March 31, 1953 E. M. SMITH 2,633,083

PUMP

Filed Sept. 21, 1948

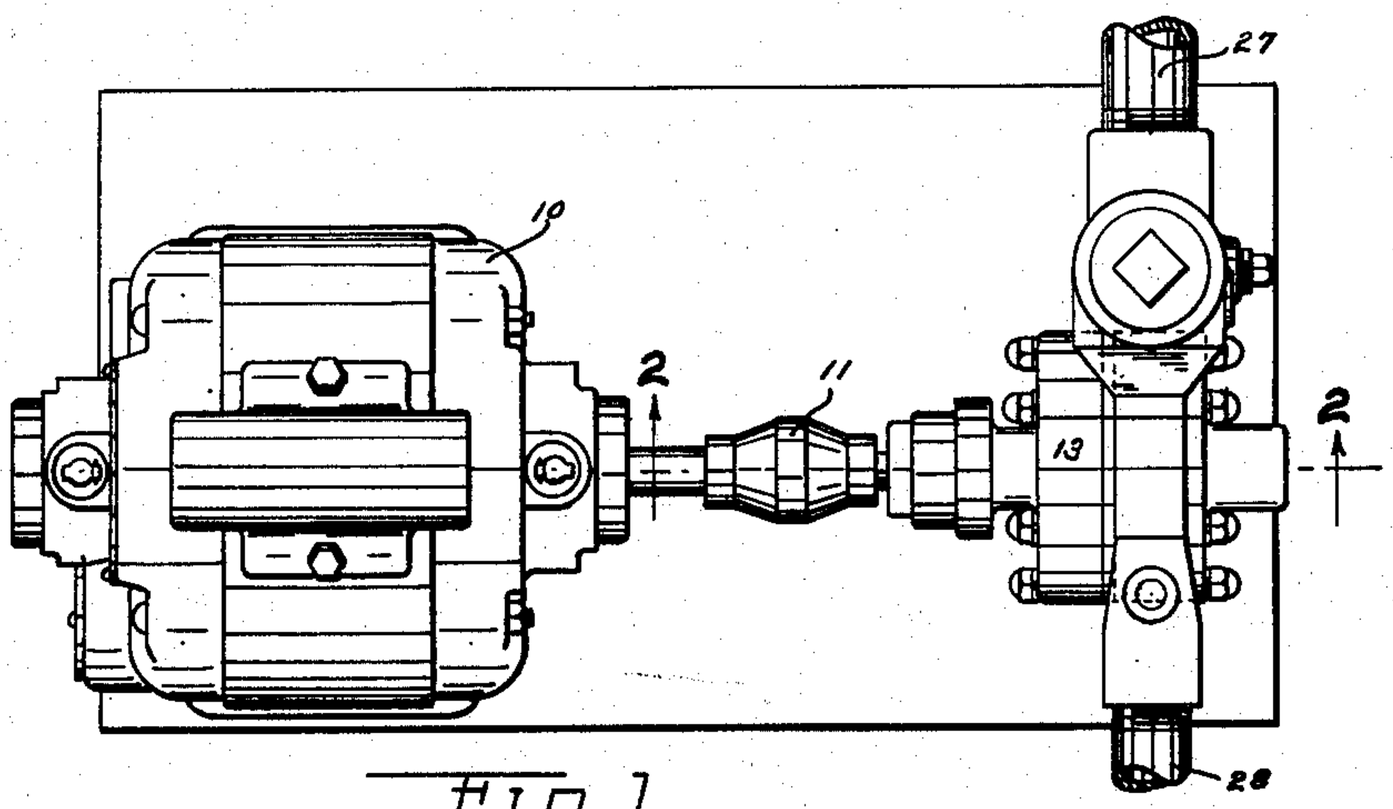

FIG. 1

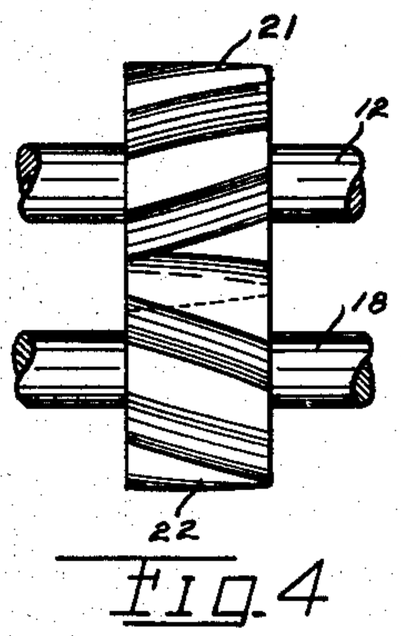

FIG. 4

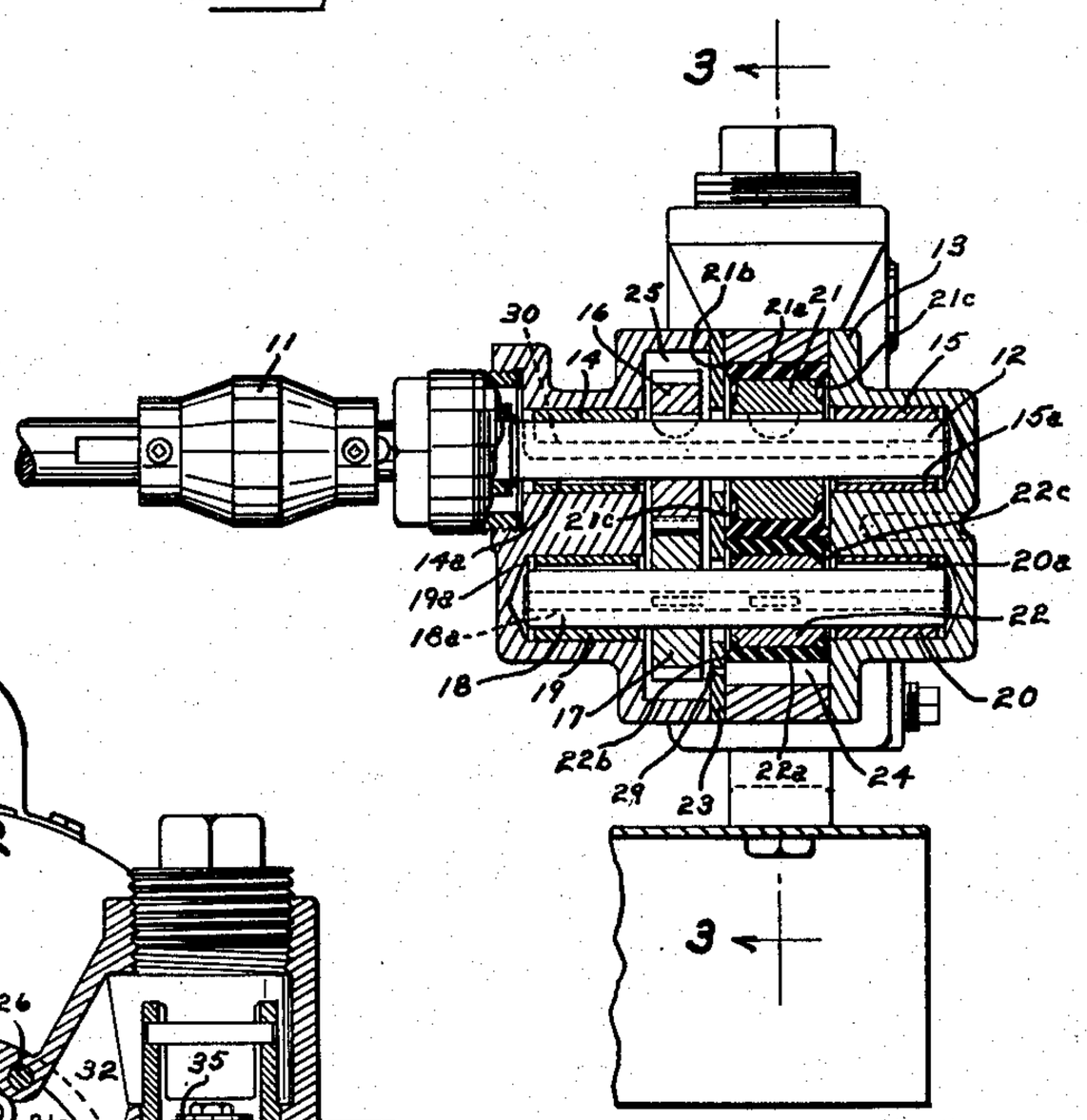

FIG. 2

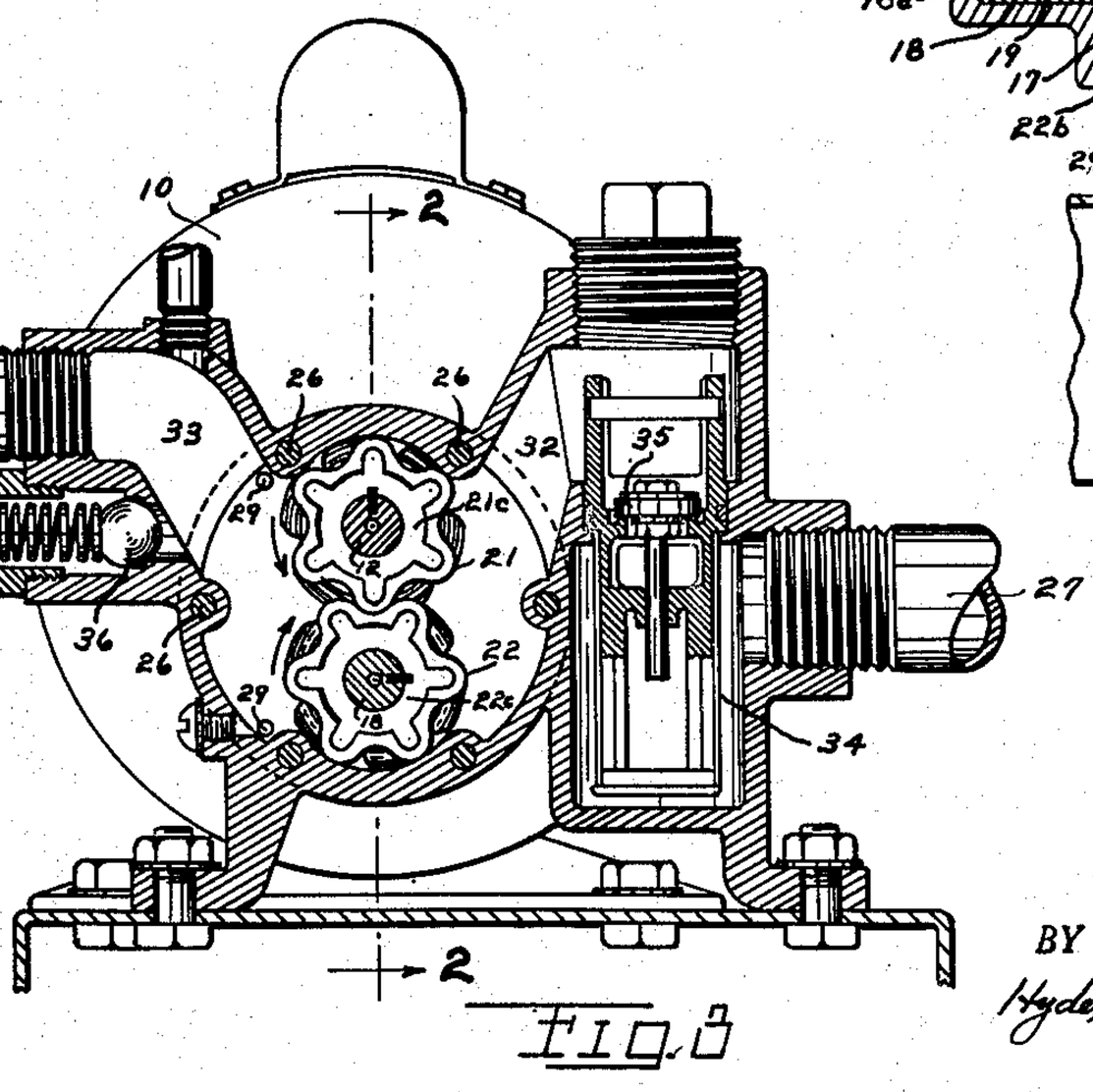

FIG. 3

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6 Claims. (Cl. 103—128)

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This invention relates to improvements in a pump having gear-like rotary impellers.

One of the objects of the present invention is to provide novel means for lubricating a rotary pump having gear-like impellers.

Another object of the present invention is to provide a novel combination between gear-like impellers of a rotary pump wherein the impellers have rigid body form with a rubber covering adapted to create pressure and suction zones between the impellers and the side plates of the pump and wherein these pressure and suction zones are utilized to facilitate the flow of lubricating material.

