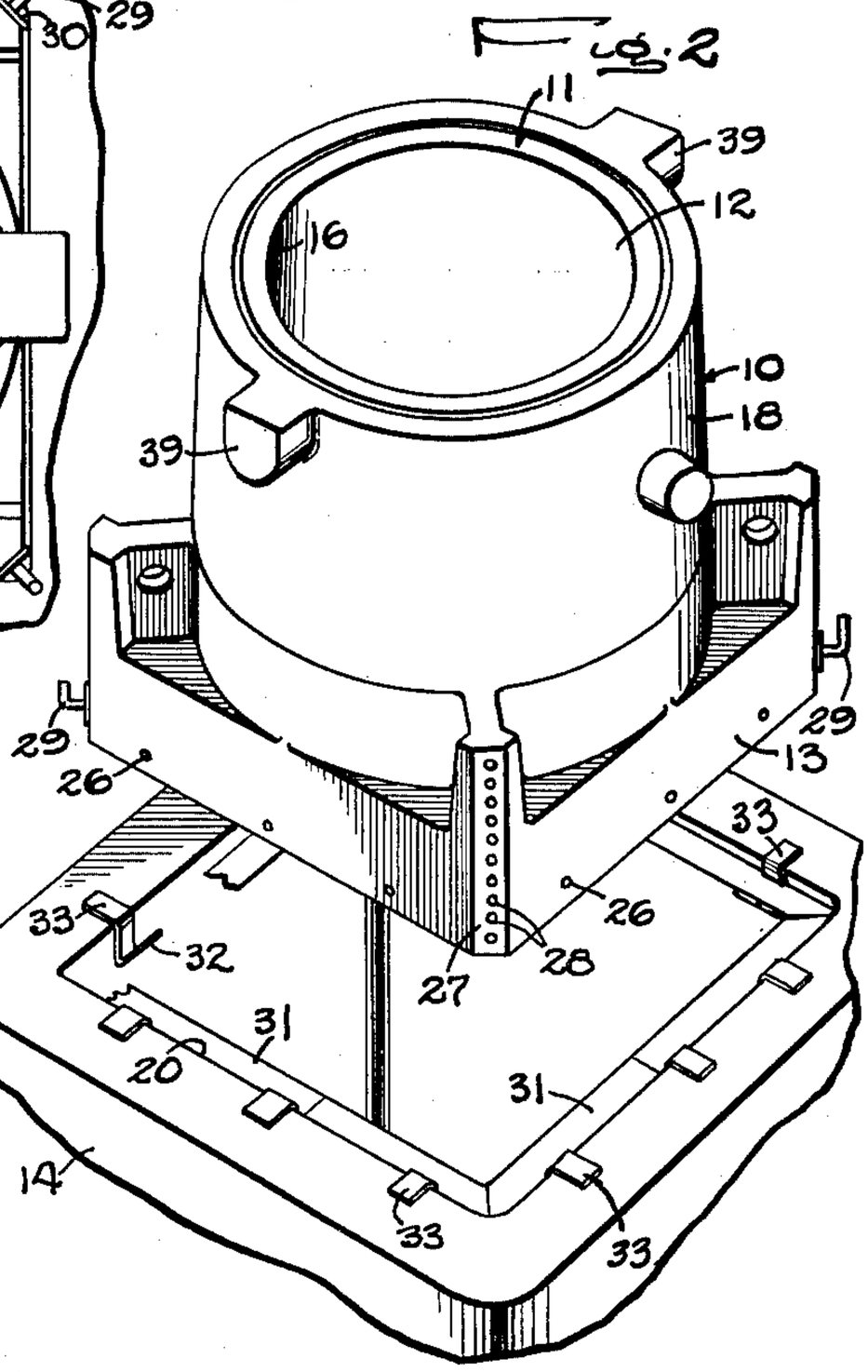



Fig. 3

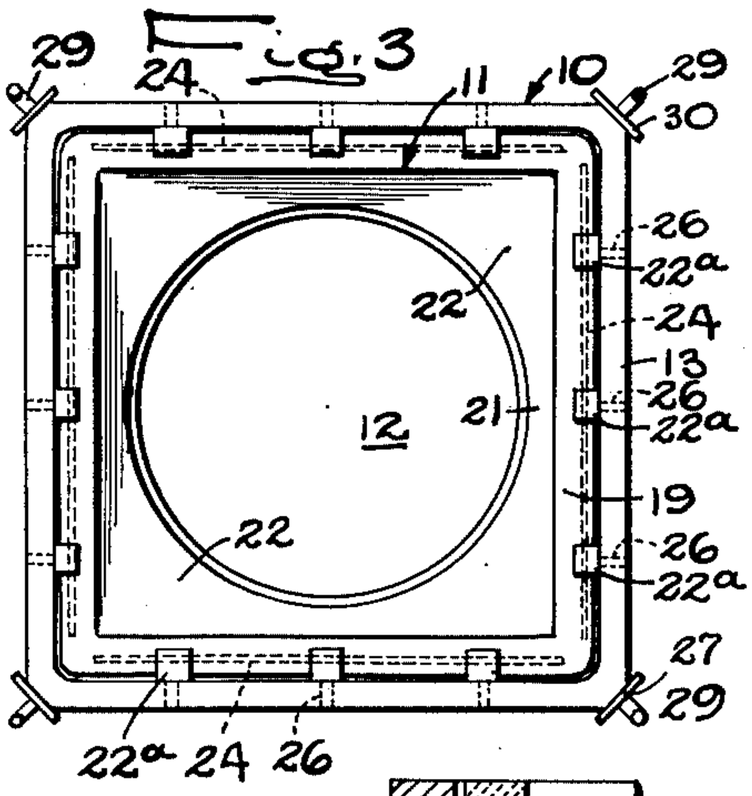



Fig. 4

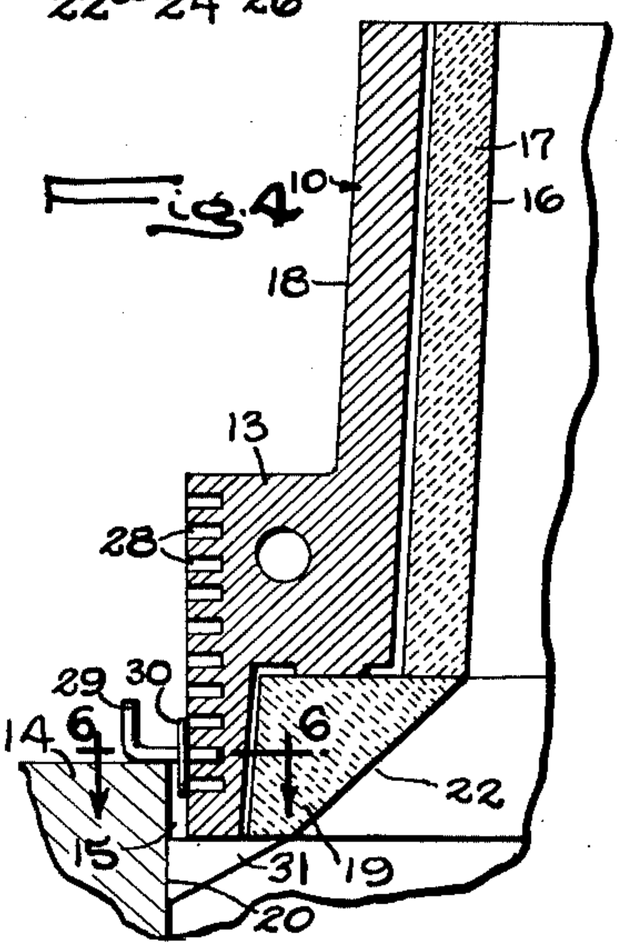



Fig. 5

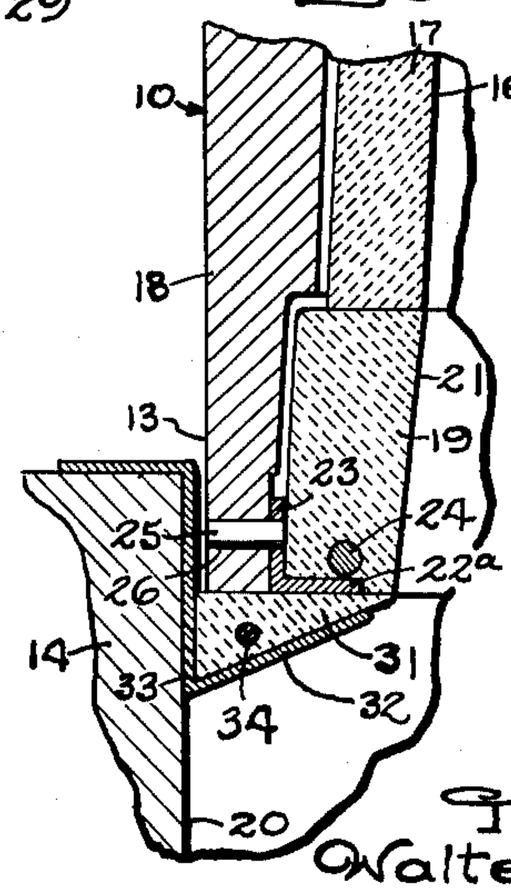
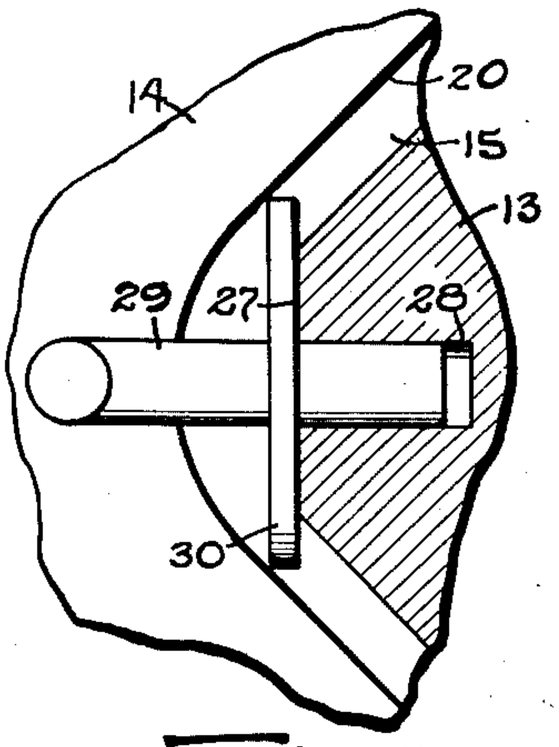



Fig. 6

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## HOT TOP

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4 Claims. (Cl. 22—147)

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This invention relates to a so-called hot top which comprises a tubular metal casing lined with ceramic or refractory material and adapted to be received in the top opening of an ingot mold to retain a body of molten metal and feed the ingot during congealing thereof.

The primary object of the invention is to provide a hot top which is adapted to feed an ingot in a generally rectangular mold more effectively than the hot tops used heretofore.

Another object is to shape the lining of the hot top in a novel manner so as to reduce the rate of cooling of the molten metal therein as compared to prior hot top constructions.

