July 18, 1967 F. S. LAPEYRE 3,331,097

PROCESS FOR TREATING SHRIMP

Filed June 11, 1965 2 Sheets-Sheet 1

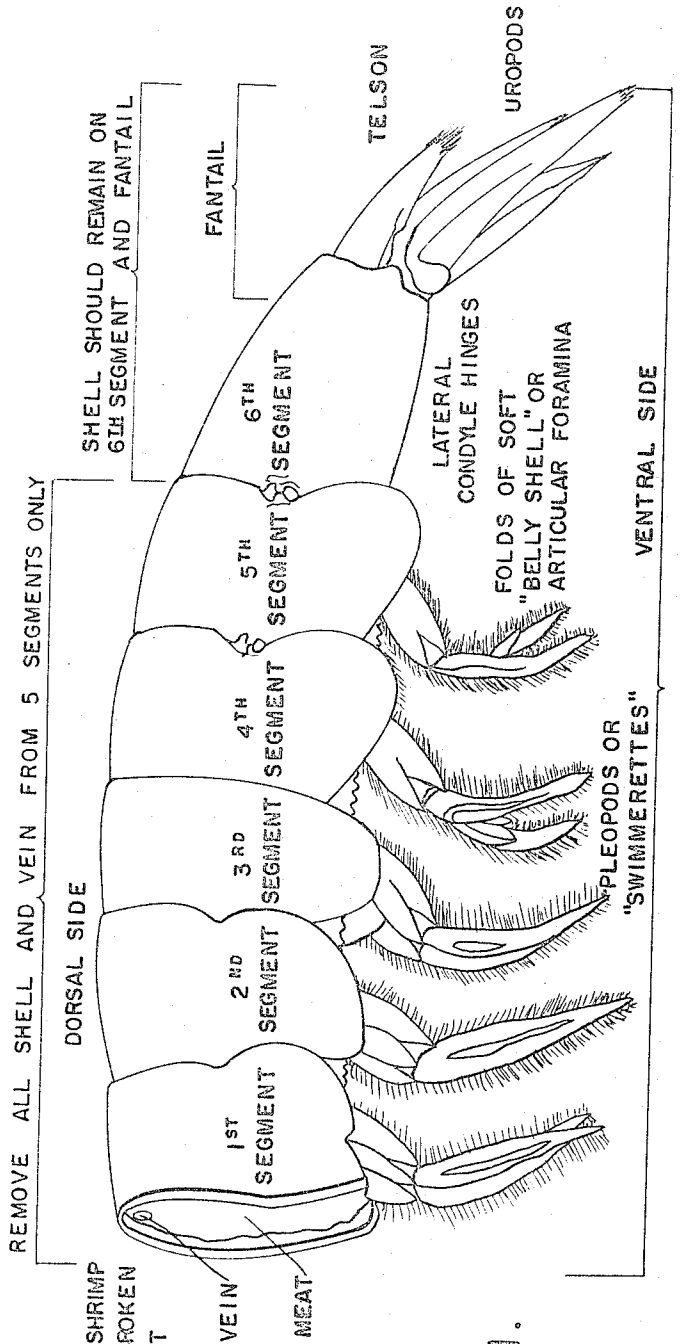

FIG. 1.

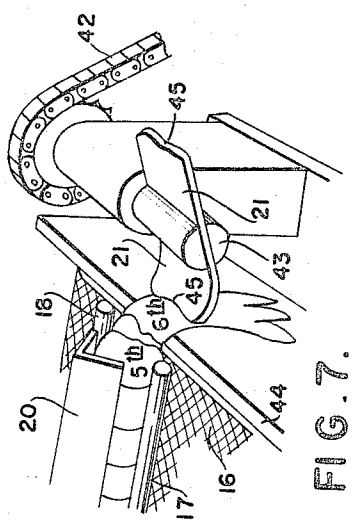

FIG. 7.

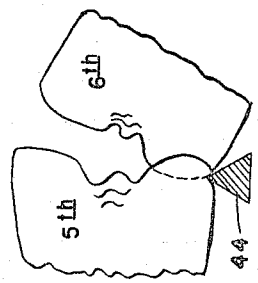

FIG. 3.

