April 2, 1957 C. M. MOE 2,787,133

ICE MAKING AND EJECTING MACHINE

Filed June 22, 1954 2 Sheets-Sheet 1

Fig. 1

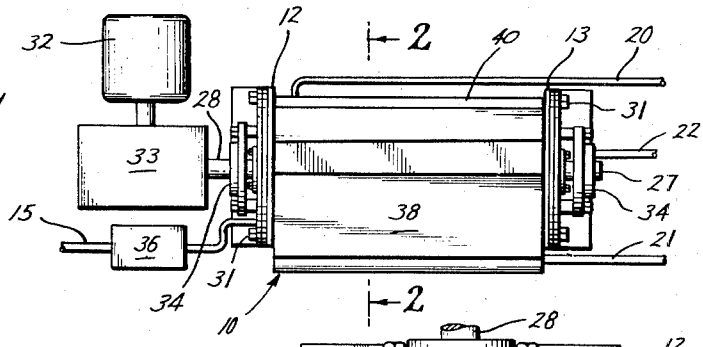
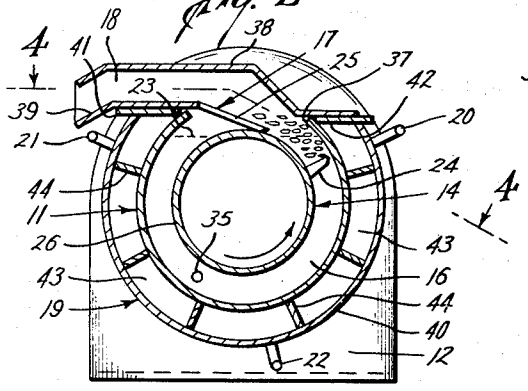


Fig. 2



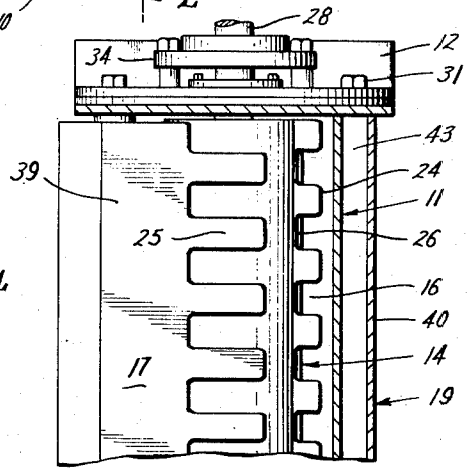


Fig. 4

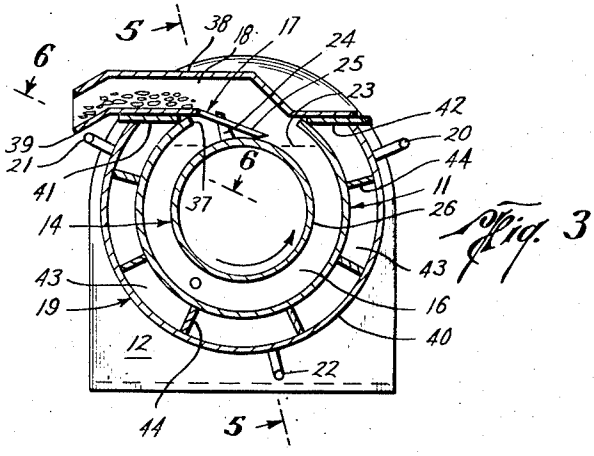


Fig. 3

Clarence M. Moe
INVENTOR.

BY

Browning, Simms & Hyer
ATTORNEYS

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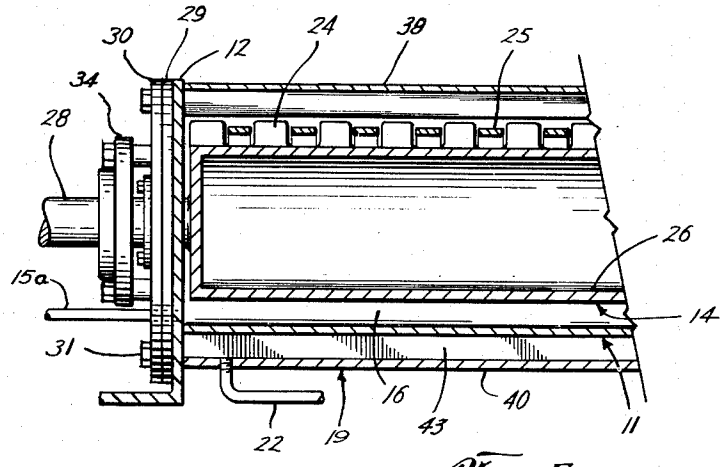


Fig. 5

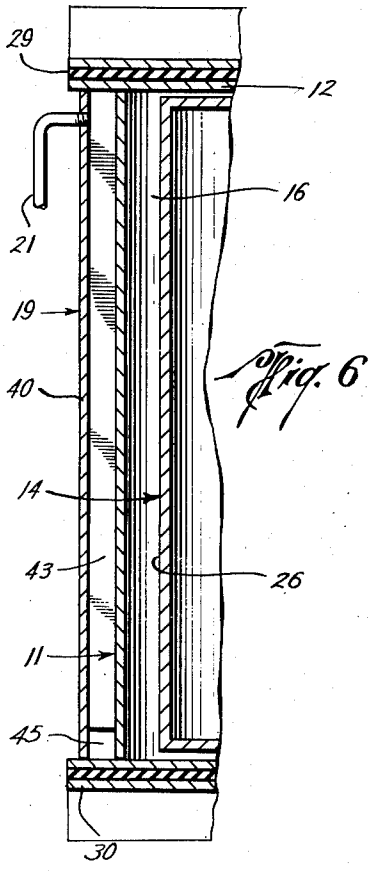


Fig. 6

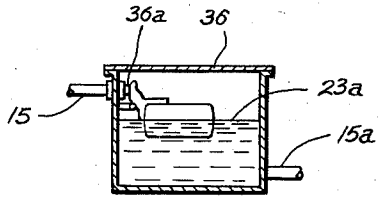


Fig. 7

Clarence M. Moe
INVENTOR.

BY

Browning, Simmons & Hyer

ATTORNEYS

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ICE MAKING AND EJECTING MACHINE

Clarence M. Moe, Fort Worth, Tex.

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8 Claims. (Cl. 62—106)

This invention relates to a machine in which ice may be formed and ejected therefrom in substantially continuous fashion. In one of its aspects, it relates to a machine adapted to form ice in an annular space thereof and provided with novel means for collecting and positively ejecting the ice from the annular space. The present application constitutes a continuation-in-part of my copending application, Serial No. 367,386, filed July 13, 1953, and entitled "Ice Making Machine," which is now abandoned.

It is an object of this invention to provide a machine having maximum ice making and ejecting capacity per unit of volume thereof.

Another object is to provide a machine having a space in which ice may be formed and subsequently positively ejected with a minimum requirement of moving parts.

Still another object is to provide a machine adapted to form ice within an annular space thereof and operable upon rotation of only a single member to collect said ice and eject the same from the machine.

A further object is to provide a machine of the character described in the foregoing object wherein the collecting member is rotatable within the annular space and cooperable in a novel manner with a complementary member fixedly disposed with respect to the machine for positively ejecting the collected ice from the machine.

A still further object is to provide a machine of the character above-described in which said complementary members comprise blade parts extending substantially across the annular space and movable past one another in a manner to remove the ice from the collecting member and direct it toward an outlet from the machine.

A still further object is to provide an ice making and ejecting machine having an annular space adapted to contain water to be frozen, a refrigerant chamber substantially surrounding said space to freeze said water, and means operable within said space for collecting and ejecting said ice, each of said elements extending substantially horizontally of the machine whereby ice may be ejected therefrom through an outlet extending substantially the entire length of said machine.

A still further object is to provide a machine in which ice may be formed by circulating a refrigerant gas adjacent to a supply of water, wherein the gas is circulated through a chamber having a novel arrangement of passages and inlet and outlet thereto.

Other objects, advantages and features of this invention will be apparent to one skilled in the art upon a consideration of the written specification, the attached claims and the annexed drawings.

In the drawings, wherein like referenced characters are used throughout to designate like parts:

Fig. 1 is a top plan view of an illustrative embodiment of the machine of this invention, including power means for rotating the ice collecting member as well as means for supplying water to the annular ice forming space and circulating refrigerant gas through the refrigerant chamber;

Fig. 2 is an enlarged cross-sectional view of the machine taken substantially along broken line 2—2 and showing the ice collecting member in a position just prior to ejection of the collected ice;

Fig. 3 is a view similar to Fig. 2, with the ice collecting member in a position during ejection of the collected ice;

Fig. 4 is a partial longitudinal sectional view of the machine, taken substantially along broken line 4—4 of Fig. 2;

Fig. 5 is another longitudinal sectional view of the machine, taken substantially along broken line 5—5 of Fig. 3;

Fig. 6 is a still further longitudinal sectional view of the machine, taken substantially along broken line 6—6 of Fig. 3 and

Fig. 7 is a cross-sectional view of a suitable float valve mechanism which is shown diagrammatically in Fig. 1.

In accordance with this invention and with reference to the above-described drawings, there is provided an ice making and ejecting machine designated in its entirety by the numeral 10 and including a substantially horizontally extending cylindrical drum 11 which is closed at opposite ends by standards 12 and 13 and houses a rotatable ice collecting member 14. Water is supplied from a suitable source (not shown) through a line 15 to an annular space 16 between the inner periphery of the drum and the member 14. The member 14 is adapted upon rotation to collect ice formed within the space 16, in a manner to be described, and cooperate with a complementary member 17 fixed with respect to the drum to remove the collected ice from the member and eject it through an outlet 18 extending longitudinally along an upper portion of the machine. As will be described more particularly hereinafter, the members 14 and 17 are provided with complementary blade parts which permit them to extend substantially across the space 16 but to move past one another in removing the collected ice.

Ice is formed from the water within the space 16 by means of the circulation of refrigerant gas through a chamber 19 which substantially surrounds and extends coextensively the length of drum 11 and which is closed at opposite ends by the standards 12 and 13. Refrigerant gas is introduced into the chamber from a conventional mechanical refrigeration cycle (not shown) through inlets 20 and 21 and discharged therefrom and returned to the cycle through an outlet 22. More particularly, the gas is preferably introduced toward the upper portion of the chamber and circulated in counterflow relation to the outlet therefor toward the lower portion of the chamber.

It will be understood from only this brief description that upon the maintenance of a water supply within the space 16 at a level such as indicated at 23, the continuous circulation of refrigerant gas through the chamber 19 will form ice upon the inner periphery of the drum 11 and rotation of the collecting member will collect ice on a blade part 24 thereof and carry said ice to a position such as shown in Fig. 2. Continued rotation of the member 14 will cause blade part 24 to coact with and move through a complementary blade part 25 on member 17, as indicated in Fig. 3, such that ice will be removed from the collecting member and be ejected through the outlet 18.

Referring now more particularly to the above-described apparatus, it can be seen that the collecting member 14 comprises a cylindrical hub portion 26, which is preferably hollow to reduce its weight, to which is secured the blade part 24. The hub portion is mounted for rotation upon stub shafts 27 and 28 at opposite ends thereof, said shafts being journaled within openings through

standards 13 and 12, respectively. As best shown in Figs. 5 and 6, a gasket 29 and supporting member 30 are secured by bolts 31 or other suitable means to the outside of the standards to provide a seal about the shafts and insure that water will not leak out from the space 16. As shown in Fig. 1, the shaft 28 may be driven at a desired speed by motor 32 through a conventional gear reducer 33. As well, each of the shafts 27 and 28 are supported in suitable bearings 34 secured to the opposite standards 12 and 13.

The water supplied through line 15 is maintained at a predetermined level 23 with annular space 16 by means of a suitable float valve mechanism 36, which may correspond to the mechanism shown in Fig. 1 of Nitsch Patent No. 2,597,515. More particularly, as shown in Fig. 7, the passage of water from line 15 into the mechanism 36 is controlled by means of a float-operated valve 36*a* for maintaining the water level 23*a* therein. Water from the mechanism 36 is conducted to the inlet 35 (Fig. 2) by means of line 15*a* therebetween so as to maintain the water in the space 16 at a level 23 corresponding to the level 23*a*. It will be understood that with the gaskets 29 tightly engaging the stub shafts 27 and 28 and with the drum 11 and refrigerant chamber 19 secured as by welding to the inner sides of the standards 12 and 13, the space 16 will be fluid tight against leakage of water at a level 23 and the chamber 19 will be fluid tight against the escape of circulating refrigerant gas. As well, with the opposite ends of the hub 26 of collecting member 14 closely adjacent the standards, the danger of ice chips jamming the rotation of the collecting member by falling into the space between said hub ends and standards will be obviated.

It can be seen that the blade part 24 comprises individual teeth arranged lengthwise and in spaced relation along the hub portion 26 of the collecting member 14. Each of the teeth are equally spaced apart so as to provide in effect a serrated blade along the length of the periphery of the hub portion. With the collecting member 14 arranged substantially concentrically within the drum 11, it will be understood that the teeth 24 may extend from the periphery of the hub portion to a point substantially adjacent the inner periphery of the drum such that, upon rotation of the collecting member, substantially all of the ice will be scraped and collected from the inner periphery of the drum.

Of course, the diameter of the hub portion, and thus the size of the space 16, may generally be determined by the ice making capacity of the machine. Also, of course, the desired speed of rotation of the collecting member 14 and thus that of the blade teeth 24 is governed by the rate at which ice is formed in the space 16. In fact, although only one such blade is shown in this particular embodiment of the invention, it will be understood that a plurality of blades may be arranged about the hub portion 26, depending upon the capacity of the refrigeration cycle used. On the other hand, the teeth or blade parts 24 may be arranged in staggered relation about the periphery of the hub portion 26 such that they form in effect a spiral blade. In actual practice and with the embodiment shown in the drawings, I have used a refrigeration cycle having a ⅓ H. P. compressor in combination with a collecting member rotating at a speed of 1 R. P. M. Of course, the greater the output of the refrigeration cycle, the greater the need for additional blades, or, on the other hand, the greater the possibility for increased speed of rotation of the collecting member.

As best shown in Figs. 2 and 3, the cylindrical drum 11 is provided with an opening 37 running lengthwise of its upper portion and communicating with the outlet 18. The aforesaid outlet comprises a conduit formed by a top wall 38 which extends the length of the machine and covers a lower wall 39 which is preferably a portion of the complementary member 17. As can be seen from the drawings, the main portion of the conduit forming the outlet 18 is substantially horizontal and may be turned down at its outer end to facilitate ejection of the ice therefrom. It will be understood from the foregoing that maximum ice making and ejecting capacity is accomplished by means of this longitudinally extending outlet, especially inasmuch as it is disposed along the upper portion of the machine such that substantially all of the remainder of the machine may be devoted to ice making.

Secured to and projecting from the inner end of the lower wall 39 is the blade part 25 of the collecting member 17 which, as previously mentioned, is thus fixed with respect to the drum 11. Similar to the blade part 24, the part 25 comprises spaced teeth arranged longitudinally of the drum to form in effect a serrated blade. As best shown in Figs. 4 and 5, the teeth 24 and 25 are complementary in that they are arranged in staggered relation to one another such that the serrated blade elements may be moved past one another. In other words, with the teeth 25 extending across the annular space 16 to a point at least substantially adjacent the outer periphery of the hub portion 26, the teeth 24 will actually move through and past the teeth 25 upon rotation of the collecting member 14. Thus, as illustrated in Figs. 2 and 3, the ice collected in front of the blade parts 24 will be diverted by the teeth 25 into the outlet 18 as the teeth 24 pass through the teeth 25, thus effecting a positive and mechanical removal of the ice from the collecting member into the outlet from which the ice is ejected from the machine. As shown, the water level 23 is preferably maintained below the substantially horizontal portion of the lower wall 39 such that water will not escape from the space 16 and be ejected outwardly of the machine with the ice.

It will be obvious that some of the particles of ice removed by rotatable blade 24 will be of sufficient length such that they will extend over the side edges of the teeth upon this rotatable blade. These individual particles or slivers of ice will be deposited upon the serrated teeth of fixed blade 25 as the rotatable blade passes its Fig. 3 position. It will be further understood that when a number of such slivers are built up upon the fixed blade that some of them will be shoved into the position indicated in Fig. 3. In fact, the movement of the blade 24 relative to the blade 25 may be sufficient to push such articles by themselves into the position shown in the horizontal portion of the outlet. Further, those slivers or particles of ice collected on the teeth of rotatable blade 24 which do not extend or project over the side edges of the blade teeth will, upon several rotations of the blade, compact with other particles so as to form one or more composite particles or slivers of the size or length necessary for depositing upon fixed blade 25. Although, as noted above, it is preferred to maintain a water level below the water outlet, the machine could operate with a water level above such outlet, in which case the particles removed by rotatable blade 24 would be floated out of the machine, as is the case in many prior ice making machines.

As shown in Figs. 2 and 3, the blade element formed by the teeth 25 is projected across the space 16 in a plane substantially tangential to the periphery of the hub portion 26. Thus, with the blade element comprising the teeth 24 projecting radially from the hub portion, the collected ice will be easily pushed onto the teeth 25 as the teeth 24 pass therethrough. Also, with the teeth 25 forming an extension of the lower wall 39 of the outlet 18, there is a minimum of opportunity for the collected ice to become jammed in the throat of the outlet. Although the illustrated arrangement of the blades is preferred, it will be understood that the fixed blade element need only be sufficiently adjacent the opening 37 and outlet 18 such that it will serve to divert collected ice from the rotary blade element into the outlet. For that matter, the teeth 25 of the complemen-

tary member need not be fixed with respect to the drum 11, but may be movable with respect thereto, the only requirement being that such movement be relative to that of the rotary collecting member 14 in a manner to permit the collected ice to be diverted by the passage of teeth 24 through teeth 25. Of course, the particular arrangement shown, in which the blade element formed by the teeth 25 is fixed, is preferred due principally to the simplicity of the machine which is enabled thereby.

Although applicant has illustrated herein one embodiment of the novel collecting and ejecting means of the present invention which comprises complementary serrated blade elements, it is to be understood that equivalent means may be used. For example, the blade elements may comprise continuous strips of relatively hard rubber or other flexible material which would be deformable upon passage of one by the other to permit substantially the removal action noted above. That, is, in any case, the blade part 25 would serve not only to divert the collected ice into the outlet 18 but also to scrape any ice particles which might form upon or stick to the outer periphery of the hub portion 26.

Turning now to a description of the refrigerant chamber 19, it can be seen that the chamber comprises an outer substantially cylindrical shell 40 which surrounds the drum 11 and which may be closed along its upper ends by longitudinally extending plates 41 and 42, as shown in Figs. 2 and 3. It will also be seen that the standards 12 and 13 support the chamber 19 above the level of the surface upon which the machine rests such that refrigerant gas outlet 22 can be disposed at a point substantially along the lower portion of the chamber. As previously mentioned, the inlet of refrigerant gas is preferably toward the uppermost portion of the refrigerant chamber such that flow of gas is downward during circulation of same through the chamber. As well, two such inlets 20 and 21 are provided and the chamber is divided into a plurality of passages 43 extending longitudinally thereof by means of baffles 44 such that a single outlet 22 may be used.

More particularly, a counter or reverse flow of the refrigerant gas is obtained by providing passages 45 (Fig. 6) through the baffles 44 for connecting adjacent passages 43. That is, each successive baffle 44 is provided with an interconnecting opening at an end opposite from the preceding baffle, such that the refrigerant gas is caused to flow from one end of each passage to the other and a maximum time is provided during which the water within the space 16 may be frozen by the refrigerant gas. As can be seen from the drawings, the gas passing in this counterflow relation from each of the inlets 20 and 21 is discharged from the machine and returned to the refrigeration cycle through the common outlet 22.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth, together with other advantages which are obvious and which are inherent to the apparatus.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

The invention having been described what is claimed is:

1. An ice making and ejecting machine, comprising, a substantially horizontally extending cylindrical drum closed at opposite ends, means for introducing water into the drum, means disposed about and adjacent to a portion of the outer periphery of the drum through which a refrigerant gas may be circulated to form ice from the water on the inner periphery of the drum, a substantially longitudinally extending blade within the drum and mounted for rotation about an axis parallel to the longitudinal axis of the drum, said blade having an outer edge for collecting ice from the inner drum periphery upon rotation of the blade, means for rotating the blade, and an outlet from the upper portion of the drum through which collected ice may be ejected by the blade, said outlet extending substantially coextensively with the length of the blade within the drum, the outlet from the drum including a conduit extending outwardly from an opening through the drum, and means for maintaining the level of water within the drum at a level to prevent escape of said water through said outlet.

2. An ice making and ejecting machine, comprising, a substantially cylindrical drum closed at opposite ends, means for introducing water into the drum and maintaining it at a predetermined level, means disposed about and adjacent to a portion of the outer periphery of the drum through which a refrigerant gas may be circulated to form ice from the water on the inner periphery of the drum, a rotatable hub mounted within and spaced from the inner periphery of the drum for rotation about an axis parallel to the longitudinal axis of the drum, a blade on the hub and projecting across the space between the hub and drum for collecting ice from the inner drum periphery upon rotation of the hub, an outlet from the drum above the maintained level of the water, and a blade fixedly disposable with respect to the drum for extension across the space between the drum and hub for removing collected ice from the rotatable blade and directing said ice toward said outlet, said blades having complementary portions which permit the rotatable blade to be moved past the drum blade.

3. A machine of the character defined in claim 2, said outlet from the drum including a conduit communicating with an opening through the drum, and said blade is fixed with respect to the drum and projects from the lower portion of the conduit to a point substantially tangentially adjacent the hub.

4. A machine of the character defined in claim 2, said complementary portions of the blades comprising interfitting serrated outer edges on each of said blades.

5. A machine of the character defined in claim 2, said rotatable blade and outlet being substantially coextensive in length with the hub and extending substantially parallel to the hub axis.

6. A machine of the character defined in claim 2, said hub being arranged concentrically within the drum.

7. An ice making and ejecting machine, comprising, a substantially horizontally extending cylindrical drum closed at opposite ends, means for introducing water into the drum and maintaining it at a predetermined level, a refrigerant chamber adjacent the outer periphery of the drum, said chamber comprising a series of interconnected passages extending substantially coextensively of the length of the drum and arranged side-by-side about a major portion of the outer drum periphery, means for circulating refrigerant gas in counter flow relation through said passages from the uppermost to the lowermost thereof to form ice from the water on the inner periphery of the drum, a cylindrical hub mounted concentrically within and spaced from the inner periphery of the drum for rotation about the longitudinal axis of the drum, means for rotating the hub, a blade on the hub and extending lengthwise thereof parallel to the drum axis, said blade projecting across the space between the hub and drum to a point substantially adjacent the inner periphery of the drum to collect ice therefrom upon rotation of the hub, an outlet from the drum through which collected ice may be ejected, said outlet comprising an opening through the drum above the maintained water level and conduit communicating therewith, and a blade fixed with respect to the drum and projecting across the space between the drum and hub from substantially adjacent the opening

through the drum whereby its outer edge is disposed substantially tangentially adjacent the hub, each of said blades having complementary serrations along their outer edges which permit the rotatable blade to be moved past the fixed blade.

8. An ice making and ejecting machine, comprising, a substantially horizontally extending cylindrical drum closed at opposite ends, means for introducing water into the drum, means disposed about and adjacent to a portion of the outer periphery of the drum through which refrigerant gas may be circulated to form ice from the water on the inner periphery of the drum, a substantially longitudinally extending blade within the drum and mounted for rotation about an axis parallel to the longitudinal axis of the drum, said blade having an outer edge for collecting ice from the inner drum periphery upon rotation of the blade, means for rotating the blade, and an outlet from the upper portion of the drum including a conduit extending outwardly from an opening through the drum through which collected ice may be ejected by the blade, said opening extending substantially coextensively with the length of the blade within the drum.

References Cited in the file of this patent

UNITED STATES PATENTS

1,930,569	Taylor	Oct. 17, 1933
2,066,431	Taylor	Jan. 5, 1937
2,259,841	Spiegl	Oct. 21, 1941
2,538,097	Henderson	Jan. 16, 1951
2,556,510	Topping	June 12, 1951
2,575,374	Walsh	Nov. 20, 1951
2,713,474	Read	July 19, 1955

FOREIGN PATENTS

608,910	Germany	Feb. 4, 1935
742,929	Germany	Dec. 15, 1943