July 5, 1955 R. J. SAMANIE 2,712,152½

PROCESS FOR PEELING AND CLEANING SHRIMP

Original Filed July 21, 1952 2 Sheets-Sheet 2

Fig. 2.

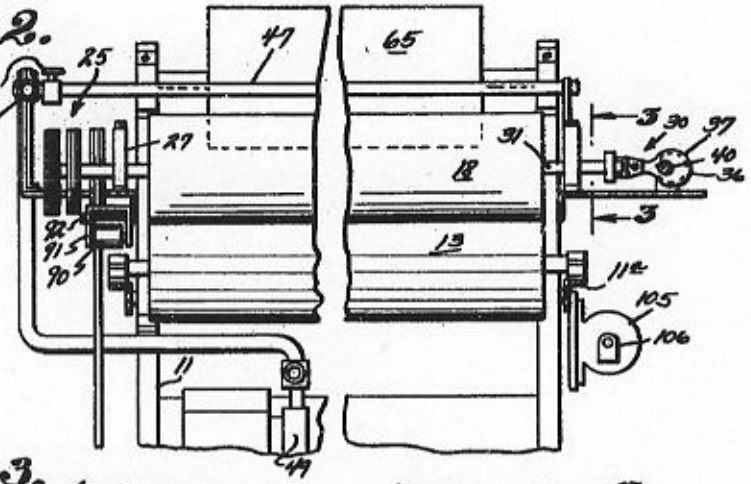


Fig. 3.

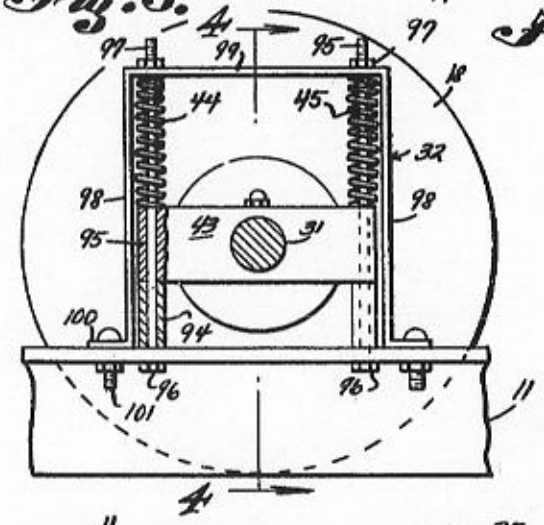


Fig. 4

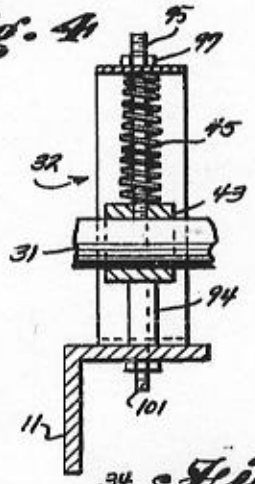
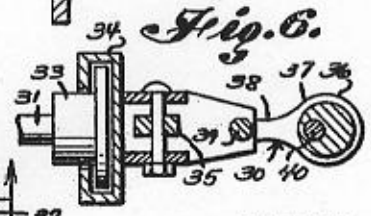


Fig. 6.



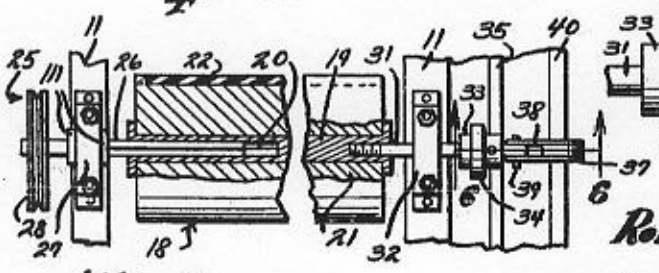


Fig. 5.