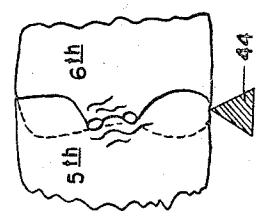

FIG. 2.

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PROCESS FOR TREATING SHRIMP

Filed June 11, 1965 2 Sheets-Sheet 2

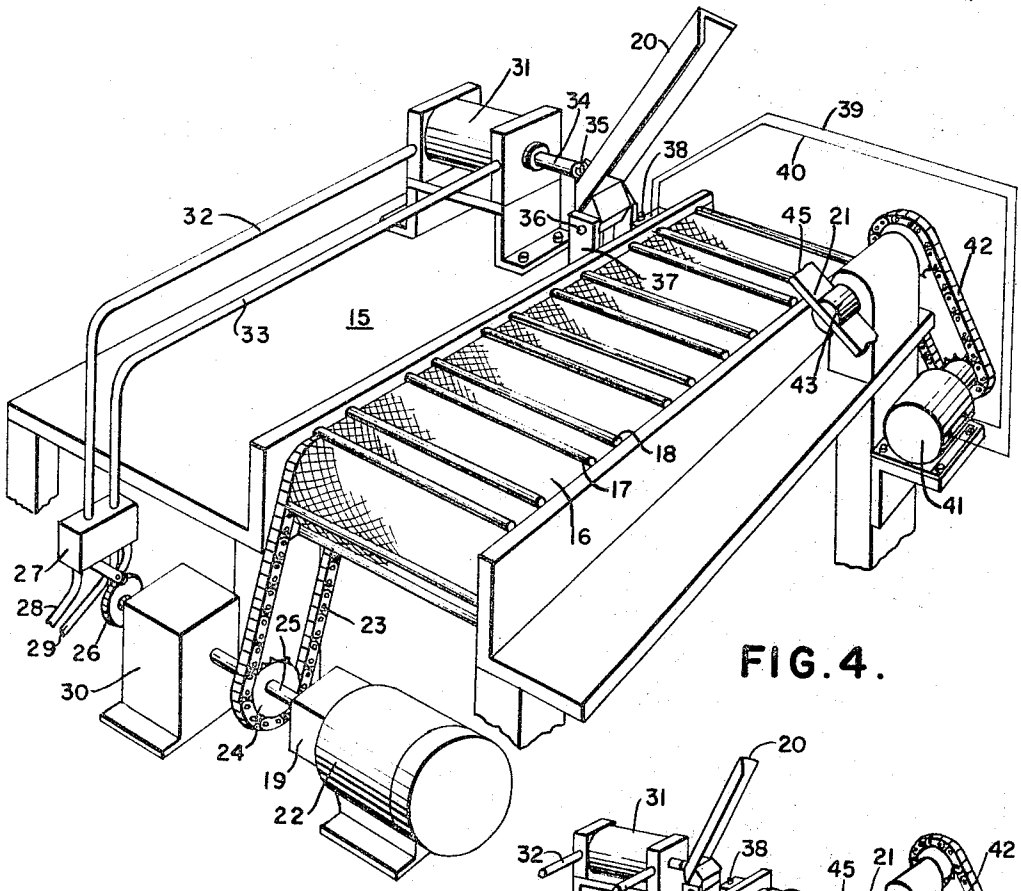

FIG. 4.

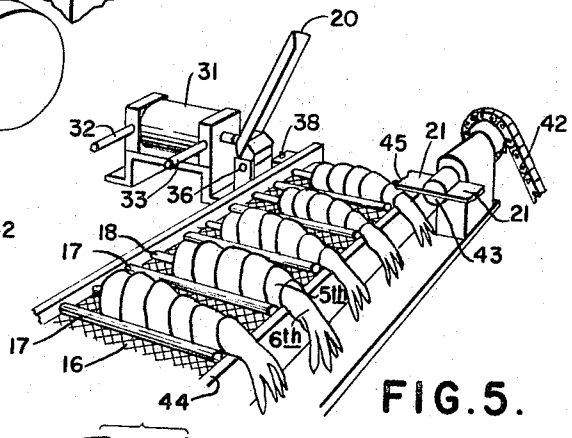

FIG. 5.

