

July 17, 1956

M. TAMA

2,755,327

DEVICE FOR THE DISCHARGE OF MOLTEN METAL

Original Filed May 26, 1948

3 Sheets-Sheet 1

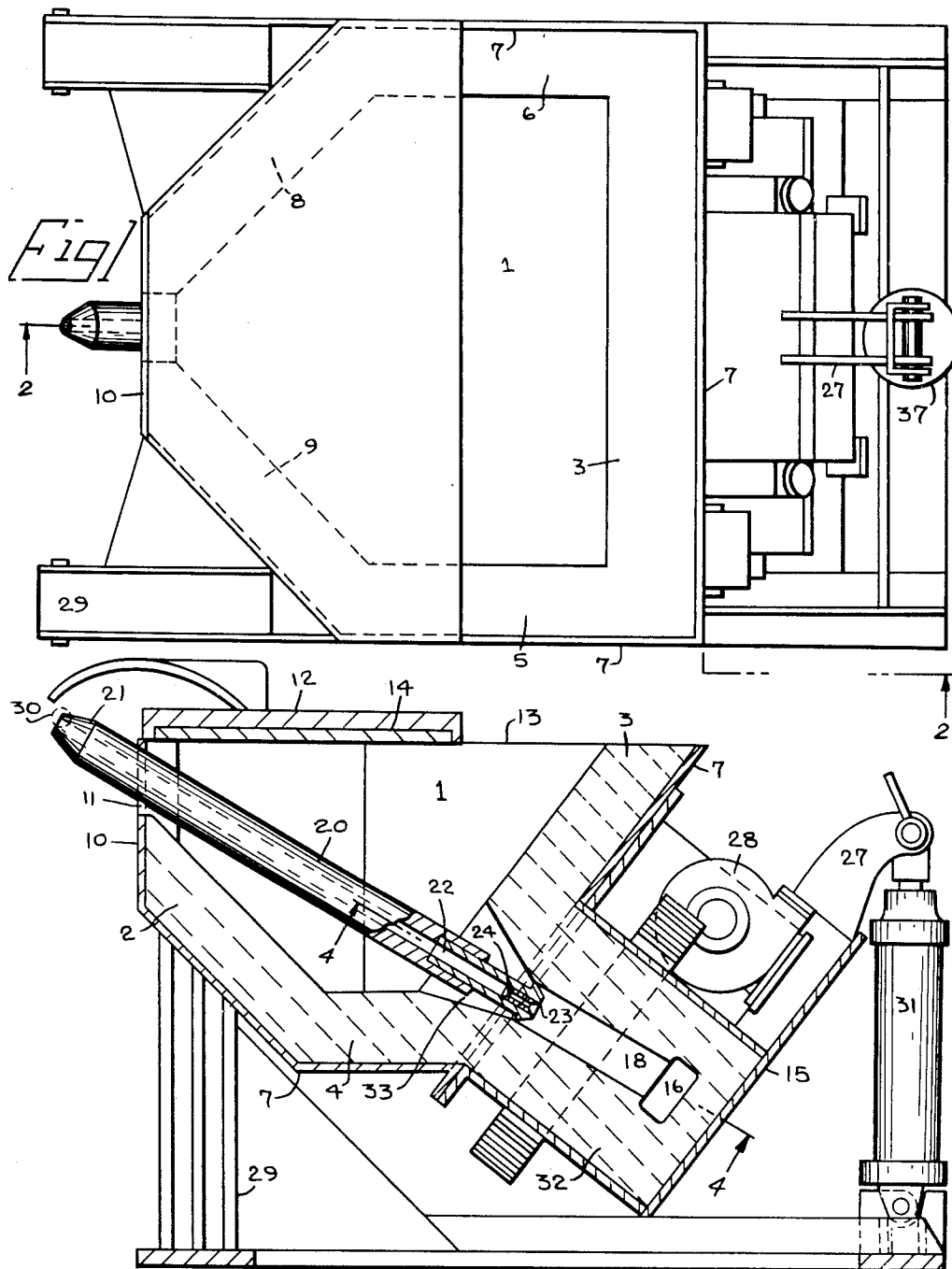


Fig 2

INVENTOR.
MARIO TAMA

BY

Freeman & Mannick,
Attorneys

July 17, 1956

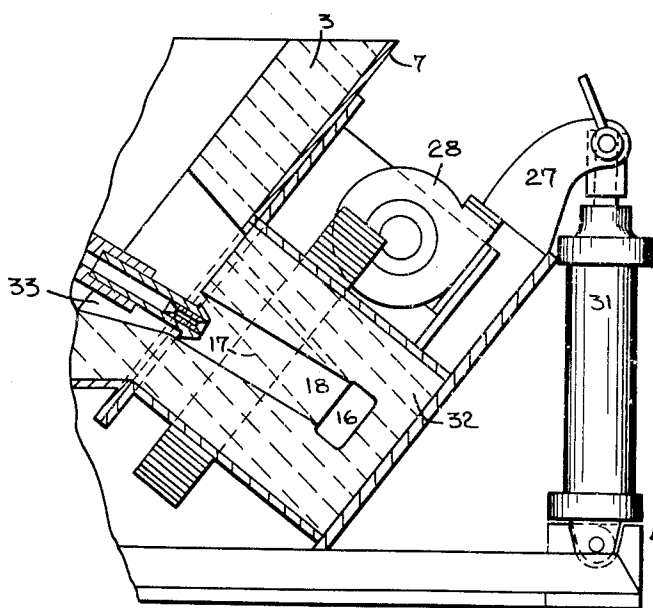
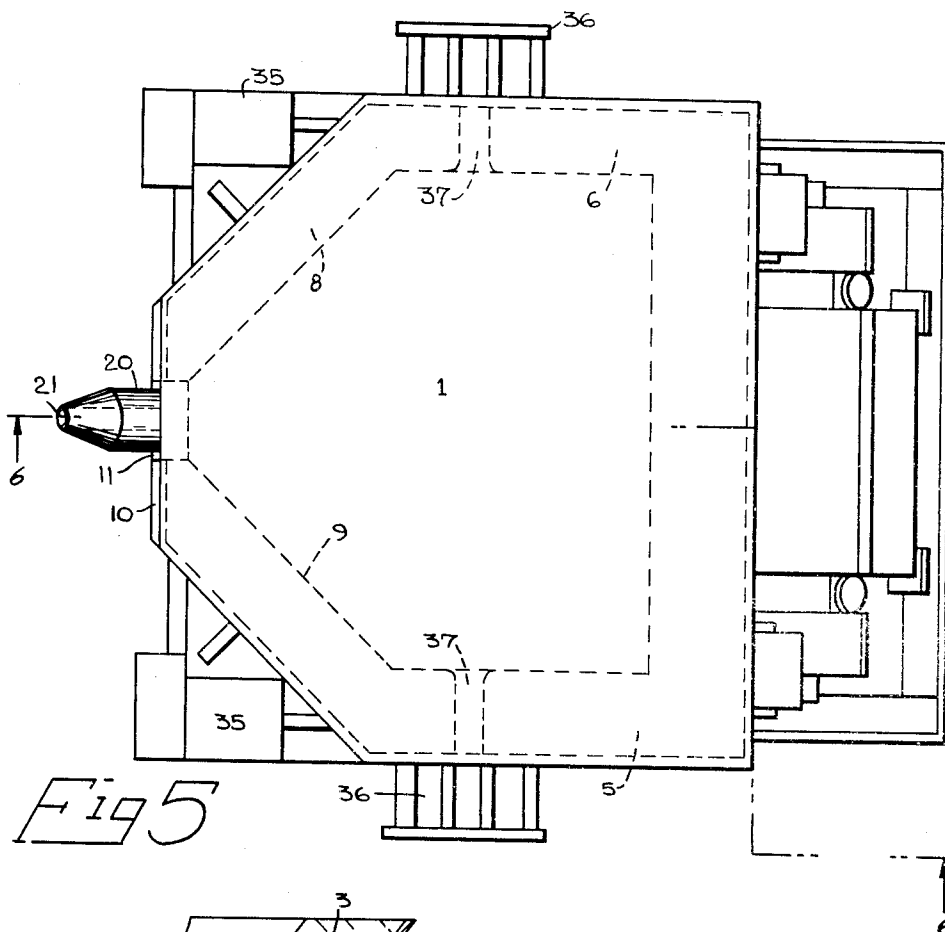
M. TAMA

2,755,327

DEVICE FOR THE DISCHARGE OF MOLTEN METAL

Original Filed May 26, 1948

3 Sheets-Sheet 2



INVENTOR.
MARIO TAMA

BY

Joseph and Marmora,
the Agents.

July 17, 1956

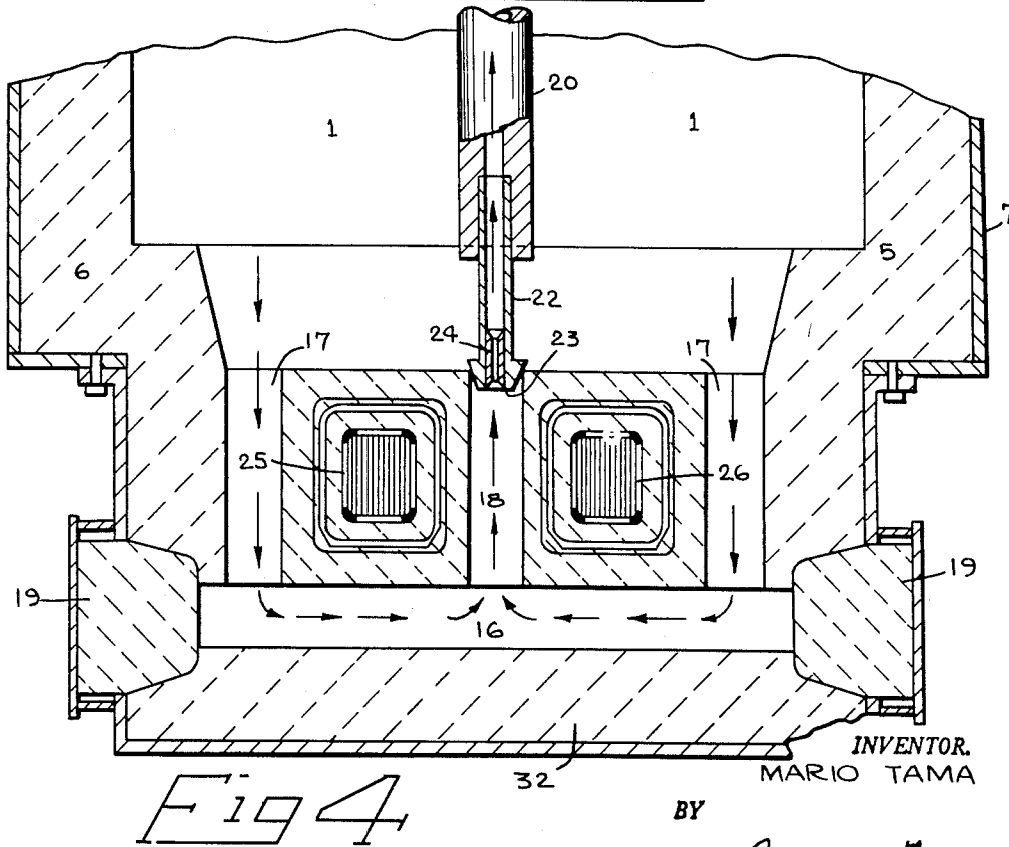
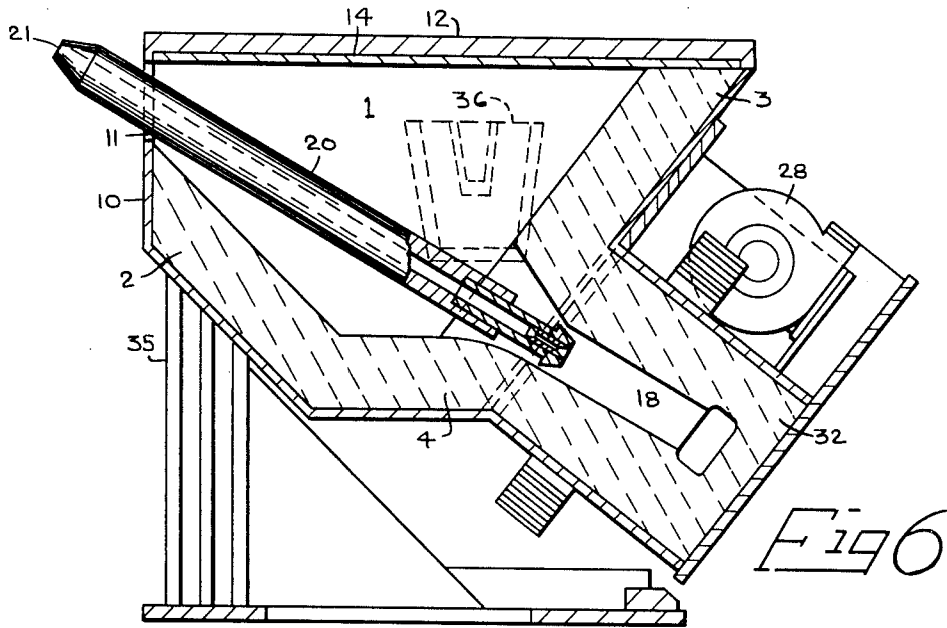
M. TAMA

2,755,327

DEVICE FOR THE DISCHARGE OF MOLTEN METAL

Original Filed May 26, 1948

3 Sheets-Sheet 3



INVENTOR.
MARIO TAMA

BY

Freeman & Marsland,
His Agents.

1

2,755,327

DEVICE FOR THE DISCHARGE OF MOLTEN METAL

Mario Tama, Morrisville, Pa., assignor to Ajax Engineering Corporation, Trenton, N. J., a corporation of New Jersey

Original application May 26, 1948, Serial No. 29,263.
Divided and this application May 2, 1951, Serial No. 224,118

3 Claims. (Cl. 13—29)

The invention relates to a device for dispensing accurate quantities of molten metal; it is a division from copending patent application Ser. No. 29,263, filed May 26, 1948, now Patent No. 2,707,718, issued May 3, 1955.

It is among the objects of the invention to dispense molten metal from a vessel in unidirectional flow, and to provide for accuracy of the quantities of metal dispensed.

With the above recited and additional objects in view, which will become apparent, as this specification proceeds, the invention will now be described in cooperation with an induction pump for the successive pressure-discharge of metal castings into molds.

However, the invention is with equal success applicable to any other casting device where molten metal is discharged under pressure from a metal holding reservoir.

The attached drawings illustrate several embodiments of the invention.

In these drawings:

Fig. 1 is a plan view of a first embodiment of a device for the successive discharge of molten metal into a mold;

Fig. 2 is a vertical sectional view on line 2—2 of Fig. 1;

Fig. 3 is a vertical part sectional view similar to Fig. 2 of a further embodiment;

Fig. 4 is an enlarged sectional view on line 4—4 of Fig. 2;

Fig. 5 is a plan view of a third embodiment of the pump; and

Fig. 6 is a vertical sectional view on line 6—6 of Fig. 5.

The induction pump shown in Figs. 1 and 2 for mold-casting equal successive comparatively small quantities of molten metals or shots is of the tiltable compensating type. The pump will be charged from time to time with metal in amounts of 200 or 300 pounds. The pump is provided with a metal holding hearth or chamber 1.

The tilting of the pump is accomplished for the purpose only to keep the level of the molten metal or the distance between the same and the point of discharge substantially constant, whereas the pumping and the casting of the mold is solely effected by electromagnetic forces. The maintenance of level constancy is essential in order to assure uniformity of the shots with regard to quantity and casting temperature.

The metal holding chamber of hearth 1 of the pump has substantially the shape of a triangle. The chamber is housed by two opposite refractory side walls 2, 3 which are downwardly inclined towards each other and two opposite refractory end walls 5, 6. Walls 2 and 3 are cut short at their converging center line to form a small horizontal bottom portion 4. A steel casing 7 covers the outer face of the walls.

The front portions 8, 9 of the side walls 5, 6 converge towards the vertical center plane of the pump; the end portion thereof as well as the corner portion of wall 2 are cut-off to form a small frontal face 10. An opening 11 is provided in front of face 10 for a purpose which will be explained in a later part of this description.

The metal holding hearth 1 is partly closed by a cover

2

12 leaving an opening 13 for the supply of fresh charges. Cover 12 has a heating strip 14 which reaches into the proximity of that part of the tube 20 extending from the metal holding chamber and being located above the molten metal.

The inductor unit which is more in detail shown in Fig. 4 is attached to the inclined wall 3. The unit consists of a refractory block 32 which is surrounded by a steel casing 15. The inductor unit contains the primary consisting of copper coils 25 and iron core 26, see Fig. 4. The primary threads the secondary duct which, as disclosed in my Reissue Patent No. 22,602, dated February 13, 1945, is of the twin coil type and composed of two lateral channels 17, a center channel 18 and a horizontal channel 16 connected with hearth 1 by the inclined channels 17, 18. Channel 16 is closed by refractory plugs 19.

A tubular spout 20 is provided for the discharge of the metal from the pump. This spout projects with its lip end 21 from hearth 1 and is led with its lower end into groove 33 provided in the refractory of wall 3. A nozzle 22 is inserted into the lower end of spout 20; this nozzle is provided with a conical extension 23, see Fig. 2. The spout 20 reaches with this extension into center channel 18. A short tube 24 is inserted into the end of nozzle 22. This nozzle arrangement 22, 24 which constricts the metal flow from the hearth 1 into tube 20 serves the purpose of regulating and equalizing the stream of metal discharged from this tube.

The installation of spout 20 provides for a change in metal flow, so that the metal flows unidirectionally from the hearth 1 through channels 17, channel 16 into channel 18 and is discharged through spout 20 into the molds, as shown by the arrows in Fig. 4.

A foremost requirement of the operation of this pump is the maintenance of level constancy in hearth 1. This level constancy is in accordance with the embodiment of my invention shown in Figs. 1 to 4 obtained by tilting the pump about the lip end of spout 20 through a small angle. The tilting axis is indicated in Fig. 2 by a dotted circle 30; the furnace is for this purpose tiltable supported in frame structure 29.

A hydraulic cylinder 31 is provided for the tilting of the pump; the piston of the cylinder is connected by arms 27 with inductor unit 32. A blower 28 is in the usual manner attached to the inductor unit and forms a part thereof. The hydraulic cylinder 31 at its lower end is rotatably supported on frame 29.

Fig. 4 shows on an enlarged scale the lower portion of the pump and the entry of spout 20 into center channel 18. The primary transformer unit consists in the usual manner of copper coils 25 and iron core 26; this primary unit threads channels 17, 18.

Fig. 2 shows the pump in its initial position. As soon as current is supplied to the coils 25 the metal will be forced through the lip end 21 of spout 20 into molds, which are not shown in the drawing; at the same time the pump is tilted by cylinder 31 about its lip end.

The operation of the hydraulic cylinder is automatically controlled in conformity with the metal discharge. The pump is charged intermittently with a certain amount of metal. Before charging the pump it is tilted into the starting position, shown in Fig. 2. Immediately after charging metal and after the commencement of its discharge by supply of current to the coils 25 the cylinder gradually raises the rear portion of the pump. The supply of the operating fluid to the tilting cylinder 31 may for this purpose be controlled by a known metering device, which will allow a uniform and slow raise over a certain period of time; the idea is that the operator of the pump should not need to pay attention to the lifting apparatus, which will work automatically after a certain speed of tilting has been set; the tilting mechanism

may for this purpose be provided with a customary stop and return valve.

As soon as the pump has reached its highest position it will upon operation of a customary stop valve fall back to the starting position. Hereupon fresh metal is charged; in this manner it is possible to keep a practically constant metal level in conformity with the discharge of the same.

The metal is pumped from the bottom of the molten bath and is therefore free from slags and impurities. Due to the triangular shape of hearth 1 that part of the metal holding space from which the metal is pumped has been greatly restricted. An accurate control of the casting temperature and great uniformity of the cast metal is accordingly obtained. Due to the inclined location of the inductor block 32 and of the melting channels 17, 18 and of the tube 20 the inertia of the molten mass can be easily overcome during the pumping action; the current requirements are accordingly reduced and the economy of the induction pump is greatly improved; moreover, and due to the inclined location of tube 20 the last traces of non-uniformity of the metal flow are eliminated.

A further modification of my induction pump is shown in Fig. 3.

Here channel 17 and channel 18 have a different inclination. Whereas the center channel 18 is inclined, as shown in Figs. 1 and 2, the two lateral channels 17 have a greater angle of inclination relative to a horizontal plane or, in other words, the channel 18 is less inclined than the lateral channels 17.

The third modification of this electromagnetic pump, which is shown in Figs. 5 and 6, is of the stationary type. This pump is in most respects similarly built to the previously described embodiments and the same numerals are used to denote identical parts.

In order to obtain the required substantial level constancy of the molten bath this pump may be coupled with a large metal melting and holding furnace preferably also of the submerged resistor type. The head of metal is kept in this large melting furnace at a level which is most suitable for the operation of the pump. Fresh metal is charged into the large supply furnace, at the ratio as it is pumped; by gradually charging the large capacity supply furnace a substantially equal level of the molten metal bath is obtained in the pump.

This pump may therefore be entirely closed by cover 12 which is also provided with a strip-shaped heating element 14. The triangular shape of the metal holding chamber 1 is unaltered and the chamber is housed by walls 2, 3, 5, 6 which are shaped to form a small bottom 4 and a small front face 10, where the opening 11 is provided for the emergence of spout 20 and its lip end 21 respectively. Inductor block 32 containing this primary transformer assembly and the secondary duct system of the twin coil type is attached to inclined wall 3; blower 28 is attached to the inductor block.

The pump is stationary and mounted for this purpose on a frame structure 35.

The pouring or discharging spout 20 reaches, as in the previous embodiments of this invention into channel 18 of the secondary duct system and protrudes with lip end 21 through opening 11 from the pump.

Since certain changes may be made in the above article and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above de-

scription or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

Having thus described the invention, what I claim as new and desire to be secured by Letters Patent, is as follows:

1. In an induction pump for successively dispensing molten metals a triangularly shaped receptacle to hold said molten metal, said receptacle comprising downwardly converging front and rear walls and two opposite side walls, a refractory block attached to the inclined rear wall, an inductor unit located in said block and adapted to subject said molten metal to internal pressure energy, an inclined tube for the discharge of the molten metal from said receptacle, said tube extending with its lower end towards said inductor unit and projecting with its upper end from said receptacle, means located in the lower end of said inclined tube to constrict the metal flow from said receptacle into said tube and means to lift said refractory block and therewith the rear end of said tube for the discharge of the metal from said receptacle.

2. In an induction pump for successively dispensing molten metals a triangularly shaped receptacle to hold the molten metal, said receptacle comprising downwardly inclined converging front and rear walls and two opposite side walls, a refractory block attached to the outside of said rear wall, a metal conducting channel system in said refractory block, said system being connected with the bottom portion of said receptacle, an inductor unit surrounding said channel system for subjecting the molten metal to internal pressure energy, an inclined tube for the discharge of the metal from said receptacle, said tube extending with its lower end towards the center channel of said channel system and outwardly projecting with its upper end from said receptacle to conduct the molten metal from the latter into the lower end of said tube and to discharge it from the upper projecting end thereof, and means in the lower end of said inclined tube to restrict the metal flow from said receptacle into said tube.

3. In an induction pump according to claim 2, means operatively connected with said refractory block to lift and to lower the same and to accordingly modify the angle of inclination of said inclined metal discharge tube.

References Cited in the file of this patent

UNITED STATES PATENTS

259,282	Bavier	June 13, 1882
1,026,733	De Buigne	May 21, 1912
1,679,219	Huff	July 31, 1928
1,815,776	Kidd	July 21, 1931
2,007,036	Cornell	July 2, 1935
2,042,037	Camerota	May 26, 1936
2,150,077	Oehler	Mar. 7, 1939
2,224,982	Morin	Dec. 17, 1940
2,232,886	Robertson et al.	Feb. 25, 1941
2,536,325	Tama	Jan. 2, 1951
2,536,859	Tama	Jan. 2, 1951
2,674,640	Tama	Apr. 6, 1954
2,707,718	Tama	May 3, 1955

FOREIGN PATENTS

615,484	Great Britain	Jan. 6, 1949
616,656	Great Britain	Jan. 25, 1949
895,181	France	Mar. 27, 1944