Other objects and advantages of the present invention are associated with the arrangement of the parts to produce a pump particularly adapted to carry out its functions as will be more clearly apparent from the accompanying drawings and description and the essential features of which will be set forth in the appended claims.

In the drawings,

Fig. 1 is a top plan view of a motor and pump assembly embodying my invention;

Fig. 2 is a transverse sectional view enlarged taken along the line 2—2 of Fig. 1;

Fig. 3 is a sectional view taken along the line 3—3 of Fig. 2; while

Fig. 4 is a side elevational view of the impellers of Figs. 2 and 3.

I have chosen to illustrate my invention as embodied in a pump of general type disclosed and claimed in the copending application of George A. Devlin, Serial No. 741,894, filed April 16, 1947, now Patent No. 2,567,699, to which reference may be had for a more complete description of the pump itself. Sufficient description for my present purpose will be given to understand the construction and operation of the pump itself.

The electric motor 10 is connected by a flexible coupling 11 with a drive shaft 12 which is rotatably mounted in the pump housing 13 in bearings 14 and 15. Keyed to shaft 12 is a synchronizing gear 16 which meshes with a similar gear 17 which is keyed to shaft 18 which is also rotatably mounted in the pump housing on bearings 19 and 20. A pump impeller 21 of gear-like form is keyed to shaft 12 and meshes with a similar impeller 22 which is keyed to shaft 18. Each of these impellers is of gear-like form as set forth in the above-mentioned Devlin application, the main body being of rigid material such as metal and having a relatively thin and substantially uniformly thick coating of rubberlike

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material 21*a* and 22*a* respectively. The rubberlike coating is provided with axially projecting lips 21*b* and 22*b* respectively, which follow the periphery of the gear teeth forms and engage the side plates of the gear housing, all as taught in the above-mentioned Devlin application. This leaves hollow depressions 21*c* and 22*c* respectively on the opposite end faces of the gears adjacent the side plates of the pump housing.

A partition plate 23 provides a general separating wall between the pump chamber proper indicated at 24 and the synchronizing gear chamber 25. The parts of the pump housing and the partition plate 23 are all held in proper position by means of six dowel pins 26 which are substantially equally spaced about the pump housing as clearly shown in Fig. 3 and provided with nuts or other securing members on the opposite ends thereof to hold the pump assembled.

In one of my pumps for pumping water for cheapness of construction, I use plain carbon bearings at the points indicated 14, 15, 19, and 20. The present invention provides novel means for lubricating these bearings and keeping them cool. Referring to Fig. 3, the pump inlet is indicated at 27 and the pump outlet at 28. The pump impellers 21 and 22 turn in the direction of the arrows indicated in Fig. 3. On the left hand side of the impellers or the pressure side thereof are provided openings 29, one of which is seen in Fig. 2. Water flowing through these openings passes through the synchronizing gear chamber 25, then along a groove 14*a* in bearing 14 to the left end thereof as viewed in Fig. 2, then through a bore 30 in shaft 12 to the right hand end thereof, then through a groove 15*a* in the bearing 15 which communicates with the undercut end face or chamber 21*c* at the end of the impeller 21. I find that the chambers 21*c* and 22*c* are under suction so that the flow of liquid through the passages just indicated is caused partly by the pressure at the openings 29 and partly by the suction in the chamber spaces 21*c* and 22*c*.

In a similar fashion, liquid under pressure entering chamber 25 through openings 29 passes along a groove 19*a* in the bearing 19 to the left end of shaft 18, then through the bore 18*a* of this shaft to the right hand end thereof, and then through a groove 20*a* in the bearing 20 back to the undercut face 22*c* of the impeller 22.

Thus, the liquid being pumped is utilized to cool the bearings and the construction of the pump impellers which aids greatly in the pump action as described in the above-mentioned

Devlin application is also utilized to facilitate the flow of the lubricating liquid. After the lubricating liquid reaches the chambers 21*c* and 22*c* it leaks past the rubber lips 21*b* and 22*b* along the side plates rubbed by these lips to the suction side of the pump impeller which aids in lubricating the rubberlike coating where the lips rub against the side plates of the pump housing.