A more detailed object is to shape the internal wall of the refractory lining adjacent the bottom thereof in a novel manner to enable the remaining major length of the wall to be cylindrical in contour and yet insure complete filling of all parts of the mold with molten metal from the hot top.

The invention also resides in the novel manner of protecting the metal casing of the hot top from contact with metal in the mold and supporting the hot top in a centered position in the mold, and in the novel character of the means for supporting the refractory lining in the casing.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which

Figure 1 is a plan view of a hot top construction embodying the novel features of the present invention and shown in pouring position in the top of a mold.

Fig. 2 is a perspective view of the hot top separated from the top portion of the mold.

Fig. 3 is a bottom view of the hot top.

Figs. 4 and 5 are fragmentary sectional views taken along the lines 4—4 and 5—5 of Fig. 1.

Fig. 6 is a fragmentary sectional view taken along the line 6—6 of Fig. 4.

In the drawings, the invention is shown for purposes of illustration in a hot top comprising a generally tubular cast metal casing 10 having a tubular lining 11 therein of refractory or ceramic material defining a central feeder recess 12. The base or lower portion 13 of the casing 10 conforms in cross-sectional shape to the internal contour of the ingot mold 14 on which the hot top is to be used. To fit the base 13 loosely within the upper open end of the mold, it is made of generally rectangular cross section with outside dimensions slightly smaller than the interior of the mold so as to leave a small clearance 15.

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In accordance with the present invention, the refractory hot top lining 11 has an internal contour different than the internal cross section of the mold 14 and somewhat smaller in diameter so as to minimize the internal surface area and thereby reduce, as compared to prior hot top constructions, the rate of cooling of the molten metal whereby to insure more effective feeding of the ingot as the metal solidifies in the mold 14. To these ends, the internal wall 16 of the lining 11 is substantially circular in cross section and generally cylindrical from the upper end thereof to a point adjacent but short of the hot top bottom, and the remaining bottom portion of the lining is flared outwardly and downwardly to merge the lining wall with the rectangular internal contour of the mold.