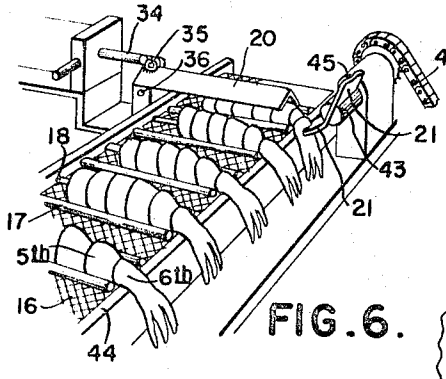

FIG. 6.

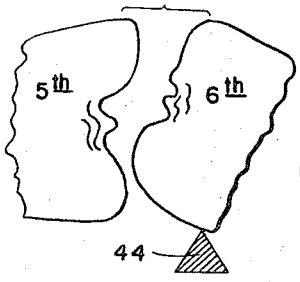

FIG. 9.

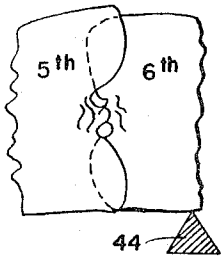

FIG. 8.

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PROCESS FOR TREATING SHRIMP

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Filed June 11, 1965, Ser. No. 463,290
15 Claims. (Cl. 17—45)

The present invention relates to process for treating shrimp.

An object of the invention is to break or disjoint the articulation between the 5th and 6th segments of a shrimp to the end that the first five abdominal segments may be peeled to expose the included meat, while the 6th abdominal segment is left intact along with the uropods and telson in a pattern which is generally referred to as fantail shrimp.

The articulation between the 5th and 6th shell segments of a shrimp is composed of what are technically referred to as lateral condyle hinges. Such hinges are two in number and the same are located at lateral portions of the segments. The object of the invention is to disjoin or pull apart the components of these segments by a single movement relatively between the 5th and 6th segments which preferably contemporaneously acts upon both lateral hinges in a movement which in effect pulls the components of the hinges apart.

A further object of the invention is to provide a process for breaking or disjointing the lateral condyle hinges between the 5th and 6th abdominal segments to facilitate the later peeling of the first five segments only subsequent to an incising or slitting operation performed on the dorsal side of the shrimp to and through the first five abdominal segments.

A still further object of the invention is to provide a process by which shrimp may be brought in succession to an operative station, there halted in movement, immobilized, subjected to a hinge disjointing operation, subsequently released and moved to a discharge position while a subsequent shrimp is being brought into correct registry in the operating station to the immobilizing means.

The invention has for a further object to provide in one embodiment a continuous process by which shrimp are moved step-wise in continuous succession to an operating station wherein the 6th segment, after being arrested in motion and immobilized, are subjected to a substantially unidirectional thrust movement in a dorsal-to-ventral direction about a lateral fulcrum which is preferably substantially parallel with and displaced from the axial line passing through both lateral condyle hinges with the ultimate effect of pulling the 6th segment from the 5th segment so that both hinges are disjointed substantially simultaneously.

With the foregoing and other objects in view, the invention will be more fully described hereinafter, and will be more particularly pointed out in the claims appended hereto.

In the drawings, wherein like symbols refer to like or corresponding parts throughout the several views:

FIGURE 1 is a schematic of a de-headed shrimp with applicable terminology applied thereto showing the raw product on which the improved process and apparatus operate.

FIGURE 2 is an enlarged fragmentary side elevational view of the articulation between the 5th and 6th shell abdominal segments showing the normal jointed condition thereof.

FIGURE 3 is a similar view showing the condition of the condyle hinges after being treated by the process and machine of the present invention.

FIGURE 4 is a fragmentary perspective view showing one form of machine for carrying out the improved process.

FIGURE 5 is a similar view with certain mechanical details omitted but showing the manner in which headless shrimp are placed upon a conveyor by which the same are moved in succession to an operating station.

FIGURE 6 is a view similar to FIGURE 5 showing a shrimp immobilized and in the act of subjection to the disjointing operation.

FIGURE 7 is a fragmentary perspective view taken at the operating station showing a form of device by which the disjointing operation may be performed.

FIGURE 8 is an enlarged fragmentary side elevational view of the articulation between the 5th and 6th shell abdominal segments showing the placement of the shrimp so that the fulcrum is beneath the 6th segment aft of the vertical line passing through the hinge axis.

FIGURE 9 is a similar view showing the separation of the condyle hinges and the position of the 6th segment after the hinges have been pulled apart.

Referring more particularly to the drawings and initially to FIGURE 1 which illustrates the essential morphology of the shrimp, particularly the white shrimp (*Penaeus setiferus*) which is more particularly illustrated on pages 4, 5, 6 and 104 of Fishery Bulletin 145 by Joseph H. Young, from Fishery Bulletin of the Fish and Wildlife Service, volume 59, United States Department of the Interior.

FIGURE 1 illustrates a headless or de-headed shrimp showing that the body section containing the edible meat is enclosed in abdominal segments **1** to **6** inclusive, the 6th segment being directly connected to the uropods and the telson: such 6th segment being connected with the 5th segment by the lateral condyle hinges which provide the articulation betweeen these segments by which the shrimp is enabled to assume the curled condition typical of the specie.

A detail of this articulation is shown more clearly on page 104 of the publication referred to. While there is a similar articulation between the 4th and 5th segments it does not possess the strength of the hinges between the 5th and 6th segments and as the 5th segment, along with segments **1**, **2**, **3**, **4**, is to be incised and removed revealing the body meat, the invention is not concerned with the articulation between the 4th and 5th segments but only with the hinges between the 5th and 6th segments, as the latter are preferably to be disjointed, pulled out or broken advantageously before slitting the dorsal side of the shrimp as otherwise the undisturbed articulation at this point may become troublesome in securing full and clean removal of the 5th segment and may cause tearing of the meat or other multilation resulting in down-grading of the meat in the market.

FIGURE 2 shows the articulation between the 5th and 6th abdominal segments intact in its natural association.

FIGURE 3 shows that, by operation of the process and machine of the invention, the 6th segment has been displaced rearwardly as a result of the operation of the process and machine of this invention.

Referring more particularly to FIGURES 4 to 7 inclusive, a form of machine is illustrated which includes a frame designated generally at **15** in which is mounted an endless conveyor **16**, preferably of a flexible mesh type, on which are mounted cradles for the headless shrimp. There cradles may comprise rods or bars **17**, **18** spaced apart a suitable distance for receiving and retaining the headless shrimp, as indicated in FIGURES 5, 6 and 7. These cradles are spaced apart suitable distances conforming to the dictates of an indexing mechanism **19** which requires that the conveyor be moved step-by-step

through exact equal linear distances in order to register the shrimp accurately at an operating station to an immobilizing member **20** and a hinge disjointing member **21**.

The conveyor **16** may be driven by any suitable motor **22**; for instance, an electric motor incorporating the usual reduction gear, through a chain or other drive **23** from a drive sprocket **24** on the shaft **25** controlled by the indexing mechanism **19**.

The indexing shaft **25** may also drive a cam **26** or other suitable mechanism for tripping a hydraulic valve **27** connected with hydraulic supply and return lines **28** and **29**. The shaft **25** may, if desired, be stepped-up in rotation through a step-up gear **30** to assure sufficient rotation of the cam **26** to supply and withdraw hydraulic fluid to and from a hydraulic motor **31** by lines **32** and **33**.

A plunger rod **34** of the motor **31** may be pivotally connected at **35** to the immobilizing member **20**, which latter may be pivoted at **36** to upstanding brackets **37** on the frame **15**.

Operation of the motor **31** is accordingly in timed relation to that of the conveyor **16** so that the immobilizing member **20** will be lowered upon a shrimp, as shown in FIGURES 6 and 7, at the operating station when the motor **22** and indexing mechanism **19** have moved the next in line shrimp on the conveyor into accurate registry at the operating station beneath the members **20** and **21**.

In descending to the position of FIGURE 6 the immobilizing member encounters and depresses a spring projected micro or other switch actuating button **38** for closing a circuit **39**, **40** to a motor **41** connected through chain and sprocket drive **42**, or otherwise, to a rotary shaft **43** on which the hinge disjointing member **21** is mounted. In this way the tail or hinge breaker may only be put in operation after the shrimp has been halted at the operating station and the immobilizing member **20** lowered to final position thereon.

As shown in FIGURES 5, 6 and 7, the shrimp are placed upon the conveyor belt **16** in the order and orientation illustrated in which the 6th abdominal segment overhangs an anvil **44** which may be a siding for the conveyor. This anvil serves to supply a fulcrum about which the 6th abdominal shell segment may be rocked or partially rotated incident to the downward striking or thrust movement of the breaker member **21** which may have one or more paddles, two such paddles being indicated in the drawing.

The free edges of the paddles may be incurved as indicated at **45** to conform generally to the curvature of the dorsal side of the 6th abdominal segment, as shown particularly in FIGURE 7 where the member **21** is shown as being flexed incident to the downward striking blow and the resistance thereto afforded by the 6th abdominal segment. In other words the so-called tail breaking member **21** may be of relatively stiff rubber contoured at its striking edges, as shown and referred to.

In operation, shrimp may be placed on the conveyor by hand or machine as the cradles rotate from the underside of the conveyor upwardly at the near end of the conveyor, as viewed in FIGURE 4. The conveyor moves step-by-step the distance between cradles and undergoes dwell periods at the operating station. At dwell periods the indexing mechanism halts each cradle in accurate registry with the immobilizing member, at which time the cam **26** has positioned the valve mechanism **27** to deliver pressurized fluid through the line **32** to the cylinder **31** of the motor, moving the piston and plunger rod **34** forwardly and lowering the immobilizing member **20** upon the shrimp occupying the incident cradle. This position of the parts is shown in FIGURE 6.

Incident to this movement of the immobilizing member **20** the circuit **39**, **40** is closed through the valve actuating member **38** and motion of the breaker member **21** is generated by action of the motor **41**. One or more strikes may be made by the paddles of the breaker member **21** which will rotate in a counterclockwise movement, as viewed in FIGURES 4, 5 and 6.

The breaker member **21** will descend on the tail portion of the shrimp which is overhanging the anvil **44** and tend to rock the tailpiece including the 6th abdominal shell segment about the axis defined by the upper edge of the anvil **44**, thus causing a dorsal-to-ventral movement of the tailpiece in a substantialy vertical or unidirectional movement which in effect will pull the lateral condyle hinges apart in a single displacing movement. The fulcrum defined by the upper edge of the anvil **44** is preferably substantially parallel to the axial line connecting the two lateral condyle hinges between abdominal shell segments **5** and **6** so that simultaneous pulling action is exerted on both hinges.

The intermittent movement of the conveyor, the subsequent movement of the immobilizing member and the consequent operation of the breaker member are all timed in a definite sequence in which a preselected linear travel of the conveyor between dwell periods acts to set in motion the motor for lowering the immobilizing member **20**, and the final descending movement of the immobilizing member sets in motion the tail breaking member.

In FIGURE 2 the shrimp is so placed that the fulcrum is located directly under the condyle axis.

FIGURE 3 shows the position of abdominal shell segment **6** after the breaker member has rocked the 6th segment about this fulcrum, showing the separation of the components of the hinges.

FIGURE 8 shows that the shrimp has been so placed that the fulcrum is now placed aft of a vertical line running through the axis of the two condyle hinges.

FIGURE 9 shows the rocked position of the 6th segment after being operated on by the breaker member.

In some of the claims, notably claims **7** and **9**, appears the expression, "shear stresses." In Van Nostrand's Scientific Encyclopedia, third edition, 1958, page 563, the following appears in the second column, lines 4–6:

"Shearing stress is the force tending to push one layer of the material past the adjacent layer, per unit area of the ayers,"

In its application here the paddle **45** pushes segment **6** past adjacent overlapped segment **5** to break the attachment of the condyle hinges.

Although I have disclosed herein the best forms of the invention known to me at this time, I reserve the right to all such modifications and changes as may come within the scope of the following claims.

What is claimed is:

1. The process of treating shrimp to break both of the condyle hinges between the 5th and 6th abdominal shell segments comprising the step of causing at least a single movement of one of the segments relatively to the other substantially in a dorsal-to-ventral direction of the shrimp.

2. The process of treating shrimp to break both of the condyle hinges between the 5th and 6th abdominal shell segments comprising substantially immobilizing at least shell segment **5**, while causing a controlled single moving of the 6th shell segment away from shell segment in a substantially dorsal-to-ventral direction of the shrimp, and avoiding damage to the meat of the shrimp.

3. The process as claimed in claim **2**, wherein the movement of shell segment **6** is about an axis displaced from the axis passing through both natural condyle hinges connecting shell segments **5** and **6**.

4. The process as claimed in claim **3**, wherein the axis displaced from that passing through the condyle hinges generally coincides with the edge of a fulcrum about which shell segment **6** is caused to pivot.

5. The process as claimed in claim **3**, wherein the axis about which the 6th shell segment is caused to pivot and the axis through the two condyle hinges between shell segments **5** and **6** are substantially parallel.

6. The process of treating shell-on shrimp to break the articulation between the 5th and 6th abdominal shell segments comprising the step of applying unidirection stresses to the condyle hinges substantially simultaneously in a substantially dorsal-to-ventral direction of the shrimp, by causing a forced movement of shell segment **6**, while restraining shell segment **5** from moving so that the said condyle hinges are disjoined.

7. The process of treating raw shrimp to break the articulation between the 5th and 6th abdominal shell segments comprising the step of applying stresses to the condyle hinges substantially simultaneously in a single movement resulting from at least a single applied force to one of said segments relative to the other of said segments, while substantially restraining the other segment, so that said condyle hinges are disjoined.

8. The process of treating shrimp to break the articulation between the 5th and 6th abdominal shell segments comprising the step of applying sufficient stresses to the condyle hinges substantially simultaneously in a single movement of abdominal segment **6** in relation to abdominal segment **5**, the movement being in a substantially dorsal-to-ventral direction so that the said condyle hinges are disjoined.

9. The process of treating raw shell-on shrimp to break the articulation between the 5th and 6th abdominal shell segments comprising the step of applying shear stresses substantially simultaneously to the two lateral condyle hinges connecting said shell segments in a single forced movement of abdominal segment **6** while restraining abdominal segment **5** from moving, the movement being in a substantially dorsal-to-ventral direction so that the hinge connections are disjoined.

10. The process of treating shell-on shrimp to break the articulation between the 5th and 6th abdominal shell segments comprising the step of applying substantially simultaneously sufficient stresses to the two lateral condyle hinges connecting said shell segments in a single forced movement of abdominal segment **6**, such single forced movement being in a substantially dorsal-to-ventral direction while restraining abdominal segment **5** from moving, so that the hinge connections are disjoined.

11. The process of treating shrimp to break the articulation between the 5th and 6th abdominal shell segments comprising the step of applying a unidirectional force between the 5th and 6th abdominal segments for moving the segments relatively apart and simultaneously disjoining both lateral condyle hinges, such unidirectional force being applied in a substantially dorsal-to-central direction.

12. The process of treating shrimp to break the articulation between the 5th and 6th abdominal shell segments comprising the step of applying thrust substantially simultaneously to lateral areas of the 5th and 6th abdominal shell segments in the vicinity of the lateral condyle hinges in a substantially dorsal-to-ventral direction for disjoining the hinges.

13. The process of treating shrimp to break the articulation between the 5th and 6th abdominal shell segments comprising the step of generating a force applied in one movement to both lateral condyle hinges acting in a substantially dorsal-to-ventral direction for separating the components of the hinges and enabling the first five segments to be de-shelled while leaving the 6th segment intact.

14. The process of treating shrimp to break the articulation between the 5th and 6th abdominal shell segments comprising the step of pivoting in a dorsal-to-ventral direction the 6th segment relatively to the 5th segment about an axis displaced from the lateral axis passing through the natural condyle hinges to lever the condyle hinges apart.

15. The process of treating shrimp to break the articulation between the 5th and 6th abdominal shell segments comprising the steps of immobilizing at least shell segment **5**, angularly moving the 6th segment relatively to the 5th segment about a fulcrum displaced rearwardly of the axis passing laterally through both condyle hinges to exert a longitudinally rearward force pulling the hinges apart.

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LUCIE H. LAUDENSLAGER, *Primary Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,331,097 July 18, 1967

Fernand S. Lapeyre

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 4, line 60, for "segment", second occurrence, read -- segment 5 --.

Signed and sealed this 27th day of August 1968.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents