

Feb. 7, 1961

F. R. ERBACH

2,970,938

CONTROL OF STOCK SUPPLY IN PAPER MAKING MACHINES

Filed May 8, 1956

2 Sheets-Sheet 1

FIG. 1

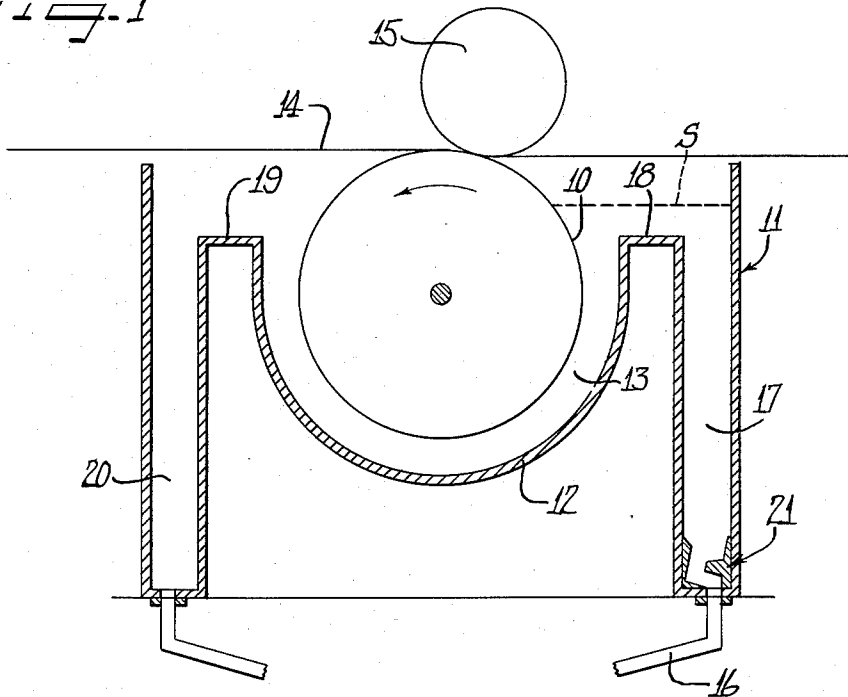


FIG. 2

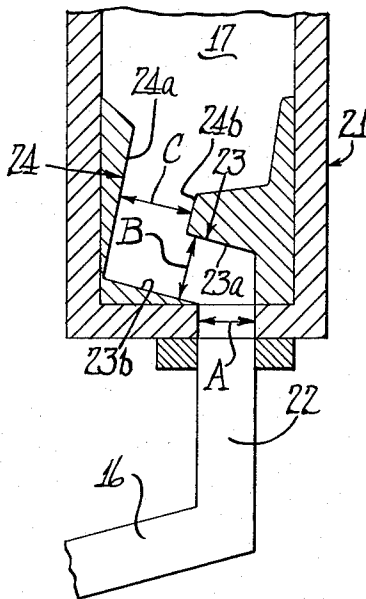


FIG. 4

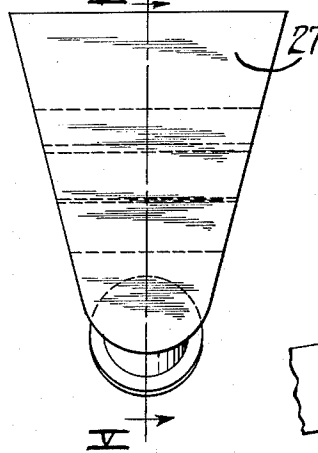
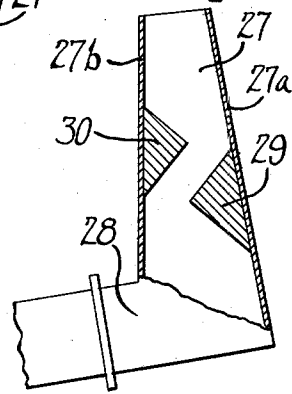


FIG. 5



Inventor
Frederick R. Erbach

by *Skil, Sherman, Moroni, Gross & ...*

Feb. 7, 1961

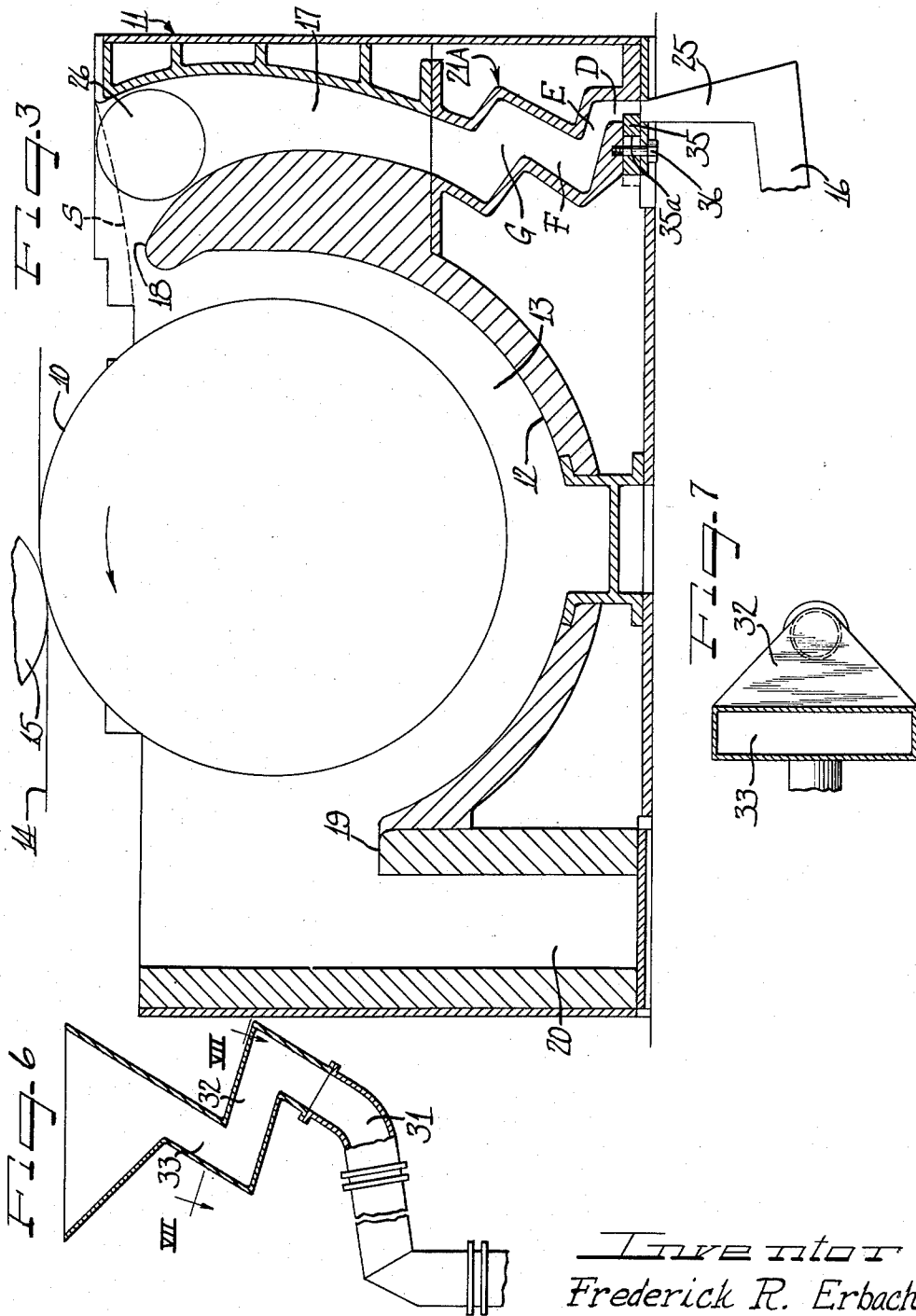
F. R. ERBACH

2,970,938

CONTROL OF STOCK SUPPLY IN PAPER MAKING MACHINES

Filed May 8, 1956

2 Sheets-Sheet 2



Inventor
Frederick R. Erbach

W. H. Hill, Sherman, Merwin, Gross & Simpson Attys

1

2,970,938

CONTROL OF STOCK SUPPLY IN PAPER
MAKING MACHINESFrederick R. Erbach, Beloit, Wis., assignor to Beloit
Iron Works, Beloit, Wis., a corporation of Wisconsin

Filed May 8, 1956, Ser. No. 583,456

10 Claims. (Cl. 162—212)

This invention relates in general to paper making and paper making machines, and more particularly to apparatus and to a related method whereby a suspension of paper fibers in water or paper stock to be supplied to such machines through a conduit at a relatively high velocity can be controlled and have its velocity progressively reduced as it is led always upward to be delivered under the liquid to air surface of said stock in the vat inlet portion of such machines to prevent undesirable surface splashing and other flow disturbances, and is especially useful in connection with cylinder paper machines, although other uses and purposes may be apparent to one skilled in the art.

Heretofore, difficulty was encountered in carrying paper stock or liquid suspensions at high velocities through fluid channels or conduits to the atmosphere or an open vessel, wherein undesirable surface disturbance upon emergence into the open vessel or into the atmosphere was experienced. In cylinder paper machines, wherein the stock is delivered upwardly through a vat inlet to an open vessel and the atmosphere before directing it to the cylinder mold, excessive surface splashing and other flow disturbances reduce the quality of paper made by the machine.

In the present invention, apparatus is provided in the form of expanding deflectors or walls defining channels whose cross-sectional areas increase in the flow direction for use with liquid channels or conduits carrying stock or similar liquids at velocities which are so high that they would cause excess splashing, or flow disturbance upon emergence into an open vessel or into the atmosphere. The expanding deflectors include angularly connected and area increasing passageways which gradually reduce the discharge stream velocity to a point where surface flow rates avoid serious surface disturbance.

Accordingly, it is an object of this invention to provide a new and improved method and apparatus for supplying stock to a paper making machine.

A further object of this invention is the provision of an improved method and apparatus to prevent surface splashing and other undesirable flow conditions in the vat inlet portion of a paper making machine or the like.

Another object of this invention resides in the provision of method and apparatus capable of reducing the velocity of a liquid under pressure carried in a liquid channel or conduit.

Still another object of this invention is in the provision of expanding deflectors in a liquid channel or conduit carrying paper stock from a high entering velocity to a lower velocity in under the liquid surface of a chamber open to the atmosphere, wherein serious surface disturbances are eliminated.

A further object of this invention is to provide expanding deflectors in an upwardly extending liquid channel or conduit carrying paper stock which define angularly related communicating passages of increasing size for gradually reducing the velocity of liquid flowing therethrough.

A still further object of this invention is to deflect a

2

high velocity liquid stream of paper stock against fixed submerged surfaces inclined in a manner which would direct a portion of the stream flow down into a corner under the incoming stream of liquid stock and thereby force it to cross and mix with the stream before escaping to a wider passage above the incoming stream.

It is also an object of this invention to provide expanding deflectors defining angularly related communicating passageways in a liquid channel or conduit having an always upward direction of liquid paper stock flow, wherein the bottom surfaces of the passageways are sloped to permit complete drainage back into the bottom entrance opening and the top surfaces are sloped upward to allow upward escape of entrained air, foam or other foreign materials which may be washed up and carried with the flowing stream when in operation.

Another object of this invention is to provide adjustable means at the inlet of an expanding deflector arrangement which is capable of controlling the flow of paper stock into the deflector and thereby insuring the spreading of the flowing stream across the full width of the opening prior to the admission of the paper stock into the passages of the deflector and making it possible to set the opening area in proportion to the volume of paper stock delivered to the passage.

Other objects, features, and advantages of the invention will be apparent from the following detailed disclosure, taken in conjunction with the accompanying sheets of drawings, wherein like reference numerals refer to like parts, in which:

On the drawings:

Figure 1 is a somewhat diagrammatic transverse sectional view through the vat of a cylinder paper machine including the expanding deflectors of the instant invention installed in the vat inlet;

Figure 2 is a fragmentary enlarged sectional detail view of the expanding deflectors employed in the vat inlet of the paper machine shown in Figure 1;

Figure 3 is a transverse sectional view of a cylinder vat showing a practical application of the invention to the inlet side thereof;

Figure 4 is an end elevational view of a simple hopper embodying the principles of the instant invention;

Figure 5 is a transverse sectional view, taken substantially along line V—V in Figure 4;

Figure 6 is a side elevational view showing a different form of the present invention; and

Figure 7 is a view taken substantially along line VII—VII of Figure 6.

As shown on the drawings:

Referring particularly to the embodiment of Figures 1 and 2, wherein the invention is applied to a vat inlet of a cylinder paper machine, a hollow cylinder roll or mold 10 having a foraminous forming surface is bearingly supported at each end in a vat 11. The vat 11 includes a hemicylindrical bottom or vat circle 12 which defines with the surface of the cylinder mold a substantially hemiannular passage 13, commonly known as the vat circle space. Suitable seals are provided at each end of the mold 10 to prevent stock from flowing into the interior thereof. While not shown, a suitable prime mover may be drivingly connected to the end of the mold 10 by a shaft or other equivalent means for driving the mold.

As the cylinder mold 10 rotates, it will be partially immersed in a quantity of stock contained in the vat, wherein water from the stock, commonly called white water, passes through the foraminous surface of the cylinder mold and leaves a web of fiber deposit thereon. This web of fiber is removed from the cylinder mold 10 near the top thereof by causing it to adhere to the underside of an endless pick-up felt 14 pressed against the cylinder mold forming surface by a couch roll 15. White

water collected on the interior of the cylinder mold 10 flows from both ends of the cylinder and the vat to be delivered to a white water storage or deaerating tank for further usage.

Counterflow operation of the cylinder machine is attained by delivering dilute aqueous stock through a conduit 16 to the vat inlet 17 over an associated making board 18 to the adjacent upper end of the vat circle space 13. The stock then flows downwardly against the rotation of the cylinder mold 10 and around the vat circle space 13. If overflow operation is desired, the stock will continue to flow around the vat circle space 13 and leave the opposite end to flow over a board 19 and out of the vat through a vat outlet 20.

It is essentially important that little or no splashing or surface disturbance be encountered on the open top surface S on the inlet side to the cylinder vat circle space 13 in order to reduce, if not eliminate the making of defective paper on the cylinder mold. To this end, the instant invention provides means in the vat inlet 17 capable of gradually reducing the submerged discharged stream of velocity to a point where surface flow rates avoid serious surface disturbance. This means is in the form of an expanding deflector arrangement 21 which forces the incoming stream of stock against inclined surfaces, while changing or alternating the flow direction of the stock and sending it through passages of gradually increasing sizes or cross-sectional areas, all while this flow of the stock is confined to an always upward direction.

Referring especially to Figure 2, as the stock leaves the conduit 16, it flows upwardly through a substantially vertically positioned passageway 22 having a width indicated at A. The passage 22 communicates at its upper end with an angularly related passageway 23 of increasing width, as indicated at B, and having an upper inclined wall 23a and a lower inclined wall 23b. Thus, the stream hits the upwardly inclined wall 23a which directs a portion of the stream down into a corner under the incoming stream of liquid forcing it to cross and mix with the stream before escaping to a still wider passage or passageway 24 above the incoming stream. The passageway 24 is of increasing width as indicated at C, and includes an upper inclined wall 24a angularly related with the lower inclined wall 23b of the passage 23, and a lower inclined wall 24b continuing angularly from the upper inclined wall 23a of the preceding passage 23. As the stock leaves the passageway 24, it then enters the full width of the vat inlet 17 leading to, and opening in under, the open top surface, or the supply stock liquid level, S. Thus, it is seen that the uppermost passageway 24 in the expanding deflector arrangement is greater in cross-sectional area or wider than the next lower passageway 23 which is also greater in width or cross-sectional area than the first passageway 22, thereby providing a flow channel gradually increasing in width in each succeeding passage following a change of direction. This, in turn, provides for proportional decreases in flow rate as the point of emergence in the vat inlet 17 is approached.

While in this embodiment only three passages, progressively increasing in width, are shown, it will be understood that any number of passages may be provided and arranged in sufficient number to gradually reduce the submerged discharge stream velocity of the stock to a point where surface flow rates avoid serious surface disturbance.

It should also be noted that the passages are arranged to have the bottom surfaces sloped to permit complete drainage back into the bottom entrance opening and the top surfaces sloped upward to allow escape of entrained air, foam, or other foreign particles which may be washed up and carried with the flowing stream when the machine is in operation.