It will be noted in Fig. 3 that the pump is symmetrically arranged with the inlet passageway 32 entering at the upper right hand corner between two of the dowel pins 26 and with the discharge passageway 33 leaving at the upper left hand corner of the pump housing through two other dowel pins 26. This reduces the overall horizontal dimension of the pump while providing efficient pumping action. In Fig. 2, I have shown between the inlet pipe 27 and the inlet passageway 32 a filter 34 and a check value 35 which permits liquid flow into the pump only. At the outlet side of the pump I have provided a relief valve 36 because a pump of this improved type will build up to one hundred to one hundred and fifty pounds per square inch of pressure if the automatic devices usually provided do not shut off the motor 10 at the proper time.

It will be noted in Figs. 3 and 4 that the impellers are in the form of spiral gears. This prevents intermittent shock on the bearings during rotation of the impellers because of the continuous rolling contact from one end of the helical shaped teeth toward the other end with a pair of teeth always in engagement. It so happens that the spiral angle and the width of the impeller are so chosen that the circumferential displacement of a given tooth across the face of the impeller is equal to one half of the pitch of the impeller gear. This gives certain advantages but is not necessary to the proper operation of the pump.

The combination of the spiral gear impellers with the rubber covering permits a greater amount of compression between the two impellers without undesirable bearing pressure on the impeller bearings. The reason for this is that the spiral gear teeth have substantially a point contact moving from one side of the gear to the other as the impellers rotate and this provides room for the expansion of the rubber coating under compression away from the point of contact. For a given clearness between the impellers, the spiral form of tooth gives a much less load on the bearings than a straight tooth would.

In the specific embodiment of my invention herein disclosed, I have used a rubber-like covering over the metallic impeller body of a thickness approximately one-eighth of an inch on the meeting faces of the teeth. This rubber-like material is between fifty and sixty durometer hardness. I find that within the range of pump pressures for which this embodiment is designed, namely, twenty-five to seventy-five pounds per square inch, the pressure of the lips 21*b* and 22*b* against the side plates 13 and 23 are sufficient to provide the result described in the specification but not great enough to substantially retard the rotation of the impellers. In other words, the thickness and hardness of the rubber coating must be coordinated to provide the desired lateral expansion of the lips 21*b* and 22*b* under compression. For, if there is not sufficient pressure of the lips against the side plates, there will be insufficient sealing; while if the rubber-like material is too thick or too soft, there will be too great expansion of the lips laterally which will greatly increase the frictional load of the impellers. I have disclosed one embodiment which operates properly. A softer rubber or a thicker rubber-like coating will increase the lateral expansion of the lips 21*b* and 22*b* under a given pressure. On the contrary, a harder rubber or a thinner coating will reduce the lateral expansion of the lips.

Wherever in the specification and claims I have used the words "spiral" or "spiral gear" in defining the pump impellers or the teeth thereof, I refer to the construction clearly shown in Figs. 3 and 4 of the drawings wherein the impellers are mounted on parallel shafts 12 and 18 and each impeller comprises a plurality of radially extending teeth having a uniform pitch, and wherein the teeth extend generally axially of the impeller in a spiral or helical manner to the opposite face of the gear so that the teeth have the same pitch at the opposite face of the gear but with a circumferential displacement of a given tooth across the face of the impeller.

What I claim is:

1. In a rotary pump having a suction side inlet and a pressure side outlet, in combination, a pump housing, two parallel shafts, bearings mounting the opposite ends of each shaft in said housing, two spiral gear type interfitting pump impellers mounted between said inlet and outlet, one impeller mounted on each shaft to rotate therewith, a passageway leading from the pressure side of said impellers to the inner end of one of said bearings at one end of one of said shafts, a passageway extending longitudinally of said one bearing to the outer end thereof, a passageway leading from said outer end longitudinally of said one shaft to the opposite end of said shaft and to the outer end of the bearing at the opposite end of said one shaft, and a passageway extending longitudinally of said last named bearing to the inner end thereof and there communicating with the suction side of said impellers.

2. In a rotary pump having a suction side inlet and a pressure side outlet, in combination, a pump housing, two parallel shafts, sleeve bearing means mounting one of said shafts for rotation in said housing, the other of said shafts being rotatably mounted in said housing, two gear type interfitting pump impellers mounted between said inlet and outlet, one impeller mounted on each shaft to rotate therewith, each impeller having a rubber-like coating about its periphery and with flexible lips projecting axially from said impeller body about its peripheral edge for engaging the walls of said housing, the ends of said impellers providing shallow recessed chambers inside said lips, a passageway leading from the pressure side of said impellers through said one shaft longitudinally thereof to the suction side of said impellers, said passageway including a passage extending longitudinally through said sleeve bearing means, and the outer end of said last named passage communicating with one of said shallow recessed chambers and so to said suction side.

3. In a rotary pump, a pump housing comprising only two generally cylindrical co-axial portions, one portion providing an impeller chamber, the other portion providing a synchronizing gear chamber, two shafts rotatably mounted in said housing with their axes in a vertical plane and parallel to the axis of said cylindrical portions, a synchronizing gear and an impeller mounted on each shaft and meshing respectively

with each other, a partition plate lying between said two cylindrical portions and separating said chambers, six bolts substantially equally spaced about said cylindrical portions and holding said portions and said partition assembled, inlet and outlet passageways in said one housing portion on opposite sides of said impellers, two of said bolts lying in a horizontal plane on the diameter of said cylindrical portion, and said inlet and outlet passageways extending outwardly and upwardly each respectively between one of said two bolts and the adjacent bolt above it whereby to provide a compact and efficient arrangement.

4. In a rotary pump, in combination, a pump housing, two parallel shafts mounted for rotation in said housing, two spiral gear-type interfitting pump impellers, one impeller mounted on each shaft to rotate therewith, each of said impellers having a rubber-like coating entirely around its toothed periphery, the outer faces of said coating of said impellers engaging, and sealing against said housing, and liquid inlet and outlet means communicating with said housing on opposite sides of said impellers, each of said spiral gear impellers comprises an inner solid non-resilient body and a relatively thin coating of rubber-like material extending around the toothed periphery of each impeller.

5. In a rotary pump having a suction side inlet and a pressure side outlet, in combination, a pump housing, two parallel shafts, two gear type interfitting pump impellers mounted between said inlet and outlet, one impeller mounted on each shaft to rotate therewith, a first and second bearing mounting each shaft in said housing with said impeller between said bearings, each of said shafts and it associated bearings having a passageway leading from the pressure side of said impellers through said housing to the inner end of said first bearing, then through said first bearing, then longitudinally of said shaft to its opposite end, then through said second bearing to its inner end and there communicating with the suction side of said impellers, each of said impellers having a rubber-like coating about its periphery with flexible lips projecting axially from said impeller body about its peripheral edge and engaging the walls of said housing, the ends of said impellers providing shallow recessed chambers inside said lips, and said passageway at the inner end of said

second bearing communicating with its associated shallow recessed chamber.

6. The combination of claim 5 wherein two intermeshing synchronizing gears are mounted on said shafts in said housing, one gear mounted on each shaft to rotate therewith, said housing having a partition dividing the space within said pump housing between said gears and said impellers, said impeller lips engaging said partition, said first bearing being on the side of the gears remote the associated impellers, and said passageway through said housing leading from the pressure side of said impellers to the inner end of said first bearing comprising an opening through said partition and outside of said lip.

EDWARD M. SMITH.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,372,576	Tullmann	Mar. 22, 1921
1,379,587	Fisher	May 24, 1921
1,495,411	Groh	May 27, 1924
1,620,261	Kennedy	Mar. 8, 1927
1,698,802	Montelius	Jan. 15, 1929
1,846,700	Ungar	Feb. 23, 1932
2,095,168	Burghauser	Oct. 5, 1937
2,111,568	Lysholm et al.	Mar. 22, 1938
2,111,883	Burghauser	Mar. 22, 1938
2,202,913	Johnson	June 4, 1940
2,212,939	Irgens	Aug. 27, 1940
2,212,994	Vrolix	Aug. 27, 1940
2,220,588	Thompson	Nov. 5, 1940
2,383,194	Hoopes	Aug. 21, 1945
2,391,072	Pugh	Dec. 18, 1945
2,407,753	Wallgren	Sept. 17, 1946
2,460,952	Simer et al.	Feb. 8, 1949
2,530,767	Hamill	Nov. 21, 1950
2,567,699	Devlin	Sept. 11, 1951

FOREIGN PATENTS

Number	Country	Date
427,475	Great Britain	Apr. 15, 1935
476,377	Great Britain	Dec. 7, 1937
535,554	Great Britain	Apr. 11, 1941
638,146	France	Feb. 14, 1928