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PROCESS FOR PEELING AND CLEANING SHRIMP

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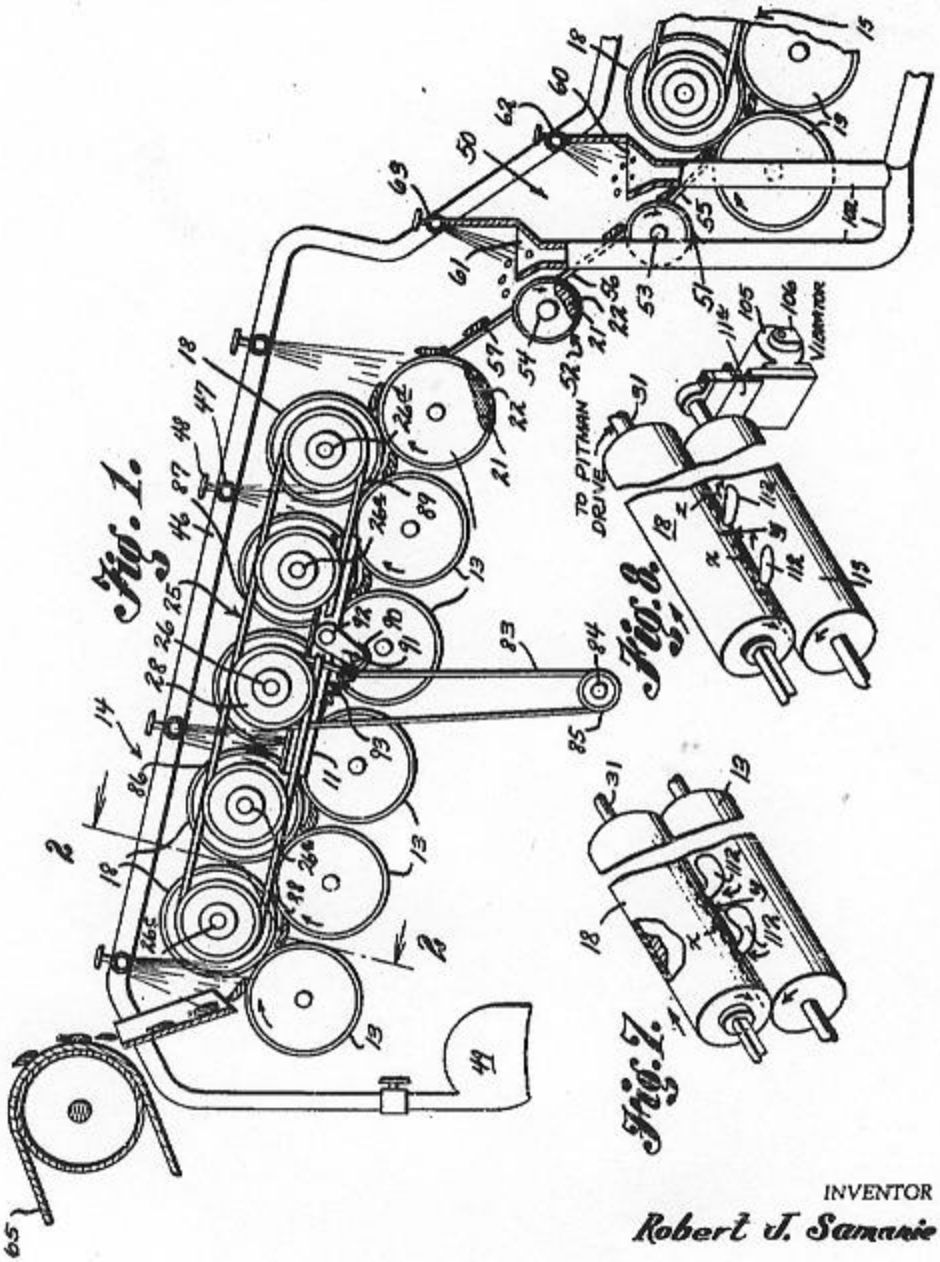

Fig. 1.

Fig. 8.

Fig. 7.

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PROCESS FOR PEELING AND CLEANING SHRIMP

Robert J. Samanie, Houma, La.

Original application July 21, 1952, Serial No. 299,995. Divided and this application October 29, 1954, Serial No. 465,651

6 Claims. (Cl. 17—45)

The present invention relates to process for peeling and cleaning shrimp and is a division of my co-pending application filed July 21, 1952, Serial No. 299,995, entitled Shrimp Peeling and Cleaning Device.

An object of this invention is to provide a process for removing the meat of shrimp from their heads and hulls without crushing or otherwise destroying the meat.

It is another object of this invention to provide a process which is particularly adapted for peeling and cleaning shrimp of various sizes.

It is a further object of this invention to provide a novel process for separating the head and hull of shrimp from the shrimp meat in a simple and efficient manner.

It is a still further object of this invention to provide a process for peeling and cleaning shrimp, the steps of which are few and simple and easily and inexpensively practiced.

A still further object of the invention is to provide a process for peeling shrimp in which a squeezing or pinching action is exerted upon the shrimp simultaneously with a rolling action in order to break the membrane holding the sections of the hull or shell together and to thus loosen the sections of hull or shell from the shrimp meats.

In a more specific aspect, it is a still further object of the invention to communicate to the shrimp a high frequency vibration while the shrimp are being rolled and squeezed or pinched to faciiitate the breaking of the membrane or the hull and shell and to thus aid in the separation of the shrimp meats from the hull or shell.

It is a still further object of the invention to provide a process for peeling shrimp in which the shrimp are cleaned by flushing water upon the same, which will wash down the shrimp heads and hulls and which will ease the movement of the shrimp as it is subjected to the pressure of the squeezing or pinching action and the rolling action as previously described.

With the foregoing and other objects in view the steps of the process will be more fully described hereinafter and more particularly pointed out in the appended claims.

For convenience in describing the several steps of the process the accompanying drawings disclose a form of machine which, among others, may be employed to carry out the process.

In the drawings, in which like parts are denoted by the same reference numerals throughout the several views:

Figure 1 is a side elevational view, with parts broken away and parts shown in section, of a machine which discloses the various steps of the process.

Figure 2 is a cross-sectional view taken on an enlarged scale on the line 2—2 in Figure 1.

Figure 3 is a vertical longitudinal fragmentary section taken on a magnified scale on the line 3—3 in Figure 2.

Figure 4 is a vertical cross-sectional view taken on the line 4—4 in Figure 3.

Figure 5 is a plan view, with parts broken away and parts shown in section of a roller showing a form of reciprocating motion for the same.

Figure 6 is a longitudinal sectional view taken on an enlarged scale on the line 6—6 of Figure 5.

Figure 7 is a fragmentary perspective view showing the initial step in the process by which the shrimp is being subjected to pressure or to a squeezing or pinching action.

Figure 8 is a similar view showing the parts of the apparatus in a subsequent position to carry out the second step of the process of rolling the shrimp while under pressure and of carrying out a third step, where the same may be desirable, of subjecting the shrimp to a vibratory action while under pressure and rolling.

Referring now more particularly to the drawings, the consideration of which will greatly facilitate the understanding of the process, the machine embodies a frame 11 of any suitable character. Disposed in end-to-end spaced relation with respect to each other are a plurality of tiers of rollers, generally designated in Figure 1 by the reference numerals 14, 15, each of the tiers being disposed in a plane inclined with respect to the horizontal. Since the structure of each of the tiers of rollers 14, 15 is the same, it will suffice to describe only one in detail.

The tier 14 of rollers embodies a first set of rollers, generally designated by the reference numeral 13 positioned in side-by-side, slightly spaced relation with respect to each other, and mounted on the frame 11 for rotary movement about transverse axes. Positioned above and in staggered, contacting relation with respect to the first set of rollers 13, is a second set of rollers, generally designated by the reference numeral 18.

Referring now with particularity to Figure 5, there is shown one of the rollers 18 which embodies a shaft 19 which is provided with a bore 20 extending inwardly from one end thereof. Superimposed about the shaft 19 intermediate its ends is a roller body 21 which is fabricated of a soft sponge rubber and is provided with an outer covering 22 fabricated of a flexible, water-proof material. The outer cover 22 may be provided with ridges or grooves to present a relatively rough surface to the shrimp to be peeled and cleaned.

Operatively connected to the shaft 19 of each of the rollers 18 of the respective tiers is a drive mechanism, generally designated by the reference numeral 25, for effecting the rotary movement of the rollers of the second set 18. As previously pointed out, the respective rollers 18 of the tiers 14, 15 are in contacting relation with the rollers of the first set 13, and therefore drive the latter upon being actuated by the drive mechanism 25.

The drive mechanism 25 embodies a stub shaft 26 rotatably journalled intermediate its ends on the frame 11 by means of the bearing 27 and having one end slidably received and supported within the bore 20 of the shaft 19 of the adjacent one of the rollers 18. The other end of each of the stub shafts 26 is provided with a drive pulley 28 which is engaged by a belt as hereinafter described. Accordingly, each of the rollers of the second set 18 of the tiers 14, 15 will be rotated about an axis extending transversely of the frame and effect a corresponding rotation of the rollers of the first set 13 of the tiers.

Operatively connected to the other end of each of the rollers 18 of the tiers 14, 15 is a reciprocating mechanism, generally designated by the reference numeral 30 for imparting a reciprocatory movement to the rollers 18 longitudinally of the rollers 13. As clearly appears in Figures 5 and 6, there is shown the reciprocating mechanism which embodies a stub shaft 31 mounted on the frame 11 intermediate its ends by means of the bearing 32, the shaft having one end fixedly secured to the

adjacent end of the shaft **19** and having its other end provided with a flanged annular collar **33** which is loosely received and supported within an annular housing **34**. Accordingly, the stub shaft **31** rotatably supports the adjacent end of the shaft **19**. A connecting rod **35** extends between the annular housings **34** of each set of rollers **18**. Operatively connected to the end adjacent ones of the annular housings **34** carried by the connecting rod **35** is an eccentric **36**, the operative connection being effected by means of a collar **37** superimposed about the eccentric **36** and an arm **38** carried by the collar **37** and pivotally supported to the annular housing **34** by means of the pivot pin **39**. The eccentric **36** is secured to drive shaft **40** which is driven by an appropriate motor (not shown). Accordingly, upon the rotation of the shaft **40** and eccentrics **36**, the rollers **18** of the tiers **14**, **15** will be reciprocated longitudinally of the rollers **13**. It is to be noted, upon reference to Figure **5**, that the end of the stub shaft **26** received within the bore **20** is squared, so that the desired reciprocatory movement can be effected without hindering the operability of the drive mechanism **25** which rotates the rollers **18**.

In Figure 3 there is shown the rotatable mounting for the rollers **18**, the mounting including a bearing **43** which is resiliently supported on the frame **11** by means of the springs **44** and **45**. Accordingly, when relatively large shrimp pass between the rollers **13** and **18**, the bearing **43** will be permitted to ride up due to its resilient mounting to thereby release the excessive pressure on the shrimp which may cause damage to the meat thereof.

Overlying the tiers of rollers **14**, **15** and supported on the frame **11** is a watering system, generally designated by the reference numeral **46** which embodies a plurality of transversely extending, perforated conduits **47**, each of the conduits being provided with a suitable control valve **48**. The water system is a closed one, and is provided with a pump **49** for circulating the water through the conduits **47**. As the water passes over the outer covering **22** of the rollers **13**, **18**, the accumulated shrimp heads and hulls will be washed downwardly beneath the rollers and if desired caught in a pan (not shown) provided to receive the same.

Positioned intermediate the spaced ends of the tiers **14**, **15**, and supported on the frame **11** is a separating means, generally designated by the reference numeral **50**, for separating the meat of the shrimp from the loosened hulls and heads. As clearly shown in Figure 1, the separating means **50** embodies a pair of rollers **51**, **52** mounted on the frame **11** for rotary movement about spaced, transversely extending axes **53** and **54**. Extending between the rollers **51**, **52** and the adjacent rollers **13** of the tiers **14**, **15** are guide plates **55**, **56** and **57**. The rollers **51**, **52** are driven, preferably at high speed, in the direction of the arrows shown in Figure 1 by appropriate mechanism (not shown). Positioned contiguous to and spaced above each of the rollers **51**, **52** is a bucket **60**, **61**. The disposition of the buckets **60** and **61** is selected with respect to the rollers **51** and **52**, so that the lighter shrimp hulls and heads will be separated from the shrimp meat by a centrifugal force applied to the lighter waste products. It is to be further noted that the water system **46** is provided with jets **62**, **63** facing the rollers **51**, **52** to maintain the latter and the adjacent guide plates **55**, **56**, **57** moistened and relatively clean.

Contiguous to the uppermost end of the tier **14** is a conveyor means, generally designated by the reference numeral **65**, for carrying the shrimp into the adjacent uppermost end of the tier **14**.

Rotation of the rollers **18** may be accomplished by any suitable drive, for instance by a belt drive **83**, shown in Figure 1, from the shaft **84** of an electric or other motor (not shown). The shaft **84** is shown as having a fast pulley **85** engaged by the belt **83** at its lower end. The upper end of the belt **83** is trained about a pulley **28** fast on the shaft **26** of the central upper roller **18**. The power thus applied to the central upper roller **18** is transmitted to the other rollers **18** of the upper series by a system of connecting belts. The belts **86** and **87** drive the shafts 26^a and 26^b of the rollers **18** immediately adjacent the central roller while belts **88** and **89** drive the shafts 26^c and 26^d of the remote rollers **18**.

An idler pulley **90** is mounted to swing from a bracket **91** pivoted at **92** to the frame of the machine and is urged against one run of the belt **83** by a spring **93** so that the pulley is in the nature of a belt tightener.

In Figure 3, limit sleeves **94** are shown as placed below the bearing blocks **43** to limit the downward movement of the blocks **43** and their rollers **18** under the influence of springs **44** and **45**. The blocks **43** may slide up and down in guide rods **95** which pass through the coil springs **44**, **45** and the sleeves **94**. Heads **96** on the lower ends of the guide rods **95** engage beneath the frame member **11** while the sleeves **94** seat on the upper surface of the frame member **11**. The springs **44**, **45** abut at their lower ends against the sliding bearing blocks **43** and at their upper ends against the fixed cross-bars **99** supported by the uprights **98**. These uprights **98** and the cross-bars **99** constitute spring frames having feet **100** resting upon the frame member **11** to which they are bolted by the bolts **101**.

Shell and trash removal ducts **102** are connected to the buckets or troughs **60**, **61**. The waste is removed by water fed into the buckets or troughs **60**, **61** by the jets **62**, **63**.

The lower banks of rollers **13**, together with their shafts **103** and bearings **104**, are mounted upon and carried by vibratable frame members 11^a, which permit of a high frequency vibration produced by a high speed electric motor **105** affixed to the frame 11^a, the rotary armature shaft of which has affixed thereto an eccentric weight **106**. The motor **105** and eccentric weight **106** will produce a high frequency vibration of not less than 500 per minute and an optimum frequency for efficient operation as high as 2,000 per minute.

In Figure 5 it is made clear that the square cavities **20** of the shafts **19** are of greater axial lengths than the square sections of the shafts **26** that fit therein. This provides clearance for the rollers **18** to reciprocate axially without any interference from the rotary drive derived from the shafts **26**.

Set collars **111** are shown in Figure 5 as being mounted on opposite sides of the bearings **27**, or their bearing blocks **43** to prevent casual sliding movement of the shafts **26** in axial directions.

Referring more particularly to Figure 7, which shows the first step of the process, a shrimp **112** is shown as being between two of the rollers **13**, **18** which constitute a unit. These rollers are rotating in relatively opposite directions as shown by the arrows applied to the ends of the rollers. Incident to this rotation the shrimp **112** has been drawn into the nip between the rollers **13**, **18**. Due to the springs **44**, **45**, pressure is being exerted upon the shrimp **112** which tends to pinch or squeeze the meat from the shell or hull. The pressure upon the shrimp **112** in the nip between the rollers **13**, **18** is indicated by the arrows *x* and *y*.

Figure 8 shows a second step of the process in which the roller **18** has been axially displaced from the position of Figure 7 to cause the rolling of the shrimp as indicated by the arrow *z*.

The third, and optional, step of the process is also disclosed in Figure 8 in that the motor **105** and eccentric weight **106** impart a vibratory action to the shrimp **112** during the first and second steps, namely while the shrimp is being fed into the nip between the rollers **13**, **18** and compressed therebetween, and while the shrimp **112** is being rolled by the pitman drive connected to the upper roller **18**.

A fourth step of the process involves the moistening and washing of the shrimp by the water sprays.

The practice of the process with a machine such as illustrated and described is as follows:

The shrimp are conveyed into the uppermost end of the central tier 14, as by the conveyor 65, whereupon they pass downwardly through the tier 14, as shown in Figure 1, the heads and hulls being loosened from the shrimp meat, due to the rotary and reciprocatory movement of the rollers 18. The shrimp then pass through the separating means 50 disposed intermediate the tier 14 and the tier 15, the separated hulls and trash being thrown into the adjacent buckets 60, 61. The shrimp then pass downwardly to and through the tier 15 which is shown broken away in Figure 1 and thence into subsequent separating means and other tiers, if desired. The shrimp may be passed through any desired number of tiers. Each successive stage conduces to loosen the shrimp heads and hulls from the meat until finally practically all of the shrimp are withdrawn in a cleaned and peeled condition. In actual use it may be determined advisable to delete several of the tiers or add additional tiers, the number of tiers depending upon the separating conditions, such as the size and speed of the rollers 13, 18.

As the shrimp pass through the machine the hulls and trash will be separated from the meats by the buckets 60, 61 and the removal ducts 102.

The upper rollers 18 are directionally rotated by belt 83 or other power. By frictional contact, induced by the springs 44, 45, the upper rollers 18 drive the lower rollers 13, but in relatively opposite directions. As the shrimp are drawn into the nips or bights of cooperating rollers 18, 13, the hulls and trash are pinched so that the meat is freed and ejected therefrom.

Each upper roller 18 is kept in contact with its companion lower roller 13 by yieldable pressure from the springs 44, 45 and the shrimp are subjected to this yieldable spring pressure.

In the peeling action of the machine, it is pointed out that the hull or shell of a shrimp does not entirely surround the meat. In cross-section, the hull somewhat resembles a horseshoe with the mouth of the shoe at the belly of the shrimp. Further, the shell is composed of several sections joined together by a membrane underneath the shell and over the shrimp meat. There is a head section of hull, a tail section and several intermediate sections. The "feet" or "swimmerettes" of the shrimp are attached to the membrane covering the underpart or belly of the shrimp.

The rotary action of the rollers of itself probably has little peeling effect upon the shrimp since the rotation of the rollers simply exerts a "squeezing" action upon the entire shrimp as it is drawn from one combination of rollers into another. However, once the hulls of the shrimp, or one section of the hull, has been loosened (either by means of reciprocation of the upper rollers 18 or by the high frequency vibration applied to the lower rollers, or both), the rotary action of the rollers does cause the separation of the sections of hull or shrimp from the shrimp meats. This is accomplished in two ways. First, the pressure of the rollers 18, 13 tends to squeeze the meat from the loosened section of hull. Second, inasmuch as a section of the hull once it is loosened from the meat is more compressible than the meat, the hull is propelled laterally across the rollers at a more extreme periphery of the rollers than the thicker meats and accordingly at a greater speed than the meats.

The functions of the reciprocatory action of the upper rollers 18 and of the high frequency vibration applied to the lower rollers 13 are to break the membrane holding the sections of the hull or shell together and to loosen the sections of hull or shell from the shrimp meats. This is accomplished as follows:

When the shrimp is caught between an upper and a lower roller, the reciprocation of the upper roller 18 tends to pull the shell or hull on the upper side of the shrimp in the direction of the axial travel of the upper roller 18. No such pulling tendency is applied to the hull or shell on the underside of the shrimp because such underside is in contact with the axially immovable lower roller 13. The shrimp tend to travel between the rollers on its side rather than on its back or on its belly, since the thickness of a shrimp is usually less than its height. A distortion of the shell is thus induced which breaks the connecting membranes of the shell sections and loosens the sections of shell from the meat. This distortion of the shell and resulting loosening action is accelerated by the high speed vibration applied to the frame of the lower rollers 13, since such vibration tends to give greater jerkiness to the action produced by the reciprocation of the upper rollers.

The shrimp pass between the upper and lower sets of rollers and are carried along down the tier of rollers by the rotary movement of the rollers. The reciprocatory action of the upper rollers tends to roll the shrimp between the surfaces of the upper and lower rollers somewhat in the manner of a pencil being rolled between the palms of the hands. As above stated, such action tends to loosen the hulls from the shrimp meat and eventually results in the complete separation of the meats from the hull.

When large shrimp enter the nips between the rollers, the upper rollers 18 may rise compressing the springs 44, 45, which springs will return the rollers 18 downwardly as limited by the sleeves 94 after passage of such shrimp. Incident to this rising movement of the upper rollers, the belt tightener 90 may be caused to swing in its bracket 91, distending the spring 93. In other words, this roller 90 places a bight in the adjacent run of the belt 83, which bight tends to straighten out on the rise of the roller 18; the action being compensated for by the swinging movement of the belt tightener roller 90. At the same time this roller 90, under the influence of its spring 93, maintains the belt 83 tight at all times around its pulleys 85, 28 so as not to impair the drive from the shaft 84 to the upper bank of rollers 18.

In the separating devices 50, the rollers 52, 51 rotate at high speed. As the waste products slide down plates 57, 56 and encounter these rollers, which are rotating clockwise as viewed in Figure 1, such waste products are thrown outwardly by impact in a direction to enter the buckets 61, 60, the spray jets 63, 62 contributing to this end.

Referring to Figure 3 nuts 97 are threaded upon the upper ends of the guide rods 95 which project up above the cross-bars 99 of the spring frames 98. These nuts hold the rods 95 from dropping through the springs 44, 45 and through the bearing blocks 43 and sleeves 94. The nuts 97 also tend to hold the spring frames down tightly upon the machine frame 11 and otherwise tend to stabilize the spring frames 98, 99.

It will be understood that I have described herein only one mode, the best known to me at this time, of carrying out the steps of the process which constitutes the invention but I reserve the right to vary such steps and the order thereof and to practice the process by other forms of apparatus, all within the limitations of the appended claims.

What I claim is:

1. The herein-described process for peeling shrimp which consists in subjecting the shrimp to localized pressure on opposite sides, rolling the shrimp while under pressure to subject substantially all portions of the body of the shrimp to said localized presure to break the connecting membrances of the shell sections to free the meat, and pinching the hull of the shrimp to eject the freed meat from the hull.

2. The herein-described process for peeling shrimp consisting in imposing pressure on the shrimp, rolling the shrimp while under pressure to induce distortion of the hull, and simultaneously with the rolling motion vibrating the shrimp to accelerate the distorting action whereby to

break the connecting membranes of the hull sections and to loosen the hull from the meat so that the imposed pressure may squeeze the meat from the hull.

3. The herein-described process for peeling shrimp consisting in subjecting the shrimp to high frequency vibration to break the membranes connecting the hull sections and to loosen the hull from the meat, and squeezing the shrimp so vibrated to expel the loosened meat from the hull.

4. The herein-described process for peeling and cleaning shrimp consisting in vibrating the shrimp to break the membranes connecting the hull sections and to loosen the hull from the meat, pinching the shrimp so vibrated to drive the loosened meat from the hull, and watering the pinched shrimp to simultaneously separate the hulls from the meat and clean the meat.

5. The herein-described process for peeling shrimp which consists in subjecting the shrimp to localized pressure on opposite sides of the shrimp body, rolling the shrimp while under pressure to subject substantially all portions of the body of the shrimp to said localized pressure to break the connecting membranes of the shell sections free from the meat, pinching the hull of the shrimp

to eject the freed meat from the hull, and watering the shrimp during the rolling operation to simultaneously separate the shell from the meat and to cleanse the meat.

6. The herein-described process for peeling and cleaning shrimp which consists in subjecting the shrimp to pressure, while under pressure rolling the shrimp to break the connecting membranes of the shell sections to free the meat to be pinched from the shell by the pressure, vibrating the shrimp to accelerate the breaking action and to assist to loosen the hull from the meat so that the imposed pressure may squeeze the meat from the hull, and watering the pinched shrimp to simultaneously separate the hulls from the meat and clean the meat.

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