Although the incoming velocity of the stock may range from above 20 feet per second down to four or

five feet per second, at these rates of flow, the turbulence of the stream passing through the passages containing the deflectors is sufficient to keep the surfaces substantially clean and free of paper stock or other deposits, provided the direction of flow is upward.

Now referring to the embodiment of Figure 3, a practical application of the invention is shown, wherein elements identical or equivalent to elements described in the embodiment of Figures 1 and 2 have been identified by the same reference characters.

In this embodiment, the inlet conduit 16 leads to a restricting spreader 25 which delivers the stock to a somewhat differently formed expanding deflector arrangement 21A associated with the vat inlet 17. At the outlet of the vat inlet 17 in this instance, a rectifier roll 26 is provided that serves to agitate the stock at this point. This deflector arrangement includes angularly communicating passages D, E, F and G of increasing width. In this embodiment, the angles between the passages E and F, and F and G are less than 90°. Additionally, an adjustable block 35, slotted at 35a to receive an adjusting screw or bolt 36, is provided at the inlet to the first passage D to insure spreading of the flowing stream across the full width of the opening to the passage D prior to the admission of the stream into this passage. This feature makes it possible to set the opening area in proportion to the volume of stock or liquid suspension of paper fibers delivered to the passage.

In the embodiment of Figures 4 and 5, a simple hopper 27 opening upwardly is connected at its lower end to an inlet conduit 28. From the connection to the inlet conduit 28, the hopper expands upwardly to provide an elongated flared opening. The hopper includes a front wall 27a and a rear wall 27b and has mounted on these walls respectively a pair of elongated, triangularly-shaped members 29 and 30 in staggered relationship which define an expanding deflector arrangement. Again, it is seen that the upward flow of liquid stock is forced against inclined surfaces and directed through an angularly related passageway to the hopper itself.

Now referring to the embodiment of Figures 6 and 7, it will be seen that the invention may be applied to a plurality of angularly connected and increasingly sized ducts or conduits with the direction of flow being upward as in the other embodiments.

The flow of liquid stock is forced upward under pressure through an inlet conduit 31 to an angularly connected and communicating conduit 32. As seen most clearly in Figure 7, the conduit 32 expands to its upstream end where it is connected to an angularly related conduit 33 at an angle less than 90°. This conduit also expands before it terminates in an open upwardly projecting end from which the liquid stock or suspension will emerge.

It will be understood that the principles of operation in the first embodiment will also be present in the other embodiments. Further, in all embodiments, the outlet from the expanding deflector should be substantially submerged in order to more thoroughly intermix and equalize the rate of flow of the various elements of the liquid stock stream as it moves upward to the open surface of the vessel.

From the foregoing, it will be understood that the present invention may be used to advantage in various types of paper making machines, including others than the exemplary cylinder type illustrated herein, and in various other applications as will be apparent to those skilled in paper making machines or the like. It will be apparent to those so skilled that the teachings of this invention are particularly useful in applications or cases wherein it is desired to supply stock or a liquid suspension of solids at a high velocity to a paper making machine or to a processing apparatus without undesirable entering liquid flow conditions, such as for splashing or surface disturbances, harmful to the paper or to the final product.

5

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention, but it is understood that this application is to be limited only by the scope of the appended claims.

I claim as my invention:

1. In combination with a paper making machine having a vat and stock supply means including an upwardly extending vat inlet passage communicating therewith at its upper end under the normal supply stock liquid surface thereof and supplied at its lower end by a conduit having a flow velocity which would, if unreduced, cause surface disturbance of the said stock liquid surface and defective paper formation; the improvement of stock velocity reducing means comprising an always upwardly extending portion in said passage having a plurality of angularly disposed paths in series which are of increasing cross-sectional areas.

2. A paper making machine having a vat, a moving, fiber collecting, and web forming means therein, said vat including a stock inlet portion having a normal liquid level therein, and stock supply means including an upwardly extending passage communicating at its upper end under the said normal liquid level of the said stock inlet portion and, at its lower end receiving stock at a slow velocity which, if unreduced, would cause surface disturbance of the said stock liquid surface in said stock inlet portion and defective paper formation; the improvement comprising a series of always upwardly extending and angularly related portions in said passage which are of increasing cross-sectional areas to progressively reduce said stock velocity before it enters said stock inlet portion.

3. In combination, in a paper making machine having a vat, moving web forming means therein, a vat inlet portion, an upwardly extending and elongated making board between said vat and said vat inlet portion and over the whole length of which stock flows into said vat from a normal liquid surface level in said vat inlet portion, and an upwardly extending vat inlet passage communicating with said vat inlet portion below said normal liquid surface level thereof at its upper end and being connected at its lower end to conduit means of a smaller cross-sectional area having a stock flow velocity which, if unreduced, would cause improper web formation; the improvement of stock velocity reducing and turbulence preventing means in the lower portion of said upwardly extending passage comprising a plurality of angularly related pairs of upper and lower walls defining an always upwardly extending path having a series of passage lengths of successively alternating angles and of increasing cross-sectional areas.

4. A cylinder type paper making machine comprising a vat, a rotating and web collecting cylinder therein, a vat inlet portion, a making board over which stock flows having substantially the length of, and being adjacent to said vat inlet portion to receive stock flow therefrom, an upwardly extending stock supply passage discharging into said inlet portion below the top of said making board and having its upper end a width substantially equal to that of said inlet portion, and said stock supply passage having portions of increasing cross-sectional areas and a series of upwardly but angularly related paths therein.

5. The method of making paper comprising the steps of supply stock at a high velocity, progressively reducing the velocity of said stock by confining it for flow in always upward directions while angularly changing its path and increasing its cross-sectional areas, leading and confining said stock flow into an open top pool from the bottom thereof and without surface splashing, and then flowing only the upper part of said pool to a paper forming region to form a web of wet paper fibers.

6

6. In the making of paper, the method of handling an unduly high velocity stock supply flow comprising confining and directing said flow into a series of upwardly extending but alternately and angularly related paths and through a series of progressively increasing cross-sectional areas in under the surface of a substantially constant level and open surface body of stock to produce desirable surface flow conditions therein and from which body said stock is adapted to be formed into a paper web.

7. A paper making machine having stock supply means comprising a vat inlet portion having a normal stock liquid level therein, an upwardly extending passage discharging into said vat inlet portion under said normal liquid level surface thereof and having portions of progressively increasing cross-sectional areas and a plurality of angularly related but always upwardly directed paths in series.

8. A paper making machine having a stock supply means comprising an elongated making board, a vat inlet portion having a width extending along the length of said making board and a normal liquid level of stock therein to overflow said making board along its length, and an always upwardly extending passage having a width parallel to the width of said inlet portion and discharging into said inlet portion below said normal liquid level thereof, said passage having portions of increasing width in its upper flow direction and correspondingly increasing cross-sectional areas and a plurality of alternately directed paths in series angularly related in directions transverse of said making board and to the width of said passage.

9. A paper making machine having a making board, a wide inlet portion adjacent thereto and whose width extends along the length of said making board to overflow it from a normal liquid level of stock therein, an upwardly extending stock supply passage having a width parallel to said making board, portions of increasing cross-sectional area in its upward flow direction, and a series of angularly directed paths and valve means to control the flow rate of the stock in said supply passage comprising an elongated valve member extending across the width of said passage and movable transverse to said making board to form a variable area slot-like opening always extending entirely across the full width of said passage to always deliver a substantially uniform stock flow across the full width of said making board.

10. A paper making machine having an elongated making board, a vat inlet portion to supply stock to overflow along the entire length of said making board, an upwardly extending stock supply passage connected to the lower portion of said vat inlet portion and having a series of paths alternately and angularly directed in directions transverse to the length of said making board and of increasing thicknesses transverse to the length of said making board to define progressively increasing cross-sectional areas to reduce the stock velocity.

References Cited in the file of this patent

UNITED STATES PATENTS

60	1,046,901	Tierney -----	Dec. 10, 1912
	1,144,306	Mock -----	June 22, 1915
	1,262,225	Meyer -----	Apr. 9, 1918
	1,856,492	Marshall -----	May 3, 1932
	2,919,233	Lee -----	July 25, 1933
65	2,114,858	Rosch -----	Apr. 19, 1938
	2,527,298	Campbell -----	Oct. 24, 1950

FOREIGN PATENTS

70	921,160	France -----	Jan. 10, 1947
	224,759	Germany -----	Oct. 24, 1950
	462,124	Italy -----	Feb. 27, 1951