Herein, the cylindrical and flared portions of the lining wall 16 are formed as separate pieces of refractory material, the upper one being a generally cylindrical tube 17 of uniform thickness flared downwardly slightly to provide the necessary internal draft for permitting the hot top to be lifted off from the solidified ingot. This tube is enclosed by and retained in the correspondingly shaped upper portion 18 of the metal casing 10, this portion being substantially smaller in diameter than the lower end or base 13 which is in the form of an external flange of the rectangular shape described above and of a depth corresponding approximately to the thickness of a ring-like member 19 of refractory material forming the lower portion of the lining 11. Lugs 39 are formed on the exterior of the upper part of the casing 10 to facilitate attachment of hoisting cables for handling the hot top.

To merge the cylindrical wall 16 of the hot top lining with the rectangular wall 20 of the mold 14, the interior of the refractory ring-like member 19 is flared outwardly and downwardly preferably around its entire inner periphery. In this instance, the internal wall of the member 19 is pyramidal in shape having generally flat sides 21 flaring gradually outward adjacent the four sides of the rectangular bases 13 and merging gradually into corners 22 which extend well into the corners of the hollow base flange 13. At its upper end, the internal wall of the lower refractory part 19 is clrcular in cross section and has the same diameter as the lower end of the cylindrical internal wall of the upper lining part 17. The upper and lower refractory parts 17 and 19 are disposed in end to end

abutment and the external surface of the lining thus formed flares downwardly slightly throughout its length and fits quite loosely in the corresponding flared interior of the casing 10. The lining is supported on ledges 22a projecting inwardly from the lower end of the base flange 13 and secured detachably to the latter to enable the lining to be removed from the casing 10 and replaced from time to time.

In the present instance, the ledges comprise flanges on a series of L-shaped brackets 23 and are fed into the bottom of the ring member 19 so as to be flush with the lower end surface of the hot top lining. The brackets are spaced uniformly around the refractory ring 19 and preferably bear against reinforcing bars 24 of metal embedded in the ring in the molding thereof. The other legs of the brackets project upwardly between the exterior of the ring 19 and the interior of the base flange 13 and are apertured to receive removable pins 25 which project outwardly through holes 26 in the flange 13. After removal of the pins 25, the brackets 23 and the lining may be withdrawn endwise from the bottom of the casing 10.

The hot top is adapted to be supported on the mold in a novel manner to enable the corners of the base 13 to be centered relative to the corners of the mold whereby the clearance 15 between the casing and the mold is substantially uniform. For this purpose, each corner of the base 13 is beveled as indicated at 27 and formed with one or more inwardly extending holes 28 adapted to receive a pin 29 which rests on the top of the mold. The beveled corners of the casing cooperate with the walls of the mold at the corners of the latter to form a recess (Fig. 6) adapted to receive a shoulder 30 carried by the pin 29 and engageable with the side walls of the mold to space the sides of the casing base equidistantly from the mold walls. In the present instance, each pin is L-shaped to facilitate its removal from the casing, and the shoulder 30 thereon is in the form of a washer which is pressed onto the pin and lies flat against the beveled corner surface 27. To permit the hot top to be supported at different depths below the top of the mold, a series of the holes 28 may be formed along each of the corners 27.

A novel means is provided for covering and shielding the lower end of the metal casing flange 13 so as to protect the latter from contact with the molten metal. For this purpose, a ring-like band 31 of molded refractory material fits snugly around the inner periphery of the mold and is suspended from the top of the latter. The band comprises a series of bars of refractory material arranged end to end around the interior of the mold and mitered at the corners as shown in Fig. 2. Each bar rests in V-shaped seats formed by upright intermediate portions and upwardly inclined end portions 32 of two Z-shaped strap-like hangers 33 composed of readily fusible metal. The other end portion of each hanger projects outwardly and hooks over the upper end of the mold. The outer face of each bar is recessed to receive the upright intermediate portion of the supporting hangers. Preferably, each bar is reinforced by a metal rod 34.

The cross section of the bars is a right triangle having one side which fits flatly against the lower end of the hot top and overlaps the ends of both the metal casing flange 13 and the refractory lining member 19, being of a width approximately equal to the sum of widths of the exposed end



of the member 19 at the narrowest points around the latter and the end of the casing flange (see Fig. 5). Thus, the downwardly and outwardly inclined inner faces of the bars 31 substantially merge with the flared surfaces 21 and 22 of the hot top lining and thus constitute downwardly flared continuations of the lining wall. As a result, there are no pockets or abrupt corners along the refractory wall which will in any way interfere with the free flow of metal from the hot top into the mold even while the metal in the latter is partially solidified.

In use, the hot top is mounted on the mold in the manner described above and molten metal is poured into the mold through the hot top which is filled to a level well above the top of the mold thus filling completely the recesses or flared portions 21 and 22 of the hot top lining. Then, the supporting pins 29 are withdrawn from the holes 28 in the base 13 to permit the hot top to float on the molten metal which melts away the metal of the hangers 33 so that the sealing band 31 also floats on the metal in the mold.

As the metal around the outside of the ingot begins to congeal the shrinkage at the top of the mold is made up by the flow of molten metal from the hot top. During the slow cooling of the metal in the hot top achieved by virtue of the generally cylindrical shape of the upper part of the lining 11, this metal remains in the liquid state for a prolonged period and continues to fill all of the parts of the mold. Such free outward flow of the metal even after substantial shrinking of the latter is facilitated by the gradual downward flaring of the interior of the hot top lining from the cylindrical part thereof all the way down to the wall of the ingot mold.

I claim as my invention:

1. A hot top comprising a tubular metallic casing having a base portion of generally rectangular cross section, an upper tubular section of refractory lining material around the interior of said casing extending to a point adjacent but short of the bottom of the latter and having a generally cylindrical internal wall, and a tubular lower lining section of refractory material rectangularly shaped on its exterior and fitting into said base portion of said casing in abutment with the bottom of said upper lining section, said lower lining section having an inner peripheral wall of generally circular cross section at its top to merge with the generally cylindrical internal wall of said upper section and flaring outwardly and downwardly therefrom into the corners of said base portion to be of rectangular cross section at its bottom.

2. A hot top comprising a tubular metallic casing having a base portion of generally rectangular cross section, and a tubular lining of refractory material around the interior of said casing extending to a point adjacent the bottom of the latter and having a generally continuous internal wall which is generally cylindrical in shape from the top of the lining substantially throughout its length to a point adjacent but short of the lower end of said casing, the remaining lower part of said lining wall being of rectangular cross section at the bottom and being flared outwardly and downwardly from the generally cylindrical upper portion into the corners of said casing base portion.

3. A hot top for use with an ingot mold having a generally rectangular top opening defined by side walls, said hot top comprising, a tubular casing having a base portion of generally rec-

tangular cross-section corresponding to the shape of the top opening of the mold and adapted to fit loosely into the latter, each of the corners of said base portion being formed with inwardly extending holes spaced therealong and adapted to receive a support pin engageable with the top of the mold at a corner thereof for supporting said casing in the mold, and a tubular refractory lining extending around the interior of said casing, said casing corners being beveled to cooperate with the side walls of said mold to form recesses adapted to receive flanges carried by said pins and engageable with said side walls to center said base portion in said mold opening.

4. A hot top for use with an ingot mold having a generally rectangular top opening therein defined by side walls, said hot top comprising, a tubular casing having a generally rectangular base portion adapted to fit within said mold opening with a clearance between the base portion and the mold, the corners of said base portion having inwardly extending holes therein adapted to receive pins engageable with the top of said mold for supporting said casing thereon, and a tubular lining of refractory material within said casing, at least two of the diametrically opposed ones of said pins having shoulders thereon conforming to the contour of the corners of said



base portion and engageable with the inner side of said mold walls to cooperate with the latter and center the base portion in said mold opening.

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## REFERENCES CITED

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

UNITED STATES PATENTS

| Number | Name | Date |
|---|---|---|
| 1,431,803 | Howard et al. | Oct. 10, 1922 |
| 1,523,208 | Howard et al. | Jan. 13, 1925 |
| 1,804,204 | Charman et al. | May 5, 1931 |
| 1,804,208 | Charman | May 5, 1931 |
| 1,921,729 | Charman | Aug. 8, 1933 |
| 1,921,731 | Charman | Aug. 8, 1933 |
| 1,994,683 | Brown | Mar. 19, 1935 |
| 2,030,199 | Charman | Feb. 11, 1936 |
| 2,030,848 | Charman | May 18, 1937 |
| 2,263,437 | Cameron | Nov. 18, 1941 |
| 2,465,977 | Marburg | Mar. 29, 1949 |

FOREIGN PATENTS

| Number | Country | Date |
|---|---|---|
| 228,016 | Great Britain | Jan. 29, 1925 |
| 326,785 | Great Britain | Mar. 19, 1930 |