United States Patent [19]

Izawa et al.

[11] **3,780,405**

[45] **Dec. 25, 1973**

[54] **APPARATUS FOR SUPPLYING CRIMPED SYNTHETIC FILAMENT TOW TO CONVEYOR FOR HEAT TREATMENT**

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[22] Filed: **May 17, 1972**

[21] Appl. No.: **254,220**

[52] **U.S. Cl.** **28/1.6**

[51] **Int. Cl.** **D02g 1/12**

[58] **Field of Search** 28/1.6, 1.7, 72.14

[56] **References Cited**

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Primary Examiner—Louis K. Rimrodt
Attorney—Eliot S. Gerber

[57] **ABSTRACT**

An apparatus for supplying crimped synthetic filament tow to a conveyer for heat treatment is installed between a crimping device and the conveyor. The apparatus comprises a supply chute having a vertical portion in which crimped tow intermittently forced out from the crimping device is piled up, a curved portion, the lower end of which is formed to set up said crimped tow at right angles with respect to conveyer surface, and an outlet portion through which said crimped tow is forced out by pressure of succeeding tow. Flapper means is pivotably attached to said outlet portion of said supply chute to control filling conditions of said tow within said supply chute. A supplemental chute member may be provided between the crimping device and the supply chute, said supplemental chute member having a flapper pivotably attached thereto to control the discharge of the crimped tow from the supplemental chute.

10 Claims, 6 Drawing Figures

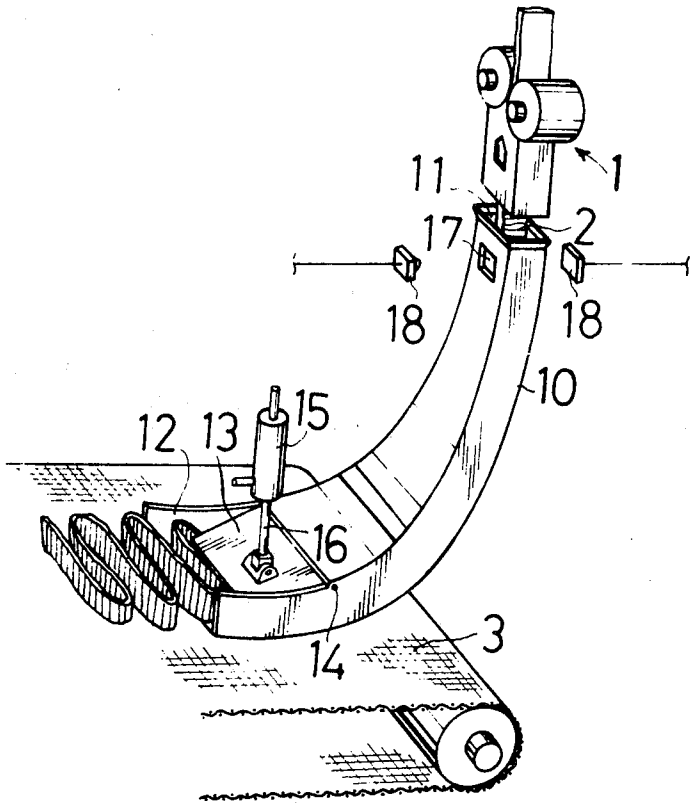


FIG. 1

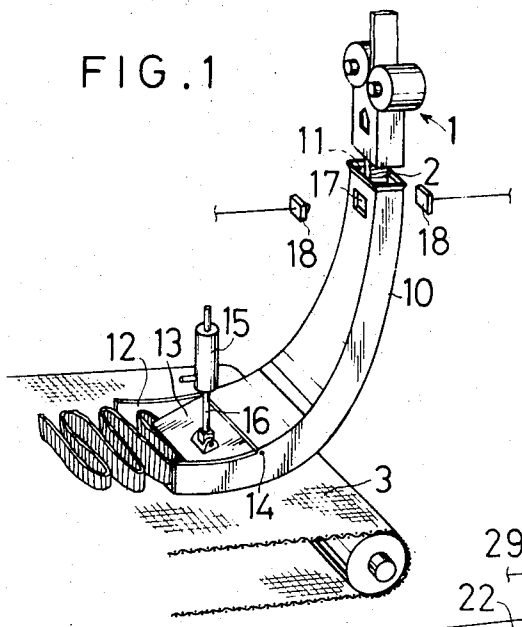


FIG. 2

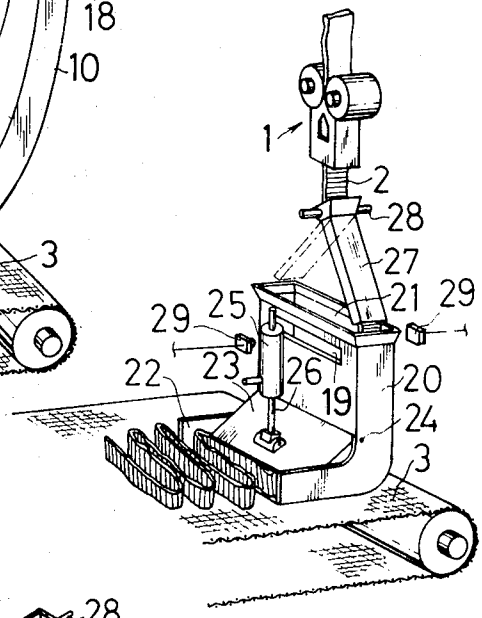


FIG. 5

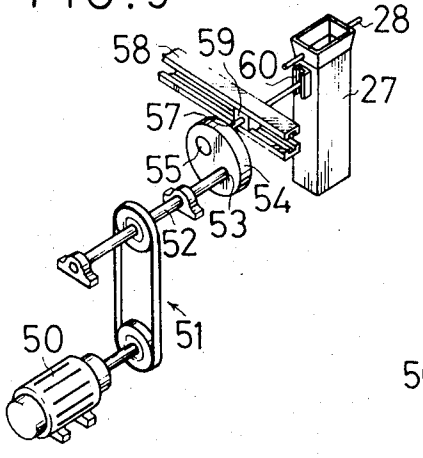


FIG. 6

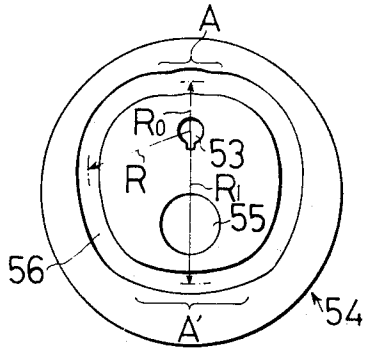


FIG. 3

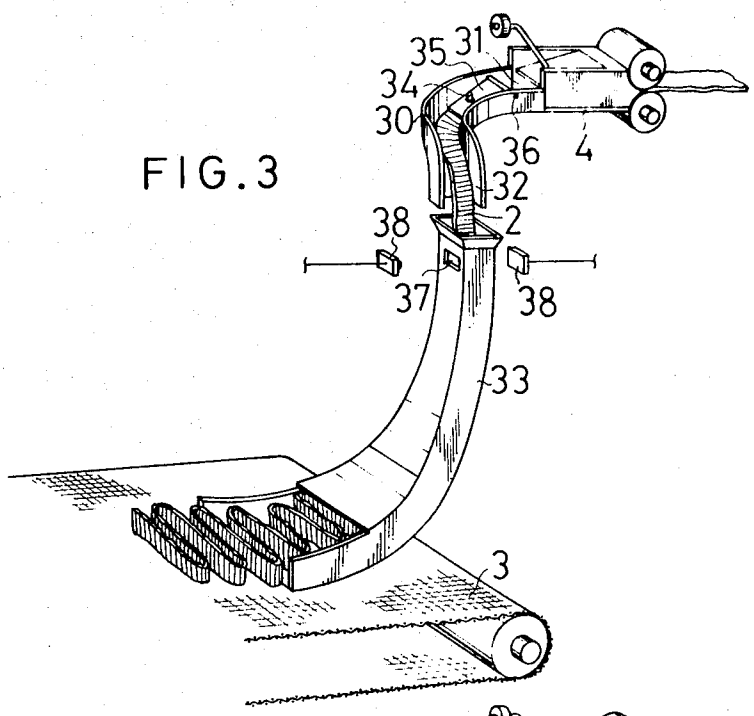
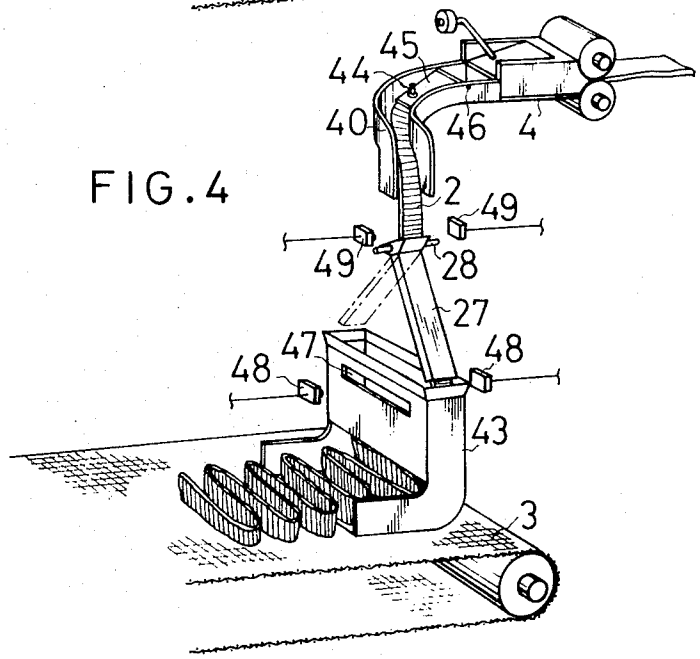

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FIG. 4


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APPARATUS FOR SUPPLYING CRIMPED SYNTHETIC FILAMENT TOW TO CONVEYOR FOR HEAT TREATMENT

This invention relates to an apparatus for supplying a crimped synthetic filament tow to a conveyor for heat treatment.

In conventional apparatus of the type with which this invention concerned, a synthetic filament tow discharged from a crimping device is successively folded and piled in a chute and are transferred to an outlet of the chute by the weight of the piled tow itself. The chute is curved or twisted and becomes wider toward the outlet thereof, so that the folded tow extends its width and changes its direction while travelling through the chute to be set up on a conveyor for subsequent drying and fixing treatments.

In another conventional apparatus of the type defined above, the synthetic filament tow discharged from the crimping device is traversed to widen its folded width and is transferred to the outlet of the chute by the weight of the piled tow itself. The tow is twisted and changed its direction while travelling through the chute to be set up on the subsequent conveyor.

However, the tow forcedly fed into a stuffing box of the crimping device by means of a pair of nip rollers is discharged therefrom only when the pressure in the box comes high enough to open a board, which is adapted to close an outlet of the box under a certain predetermined pressure. Accordingly, such discharge of the crimped tow is intermittent, that often checks the tow from being delivered upon the conveyor at an uniform density of the packed tow. Such frequently occurs especially when the chute is not sufficiently filled with the tow, for example, at starting time of the operation of the apparatus, or when the denier of the tow is too small. If the density of the tow on the conveyer is not uniform, the penetrability of the heating medium through the tow varies, which causes unevenness of the drying and fixing effects of the tow.

When the crimping device and the conveyer are installed in such a manner that the axial direction of the feed rollers for the crimping device and the moving direction of the conveyer are different, a twisted chute is employed for setting up the crimped tow on the conveyer. The twisted chute is often clogged with the crimped tow, and it is rather troublesome to remove the clogging tow.

Furthermore, when the crimped tow is traversed while being fed into the chute, the tow is more piled at the center portions of the traverse than at both extremities of the traverse. Accordingly, the piled tow at the center portions is deformed toward both sides thereof while travelling to the outlet of the chute. Such deformation of the tow will also causes to the clogging of the chute or the irregular discharge of the tow from the chute.

Accordingly, an object of the present invention is to provide an improved tow supply apparatus through which crimped tow discharged intermittently from a crimping device is continuously and regularly set up on a conveyer for the drying and the fixing.

Another object of the present invention is to provide an improved tow supply apparatus which is suited for twisting tow discharged from a crimping device to the moving direction of a conveyer for the drying and the fixing.

A further object of the present invention is to provide an improved tow supply apparatus wherein crimped tow is traversed and fed into a chute to eliminate any clogging of the chute.

According to the present invention, in a supply chute comprising an upper vertical portion in which crimped tow is piled up, a curved portion, the lower end of which is formed substantially to be in parallel to a conveyer adapted for heat treatment, and a tow outlet portion, a flapper is pivotably attached to the tow outlet portion.

Preferably, when a twisted chute is required, a relatively short supplemental chute member is installed in advance of a long supply chute.

The supplemental chute member is twisted and provided with a pivotably attached flapper.

By such provision of the flapper, though the crimped tow is intermittently discharged from the crimping device, the tow having been discharged through the outlet of the chute advances substantially at a fixed speed by the action of the flapper, thereby regularly setting up the tow on the conveyer with an uniform density of the packed tow.

Since the twisted portion is formed only to the relatively short supplemental chute member, the crimped tow having passed through the twisted portion goes down for a relatively long distance without clogging at the twisted portion. The supplemental chute member may be opened or provided with a pivotable cover to facilitate the removal of the clogging tow, if such clogging should occure.

The crimped tow discharged from the crimping device may be traversed before they are fed into the chute. It was found that if the tow in the traverse motion is positively stoped at both extremities thereof, the piled tow sliding down through the chute by its weight is hardly deformed. The stopping time T_2 at both extremities of the traverse motion is obtained from the following formula, wherein T_1 is time for one reciprocal movement between the both extremities:

$$0.15 \leqq 2\,T_2/T_1 \leqq 0.45$$

and preferably:

$$0.25 \leqq 2T_2/T_1 \leqq 0.45$$

The aforementioned and other objects and features of the present invention will be apparent from the following detailed discription of specific embodiments thereof, when read in conjunction with the accompanying drawings in which:

FIG. **1** through **4** are perspective views each showing different apparatus according to the present invention,

FIG. **5** is a perspective view showing a driving means for a tow traverse motion device, and

FIG. **6** is a plan view showing a cam plate to be used in the driving means in FIG. **5**.

In FIG. **1**, crimped tow **2** is discharged downwards from a crimping device **1** of the type which vertically compresses the tow and fed into a supply chute **10**. The chute **10** comprises an upper vertical portion having an opening **11** of rectangular section for insertion of the crimped tow **2**, a curved portion, the lower end of which is formed substantially to be in parallel to a conveyer **3** adapted for heat treatment, and a tow outlet portion **12**. The curved portion is so formed that flap surfaces of said crimped tow travelling through the chute become substantially at right angle with respect

to the conveyer surface. The tow outlet portion **12** is provided with a flapper **13** which is pivotably attached thereto by a horizontal shaft **14**. An air cylinder **15** is mounted upon the flapper **13** with its piston rod **16** connecting to the flapper.

The chute **10** is provided at its upper vertical portion with holes **17**. Photoelectric detection means **18** are provided in an alignment with the holes **17**.

The chute **10** has rectangular cross-sectioned shapes, the length of the longer sides gradually increasing from the upper opening **11** toward the outlet portion **12**.

In a second embodiment shown in FIG. **2**, there are some differences from the first embodiment in that a supply chute body **20** has a rectangular cross-sectioned shape wherein the length of the longer sides is substantially constant along the lengthwise direction of the chute, and that a traverse member **27** for feeding the crimped tow **2** into an upper opening **21** of the chute **20** is pivotably provided about a shaft **28**. However, the structure in the second embodiment is substantially same as that of the first embodiment in that a flapper **23** is pivotably attached to an outlet portion **22** of the chute **20** by a shaft **24** and that the flapper **23** is connected with a piston rod **26** of an air cylinder **25**. Photoelectric detection means **29** are also provided in an alignment with holes **19** in the chute **20**. Driving means for the traverse motion member **27** shall be described afterwards.

In both embodiments mentioned above, the flapper **13** or **23** is closed at starting times of the operation until the chute **10** or **20** is filled with the crimped tow **2**. Thereafter, the flapper **13** or **23** is opened to start discharge of the tow to the conveyer **3**. The flapper **13** or **23** may be opened continuously as far as the supply of the crimped tow to the chute **10** or **20** is balanced with the discharge of the crimped tow from the chute **10** or **20**. The air cylinder **15** or **25** can be operated to control not only the opening and closing of the flapper **13** or **23** but also the tow filling pressure within the chute **10** or **20**. Namely, if the supply amount and the discharge amount of the tow are not balanced, the air cylinder **15** or **25** can be operated to apply a fixed load or pressure upon the flapper **13** or **23**. Instead of the air cylinder **15** or **25**, a weight may be used, or if the flapper **13** or **23** itself is heavy enough to attain the purposes mentioned above, the air cylinder or the weight may be eliminated. By keeping the tow filling pressure constant, it becomes possible to obtain a fixed pressure to be applied to the back of the advancing crimped tow in the chute.

The photoelectric detection means detect the filling amount of the tow in the chute and signals to control the supply of the tow into the chute and the discharge thereof from the chute.

In a third embodiment shown in FIG. **3**, a tow supply apparatus is shown which is employed in association with a crimping device **4** which laterally compresses the tow. The tow supply apparatus comprises a relatively short supplemental chute member **30** and a supply chute **33**. The supplemental chute member **30** has a vertical outlet **32** twisted about **90** degrees with respect to a horizontal inlet **31** which is communicated with a discharge opening of the crimping device **4**. The supply chute **33** is not twisted, but curved like the supply chute **10** in FIG. **1**. A flapper **35** having a knob **34** thereon is pivotably attached to the supplemental chute member **30** by a shaft **36**. The upper surface of the supplemental chute member **30** is open in the embodiment shown in FIG. **3**, but they may be closed by a pivotable cover or a detachable cover. In order to stop the operation or to reduce the operation speed of the crimping device **4** when the crimped tow is filled within the supply chute **33** up to holes **37** made through upper both sides of the chute **33**, photoelectric detection means **38** are provided in an alignment with the holes **37**.

The functions of the photoelectric detection means are same as those mentioned in the first and second embodiments. If desired, the signal from the photoelectric detection means may be used to accelerate the speed of the conveyer **3**.

In a fourth embodiment shown in FIG. **4**, in place of the supply chute **33** in the third embodiment shown in FIG. **3**, a supply chute **43** and a traverse motion member **27** are employed which are similar to those in the second embodiment shown in FIG. **2**. In order to detect the filling up of the crimped tow **2** within the supply chute **43** for the same purpose as mentioned before, photoelectric detection means **48** are provided in an alignment with holes **47** made through upper side walls of the supply chute **43**. In addition, in order to detect the overflow of the tow from the upper end of the traverse motion member **27**, other photoelectric detection means **49** are provided at both sides and above the traverse motion member **27**.

In the embodiments which employ the traverse motion member **27**, it is designed to stop the traverse motion of the member **27** for a predetermined time at both extremities of the motion. The driving means for the traverse motion member **27** is shown in FIG. **5** by way of an example.

A shaft **52**, which is operatively connected to a motor **50** through a known transmission means **51** consisting of pulleys and a belt, is fixed eccentrically to a disk **54** at a point **53**. The disk **54** is provided with a hole **55** for counterbalance and a cam groove **56** as shown in FIG. **6**. A pin **57** is slidably engaged at its one end with the cam groove **56** and is fixed at its intermediate portion with a block **59** which is slidable in a slider casing **58**. The other end of the pin **57** is slidably fitted in a vertical guide groove **60** formed on the traverse motion member **27**. Above the vertical guide groove **60** is provided the shaft **28** for traverse motion of the member **27**.

The driving means converts the rotary motion of the disk **54** to the reciprocal motion of the block **59** by means of the cam groove **56** and the pin **57**, thereby swinging the traverse motion member **27** about the pin **28** by slidable engagement between the pin **57** and the guide groove **60**.

Profile of the cam groove **56** is, as shown in detail in FIG. **6**, designed in such a manner that the maximum radius of curvature Ro and the minimum radius of curvature R_I from the center **53**, to which the pin **52** is fixed, form constant circular arcs A and A', respectively. The time interval S for which the traverse motion member **27** stops moving is determined by the length of the circular arcs A and A'. Other remaining cam grooves are formed by radius of curvature R so that the slider **59** reciprocate along its stroke at a fixed speed. The length of stroke of the slidable block **59** is obtained from the difference between Ro and R_I. The speed of the slider can be adjusted by controlling the rotation speed of the disk **54**.

In the embodiment mentioned above, although the driving shaft **52** is eccentrically fixed to the disk **54**, it may be fixed to the center of the disk and the cam groove may be formed eccentrically with respect to the center.

Furthermore, in place of such cam assembly, limit switches may be employed to stop a driving source of swinging movement of the traverse motion member **27** at both ends of the upper opening of the chute.

Although the present invention has been described with reference to the preferred embodiments thereof, many other modifications and alternations may be made within the spirit of the present invention.

We claim:

1. An apparatus for supplying crimped synthetic filament tow to a conveyor for heat treatment, said apparatus being installed between a crimping device and said conveyor and comprising a chute having a vertical portion in which said crimped tow is piled, a curved portion of which lower end portion is formed to be substantially in parallel to said conveyor to change the direction of flat surface of said crimped tow substantially to right angle with respect to conveyor surface, and an outlet portion through which said crimped tow is discharged; and a flapper plate means pivotably attached to said outlet portion of said chute, said flapper plate means being pushed out by said crimped tow to open said outlet of said chute only when the gravity of said crimped tow piled in said chute exceeds a predetermined value.

2. An apparatus as claimed in claim **1** further comprising means for traversing said crimped tow intermittently forced out from said crimping device into said vertical portion of said chute.

3. An apparatus as claimed in claim **2,** wherein said traversing means is stopped for stopping time T_2 at both extremities of the traversing motion, said stopping time T_2 being defined by the following formula :

$$0.15 \leqq 2\,T_2/T_1 \leqq 0.45$$

wherein T_1 is time for one reciprocal movement of said traversing means.

4. An apparatus as claimed in claim **2,** wherein said vertical portion of said chute is provided at its upper portions with holes and photoelectric detection means are provided in an alignment with said holes.

5. An apparatus as claimed in claim **1,** wherein said vertical portion of said chute is provided at its upper portions with holes and photoelectric detection means are provided in an alignment with said holes.

6. An apparatus for supplying crimped synthetic filament tow to a conveyor for heat treatment, said apparatus being installed between a crimping device for laterally compressing the tow and said conveyor, said apparatus comprising a supply chute having a vertical portion in which said crimped tow is piled, a curved portion of which lower end portion is formed to be substantially in parallel to said conveyor to change the direction of flat surface of said crimped tow substantially to right angle with respect to conveyor surface, and an outlet portion through which said crimped tow is forced out by weight of succeeding tow; a supplemental chute member provided in advance of said supply chute for leading said crimped tow from said crimping device to said supply chute, said supplemental chute member being bent about 90 degrees with respect to a horizontal inlet; and a flapper plate means pivotally attached to said supplemental chute member, said flapper plate means being pushed out by said crimped tow to allow said crimped tow to come into said supply chute only when the force of the crimped tow pushing out said flapper plate means from behind the latter exceeds a predetermined value.

7. An apparatus as claimed in claim **6** further comprising means for traversing said crimped tow delivered from said supplemental chute member into said vertical portion of said supply chute.

8. An apparatus as claimed in claim **7,** wherein said traversing means is stopped for stopping time T_2 at both extremities of the traversing motion, said stopping time T_2 being defined by the following formula :

$$0.15 \leqq 2\,T_2/T_1 \leqq 0.45$$

wherein T_1 is time for one reciprocal movement of said traversing means.

9. An apparatus as claimed in claim **7,** wherein said vertical portion of said supply chute is provided at its upper portions with holes and photoelectric detection means are provided in an alignment with said holes.

10. An apparatus as claimed in claim **6,** wherein said vertical portion of said supply chute is provided at its upper portions with holes and photoelectric detection means are provided in an alignment with said holes.

* * * * *

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,780,405 Dated December 25, 1973

Inventor(s) Nobuharu Izawa et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the Heading, beneath "Appln. No. 254,220"
insert

-- Foreign Application Priority Data

May 27, 1971 Japan 46-36558
July 5, 1971 Japan 46-49443
June 14, 1971 Japan ..... 46-50630 --

Signed and sealed this 9th day of April 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents