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[54] **CRAB-PROCESSING MACHINE**
 20 Claims, 15 Drawing Figs.

[52] U.S. Cl. 17/71,
 17/54
 [51] Int. Cl. A22c 29/00
 [50] Field of Search 17/54, 71

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ABSTRACT: A machine for transporting cooked hard crabs to a plurality of successive stations at which the carapace is removed, the pincers are removed, the walking legs, swimming legs and viscera are removed, and the remaining body is scrubbed and washed. An important feature is the provision of means for supporting each crab, and cutting parts from it as it is transported through the machine, which supporting and cutting means are automatically adjustable to the size of each individual crab which is processed.

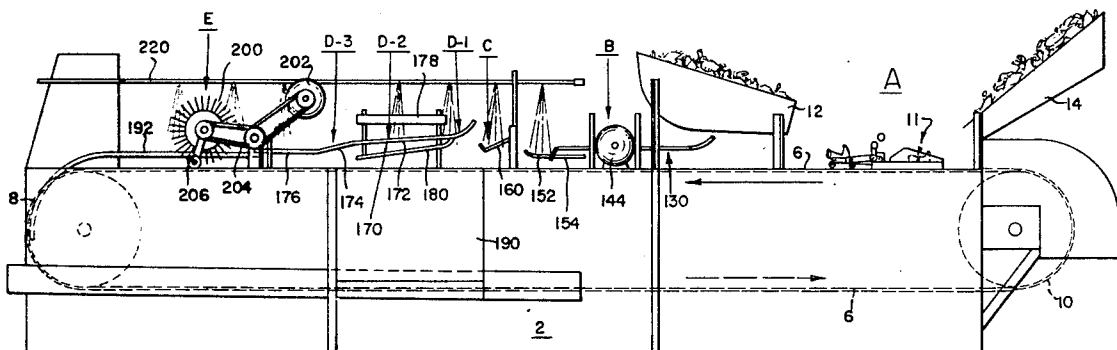


Fig. 1

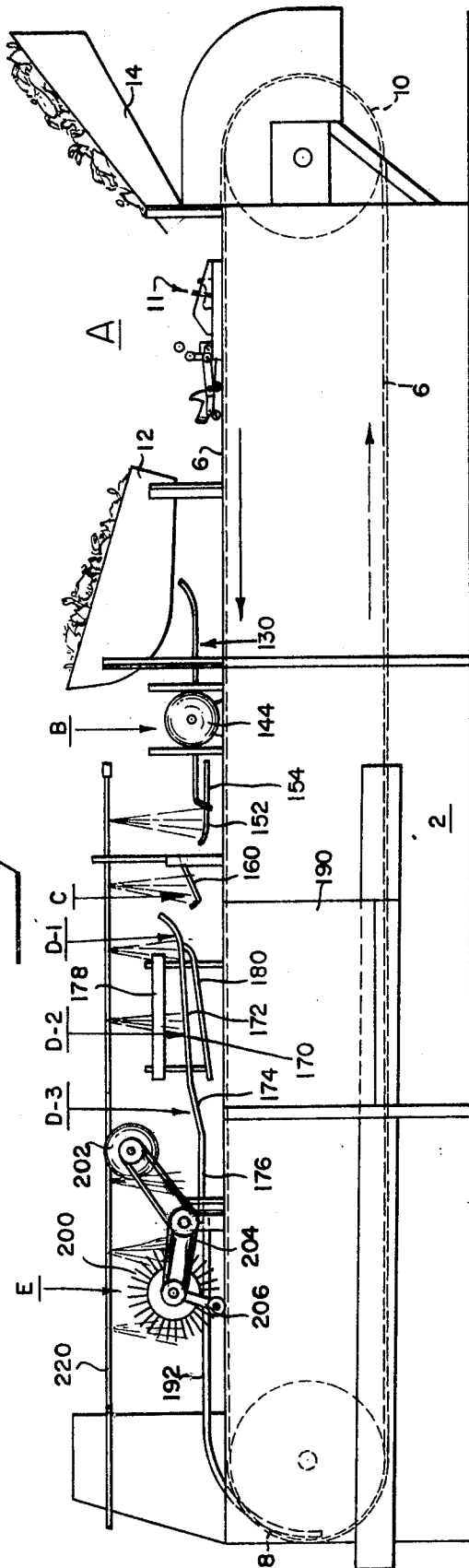
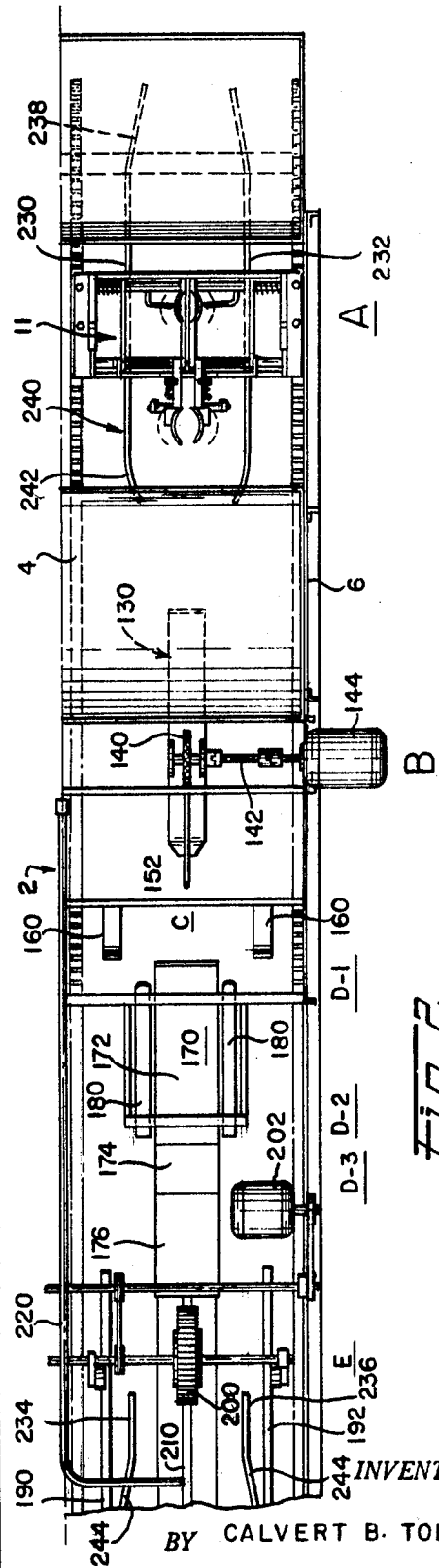


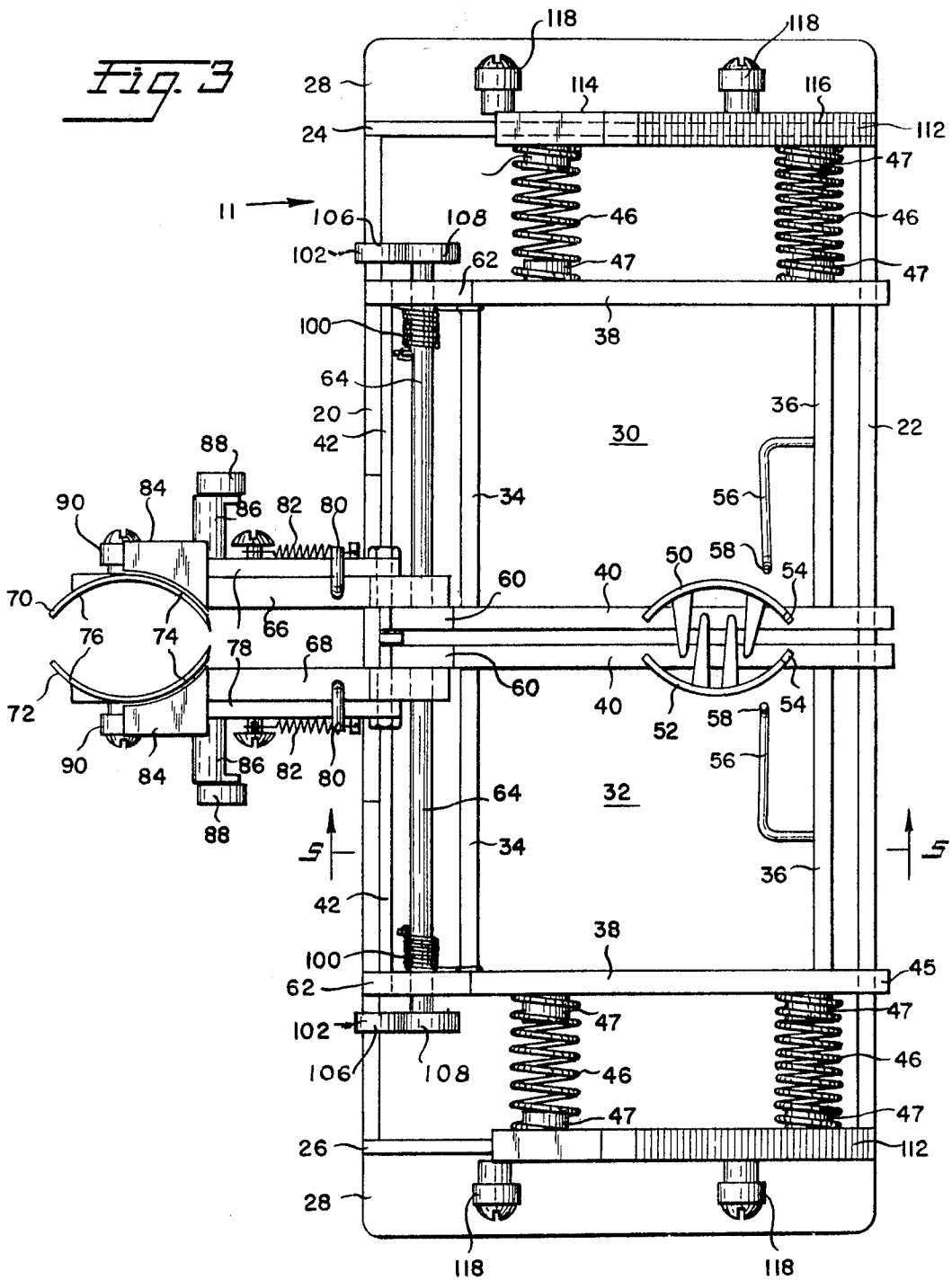
Fig. 2



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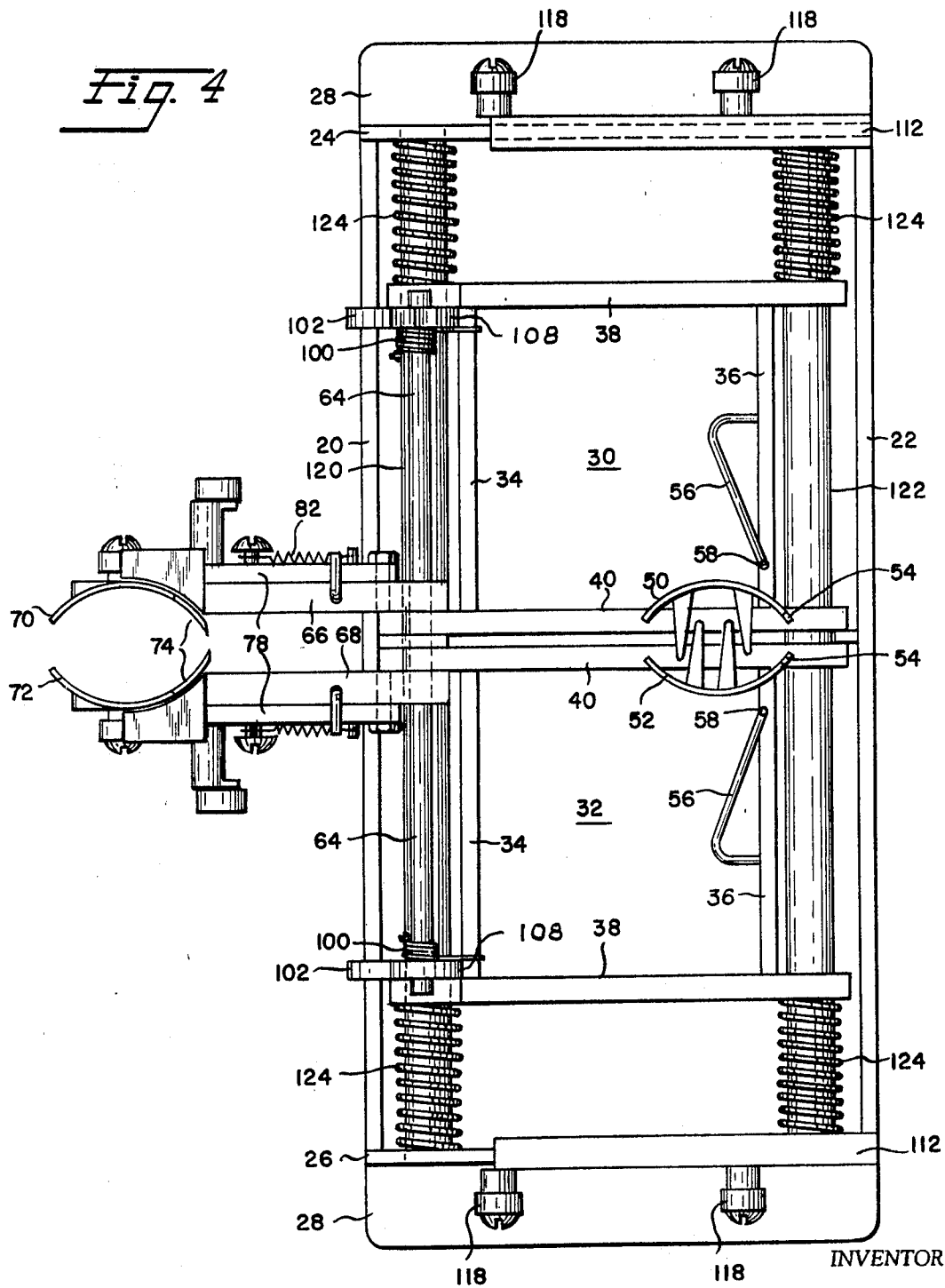


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Fig. 4



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Fig. 5

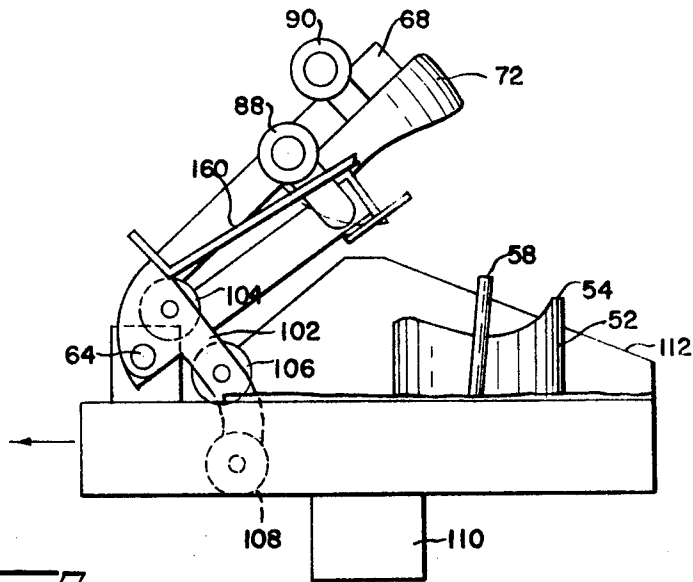
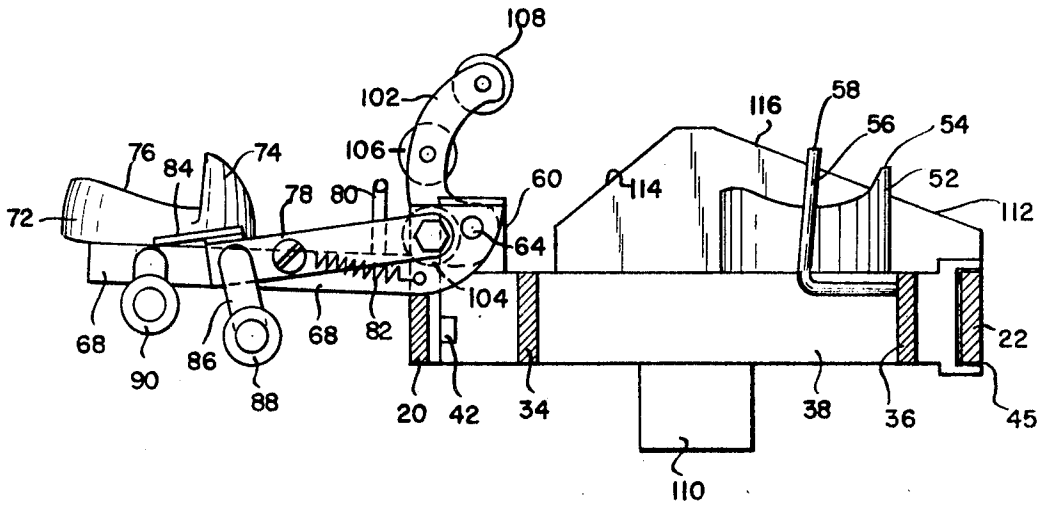


Fig. 9

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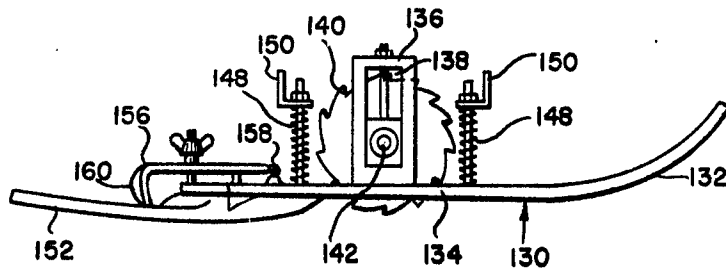


Fig. 6

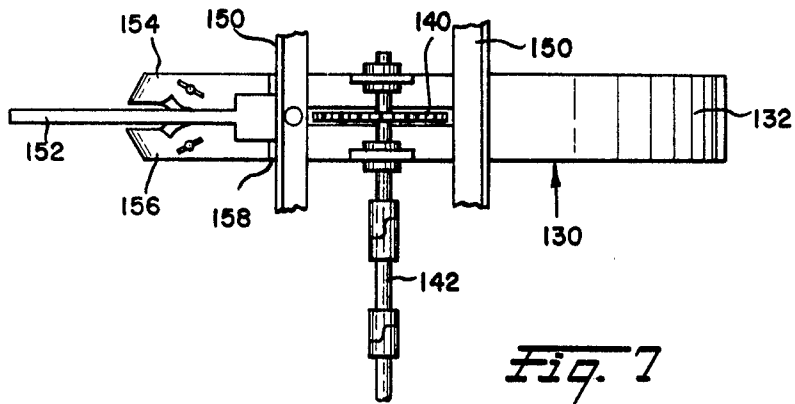


Fig. 7

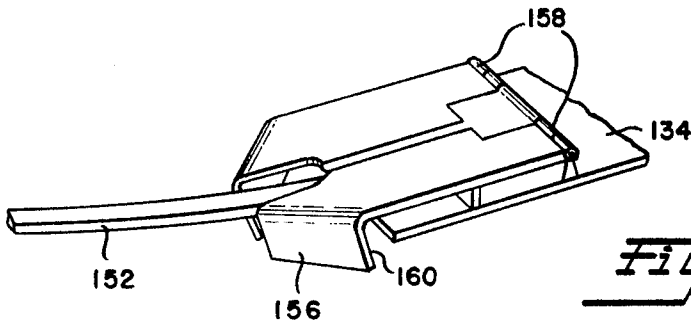


Fig. 8

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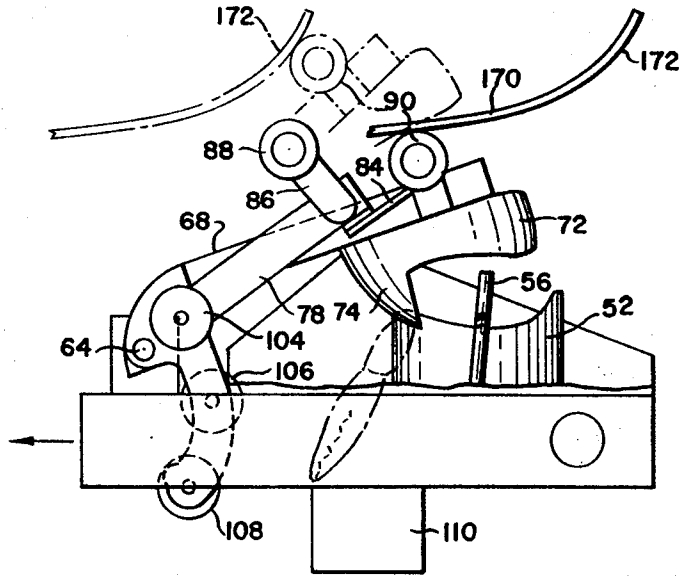


Fig. 10

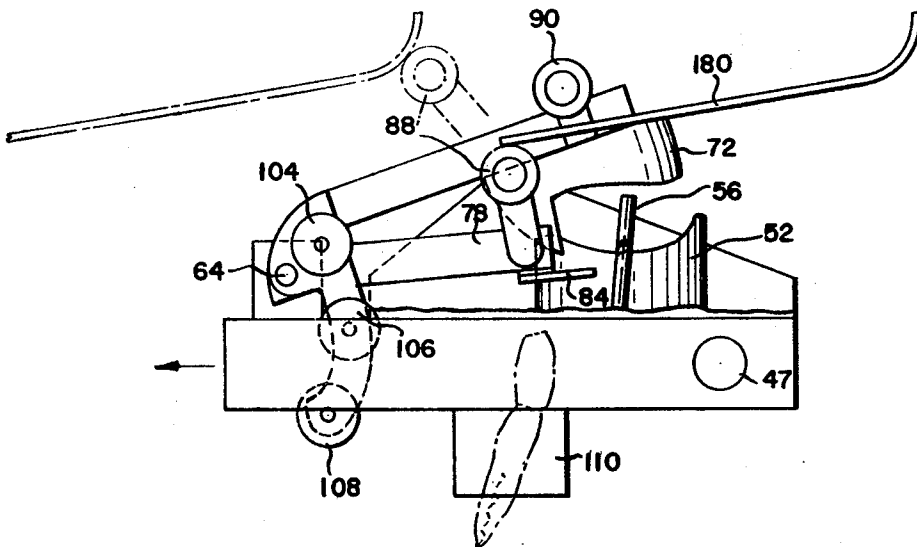


Fig. 11

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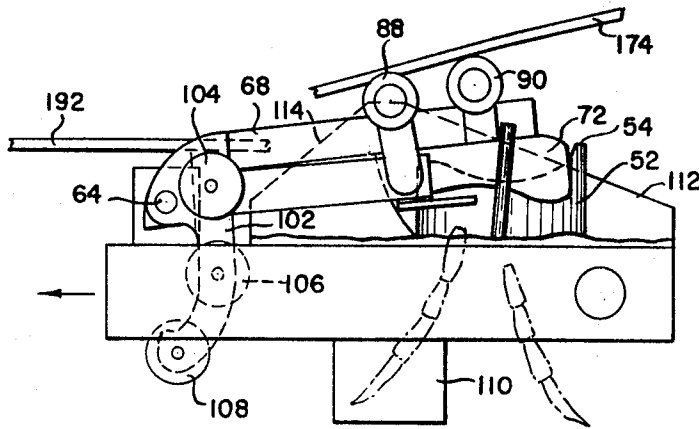


Fig. 12

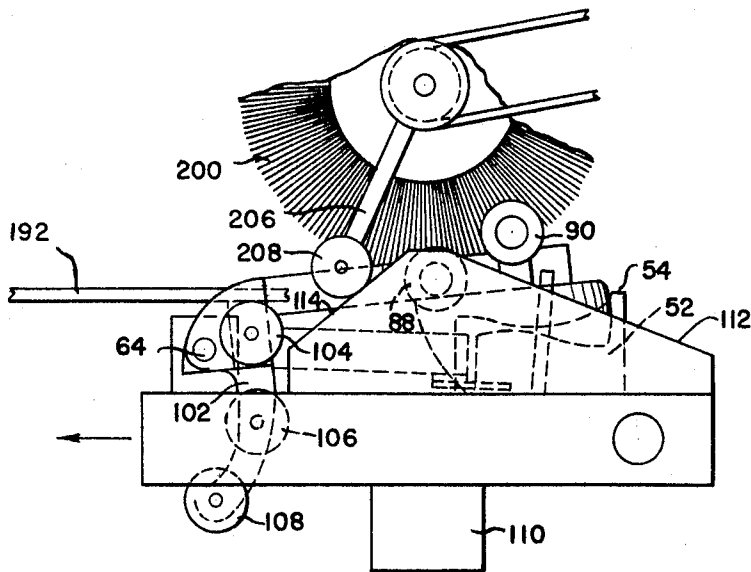


Fig. 13

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Fig. 15

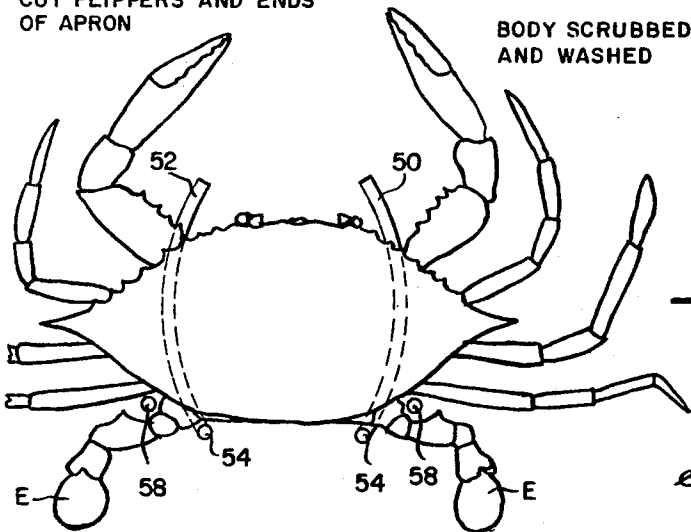
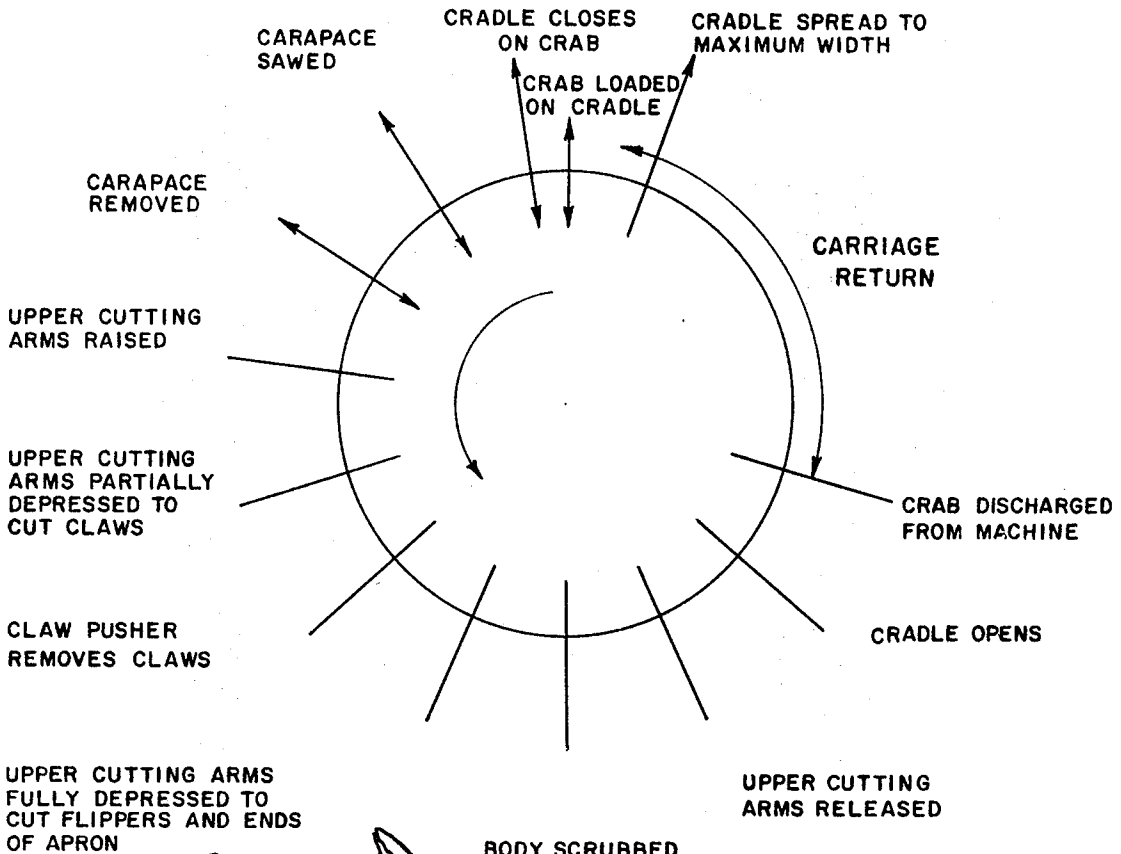


Fig. 14

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CRAB-PROCESSING MACHINE

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of the machine;

FIG. 2 is a top view of the machine;

FIG. 3 is a top plan view of a preferred form of crab transporting carriage provided by the invention;

FIG. 4 is similar to FIG. 3 and shows a modified form of the crab transporting carriage;

FIG. 5 is a cross sectional view of the carriage taken on the line 5-5 of FIG. 3 and showing the parts in their normal positions;

FIGS. 6, 7 and 8 are, respectively, side, top and partial detailed perspective views of the means provided at station B shown in FIG. 1 for removing the carapace;

FIG. 9 is a view which is similar to FIG. 5 showing the cam means provided at station C in FIG. 1 and illustrating the function thereof;

FIG. 10 is a view which is similar to FIG. 5 showing the claw cutter operating means provided at station D-1 in FIG. 1 and illustrating the function thereof;

FIG. 11 is a view which is similar to FIG. 5 showing the claw pusher operating means provided at station D-2 in FIG. 1 and illustrating the function thereof;

FIG. 12 is a view which is similar to FIG. 5 showing the means provided at station D-3 in FIG. 1 for removing the walking legs and swimming legs, and illustrating the function thereof;

FIG. 13 is a view which is similar to FIG. 5 showing the brushing, cleaning and holding means provided at station E in FIG. 1 and illustrating the function thereof;

FIG. 14 illustrates the initial positioning of an untreated crab body on the cradle, and

FIG. 15 is a schematic figure showing the sequence of operations in a complete cycle of operation of the machine provided by the invention.

DESCRIPTION OF THE INVENTION

General

The machine provided by the invention comprises means for individually moving cooked hard-shell Chesapeake Bay crabs to and through successive stations at which different operations are performed, resulting in the production of a crab body from which the carapace, claws, walking legs, swimming legs and viscera have been removed and which has been washed and scrubbed, leaving a body from which only the removal of the meat remains to be performed.

The basic parts of the machine are an elongated supporting frame, a plurality of work stations spaced along the length of the frame, endless chains or belts continuously traveling throughout the length of the frame to successive work stations, a plurality of crab supporting carriages carried by and spaced along the length of the endless traveling means, and operating means on each carriage cooperating with means at each work station to perform an operation on a crab supported on the carriage. The machine is particularly characterized by the provision of movable crab-supporting and crab-cutting means on each carriage which cooperates with means on the machine frame for the crab supporting and cutting means on each carriage to adjust the same to the size of the individual crab on the carriage, it being remembered that crabs of legal size vary considerably in size.

The machine frame is shown generally at 2 in FIGS. 1 and 2 and may be of any size and configuration necessary to properly support the parts of the machine which forms the invention.

The transport part of the machine comprises two parallel, spaced endless link-type chains 4, 6 which are trained over two spaced pairs of sprocket wheels 8, 10 which are supported at opposite ends of the machine frame and are driven by any suitable means. The upper reaches of these chains pass from a

loading station A at one end of the machine, through a plurality of work stations B to E at which successive operations are performed, to a delivery station at the other end of the machine at which the crab bodies are removed for further processing by removal of the meat.

The loading station A is located adjacent and on the downstream side of one of the two pairs of sprocket wheels which support the traveling chains. Empty crab-supporting carriages 11 arrive at this station and are filled, for example by workers, from trays 12, 14 in which cooked crabs are piled. Each carriage carries one crab to the successive work stations, and each crab is mounted on a carriage in the manner described herein in connection with the description of the carriage itself.

At the loading station the crab is mounted on the carriage on a two-part supporting means the parts of which are transversely movable on the carriage together with two relatively movable crab-cutting knives which are also mounted on the carriage. When the crab is mounted on the carriage the parts of the supporting means and those of the cutting means are at maximum separation and as the carriage moves from the loading station the two parts of the crab supporting means and the two parts of the cutting means are moved toward each other to positions adjusted to actual size of the crab so that the claws, walking legs and swimming legs of the crab will be properly cut.

From the loading station each carriage with the complete, uncut crab carried thereby is moved first to a station B where the carapace is sawed in half and the two halves are removed, then to a station C where the movable cutting knives mounted on the carriage are moved to a raised but inoperative position ready to be moved to cutting position, then to a station D-1 where the movable cutting knives are further depressed to cut off the claws, then to a station D-2 at which a claw pusher plate is actuated to fully remove the claws, then to a station D-3 at which the cutting knives are fully depressed to cut off the walking legs and swimming legs and the ends of the apron, then to a station E at which the crab body is subjected to a rotary brush and sprays of water to clean it and remove any trash and debris. After processing at the final station of the machine the crab-supporting means and the movable cutters are separated to release the crab and permit its removal, after which these parts are separated for the reception of a new crab body at the loading station.

Before describing the apparatus and operation at each station the crab-transporting carriage will be described.

The Crab-Transporting Carriage

Each crab processed by the machine is moved to and through the successive stations of the machine by a carriage 11 on which the crab is supported, a plurality of carriages being mounted on the traveling endless belts or chains and extending between them and across the machine. The carriages are preferably identical in construction and a preferred embodiment is shown in detail in FIGS. 3 and 5, while a second embodiment is shown in FIG. 4. In the form shown in FIGS. 3 and 5 each carriage comprises a rigid rectangular frame having side walls 20, 22 and end walls 24, 26, the end walls having flanges 28 by which the carriage may be attached to the endless chains. Within this carriage frame there are two rectangular frames 30, 32 having sidewalls 34, 36 and end-walls 38, 40, which are mounted for sliding movement within the carriage frame. At its left end, as seen in FIG. 3, each of the end walls 38, 40 of the two movable frames is notched to receive an elongated rail 42 which is mounted on the inside surface of sidewall 20 of the carriage frame, at its other end each end wall 38, 40 is notched as shown at 45 to receive the sidewall 22 of the carriage frame. One or more compression springs 46 which are held in place by stub shafts 47 are disposed between each of the end walls 24, 26 of the carriage and the adjacent end wall 38 of each of the movable frames 30, 32 and constantly urge the two frames to a central position

within the carriage where their end walls 40 are adjacent each other as shown in FIG. 3. On the upper surfaces of the adjacent end walls 40 of the two movable frames and adjacent their trailing ends in the direction of travel of the carriage in the operation of the machine there are rigidly mounted, as by welding, two outwardly curved, inwardly facing supporting and cutting members 50, 52 which form a cradle to support a crab. The upper edge of each of these members is formed at its trailing end with an upwardly extending point 54, and on the adjacent sidewall 36 of each of the frame members, at a point spaced from the adjacent cradle, there is mounted, as by welding, a rod 56 which extends toward the cradle and which has on its end adjacent the cradle an upwardly extending pin 58 which is spaced laterally outwardly of the adjacent 54 and slightly on the leading side of the point, i.e. in the direction of movement of the carriage in the operation of the machine. The point 54 and the adjacent pin 58 are so positioned and related that when the frames 30, 32 are laterally retracted away from each other against the forces of compression springs 46 a hard shell crab of legal size may be positioned on the cradle formed by the cutter members 50, 52 with each of the two swimming legs E between a point 54 and the adjacent pin 58, and with the points and pins at each side of the crab removed from the body of the crab, as shown in FIG. 14. The shape of each of the rods 56 is such that they are spaced away from the frame members 36 to which they are attached, so that scrap will fall freely through the opening thus formed.

Each of the movable frames 30, 32 is provided with two lugs 60, 62 which extend upwardly, respectively, from the leading ends of the end walls 38, 40. In the lugs of each frame there is rotatably journaled a rock shaft 64 and rigidly attached, respectively, to the inner, adjacent ends of these two shafts are cutter arms 66, 68 to the outer ends of which are connected outwardly convex cutter knives 70, 72 which are shaped to conform to the shape of a crab claw at the knuckle and also to the shapes of the crab supporting and cutting members 50, 52 with which they cooperate. It will be seen that by rotating the two rockshafts 64 in a clockwise direction as shown in FIG. 5 these cutter knives will be moved into cutting relation and engagement with the fixed, similarly shaped lower cutter and cradle members 50, 52 on the movable frames 30, 32, it being noted that the two pairs, each consisting of a movable cutter knife and its associated fixed cutter member, are mounted on the same one of the two movable frames, whereby the pairs are moved toward and away from each other as the frames are moved within the carriage. As shown in FIG. 5 and 10, the cutting edge of each of the movable knives 70, 72 is formed with a protruding part 74 which, when the knife is moved into engagement with the associated fixed cutter member 50 or 52, cooperates with the leading edge of the fixed cutter member to cut the claw at the knuckle before the nonprotruding remaining edge 76 of the movable cutter begins its cutting action on the walking and swimming legs as will be described.

Adjacent its connection to its connected rockshaft 64 and on its outer side, each cutter arm 66, 68 has pivotally mounted thereon the inner end of a claw pusher arm 78 which extends outwardly alongside and generally parallel to the cutter arm and which is permitted limited movement in a downward direction when the movable cutting knife is in engagement with its associated fixed cutter member, such movement being limited by a pin 80 carried by the movable cutter arm and being resisted by an extension spring 82. A pusher plate 84 is mounted on the outer end of each pusher arm 78 and is positioned adjacent the outer surface of the cutting blade carried by the associated movable cutter arm. An arm 86 extends rearwardly, i.e. away from the pusher plate, from each pusher arm and carries a roller 88 at its outer end for a reason which will be described. A roller 90 is mounted on the rear surface, i.e. away from the cutting edge, of each cutter arm, and is positioned radially outwardly of roller 88, but the latter is rearwardly outside roller 90 i.e. is mounted at the end of a longer arm, for a reason which will be described. A torsion spring 100 constantly urges each rockshaft 64 to a position in

which the movable cutting knives are in their most open positions, in which they are removed to the greatest possible extent from the fixed cutter members, as shown in FIGS. 3 and 5.

At its outer end each rockshaft 64 has rigidly connected to it an arcuate shaped rocker arm 102 which normally extends upwardly at substantially right angles to the general plane of the carriage when the movable cutting knives are in their normal, open positions away from the fixed cutter members, being held in this position by springs 100. Each of these arms 102 has three rollers 104, 106, 108 along its length, roller 104 being positioned adjacent the rockshaft, roller 108 being at the outer extremity of the arm, and roller 106 being intermediate these.

The outer end wall 38 of each of the frames 30, 32 is provided with a downwardly extending lug 110 for a purpose which will be described, and the upper edges of the end walls 24, 26 of the carriage are provided with cam members 112 having downwardly diverging leading and trailing edges 114, 116 respectively, the function of which will also be described. A pair of rollers 118 which are spaced apart in the direction of movement of the carriage extend outwardly from each end wall of the carriage just above the adjacent flange 28 for a purpose to be described.

An alternative form which the crab-transporting carriage may take is disclosed in FIG. 4. The basic parts of this modified structure are the same as those disclosed in FIG. 3, are similarly numbered, and comprise the sidewalls 20, 22 and end walls 24, 26 forming the main carriage frame, the end wall flanges 28, the crab-supporting cradle parts 50, 52 with the pins 54 and points 58, the rockshafts 64 with their attached and associated movable cutter arms 66, 68, cutter knives 70, 72 the pusher arms 78, and rocker arms 102, all as illustrated in FIG. 3 and described above. In this form of the invention two elongated shafts 120, 122 are provided which extend between end walls 24, 26 of the carriage and are parallel to and, respectively, positioned just inwardly of the carriage sidewalls 20, 22. The two movable frames 30, 32 are mounted to slide on these two shafts, their end walls 38, 40 being formed with openings through which the two shafts freely pass. A compression springs 124 surrounds the end of each of these shafts and bears at its ends on the carriage end wall and on the outer end wall 38 of the adjacent movable frame.

Station B—Carapace Removal

Means are provided by the invention for holding the crab body firmly on the carriage, cutting the carapace in half longitudinally of the body, cleaning out the visceral cavity of the body of the crab, and removing the two halves of the carapace. These means are illustrated at station B in FIGS. 1 and 2 and, more particularly, in FIGS. 6, 7 and 8 of the drawings and comprise, first, a plate 130 which extends in the direction of carriage travel midway between the endless belts which transport the carriages, and above the level of the upper surfaces of the moving carriages. The trailing end of this plate, i.e. the end first engaged by the moving carriages, is upwardly curved as shown at 132 to freely admit and accommodate the upper surface of a crab body on a carriage, and downstream of this upwardly curved entering part the plate descends to provide an elongated level part 134 which is vertically positioned to bear downwardly on the moving crab body to hold it firmly on the carriage. Between its entering and leaving ends the upper surface of this plate carries a frame 136 having openings 138 which are aligned transversely of the machine and within which is floatingly journaled a rotatable circular saw 140 which is driven through a flexible shaft 142 by motor 144. The cutting edge of the saw extends below the lower surface of section 134 of plate 130 so that it will cut the carapace of a crab moving on a carriage and held by the lower surface of the plate and will extend into the visceral cavity of the crab, cleaning the cavity as it rotates. The plate 130 is constantly and resiliently urged downwardly by springs 148 which are mounted between the upper surface of the plate and parts 150

of the machine, whereby a resilient, constant downward pressure is maintained on the plate 130, 132, 134 and therefore on the crab body. After the crab leaves the plate it is held on the cradle by downward pressure maintained on the crab by a vertically floating rod 152 which extends from the lower surface of the plate in the direction of carriage movement and which is positioned to extend through the saw cut in the carapace into the visceral cavity. The means provided at this station for removing the carapace are located downstream from saw 140 and comprise two elongated arms 154, 156 which are arranged in side-by-side relation midway between the endless chains and which extend in the direction of carriage travel from pivotal supports 158 on the downstream end of plate 130 so that they have floating vertical movement. At its downstream end each of these arms is turned downwardly and rearwardly to provide a hook 160. It will be apparent that as a carriage moves from beneath the plate 134 the edges of the two halves of the cut carapace will engage the hooks and on further movement of the carriage they will be torn off and removed from the body, and then discharged from the machine by gravity. As the hook members float vertically on their pivotal supports they adjust automatically to the height of the crab body and therefore always grasp the leading edge of the carapace of each crab.

Station C—Initial Movement of Cutters

As particularly disclosed in FIGS. 1, 2 and 9 there are provided at station C, which is the next station on the downstream side of station B, two downwardly facing cam members 160 which are positioned in transverse alignment on opposite sides of the machine. These cam members are so positioned that as each carriage moves to station C the roller 108 on the outer end of each rocker arm 102 is engaged by one of these cams and these arms and their connected rockshafts 64 are rotated to move the movable cutter arms 66, 68 to the upright position shown in FIG. 9 in which they are spaced above the lower cutting members 50, 52 and therefore do not perform any cutting operation, but are in position to be moved to cutting positions, on further carriage movement.

Stations D-1, D-2 and D-3—Removal of Claws and Walking and Swimming Legs

Means are provided at stations D-1, D-2 and D-3 for first cutting the two claws from the crab body, pushing them downwardly to effect complete removal, and then cutting off the walking and swimming legs. These means are illustrated in FIGS. 1, 2, 10, 11 and 12 and comprise an elongated plate 170 which extends in the direction of carriage movement midway between the moving chains and which is of such width that it engages the rollers 90 on both of the movable cutter arms 66, 68 as they move with the carriage. The entrance end part of this plate, i.e. the end part first engaged by the carriage, slopes downwardly in the direction of carriage movement for a short distance, as shown at 172, then descends at a greater angle as shown at 174, and then has a level end part 176 which is parallel to the generally horizontal parts of the machine. This plate 170 is rigidly supported on the machine by suitable means which are shown at 178 in FIG. 1.

On either side of plate 170, beginning substantially downstream of its upstream end and terminating at the downstream end of its first part 172, are elongated cam members 180 which are positioned below the lower surface of plate 170 and are positioned laterally of the machine to engage the rollers 88 which are mounted on the claw pusher arms 78 which have been described.

When a carriage arrives at the entrance end of cam plate 170 the movable cutter arms are in the partially raised position shown in FIG. 9, to which they were moved by cams 160 at station C. As the carriage passes under part 172 of plate 170 the rollers 90 on the movable cutter arms 66, 68 engage the lower surface of the plate, rotating the rockshafts 64 and the movable cutter arms 66, 68 downwardly toward the fixed

cutter members 50, 52, and as the level of the plate 712 descends the movable cutters are moved into cutting relation with the fixed cutters. As the cutters come together the initial cut will be made by the raised parts 74 of the movable cutting knives and because of the positioning of the crab on the fixed cutter members, as shown in FIG. 13, this initial cutting will sever the claws at their connection to the body, as illustrated in FIG. 10.

As particularly shown in FIG. 11, the rollers 88 on the claw pusher arms 78 will now engage the lower surfaces of the inclined cams 180 and as these rollers move along the descending lower surfaces of these cams with continued carriage movement the pusher arms will be depressed causing the pusher plates 84 on their free ends to engage the claws and forcibly remove them from the body, as shown in FIG. 11. As the claws contain valuable meat they are allowed to fall by gravity into a container 190 from which they may be removed for further processing. As the rollers 88 leave cam tracks 180 the pusher arms will be released and will be returned to their normal positions by springs 82.

As shown in FIG. 12, further movement of the carriage will bring the rollers 90 which are mounted on the ends of the movable cutter arms 66, 68 into engagement with the steeper part 174 of plate 170 and the movable cutter arms will be further depressed toward the fixed cutters, thereby completing their cutting action to remove the walking and swimming legs and the ends of the apron. These legs of the Chesapeake Bay hard crab contain no edible meat, are economically without value, and are allowed to fall by gravity to be removed as trash.

As the carriage moves from under the last inclined part 174 of plate 170 the movable cutter arms are not released from restraint but are kept in cutting relation to the fixed cutter members. The means provided for doing this comprise the final horizontal part 176 of plate 170 and two, parallel, elongated cam tracks 190, 192 which are positioned on opposite sides of the machine just inside the movable chains and the entering ends of which overlap the downstream end of part 176 of plate 170. These tracks are so positioned that they engage the lowest rollers 104 on the rocker arms 102 and are at such a level that they hold these rocker arms, the rockshafts 64 and the movable cutter arms 66, 68 in the last position given to them by part 176 of plate 170, thus holding the movable and fixed cutters in fully engaged positions as the carriage proceeds to the next station E, which is illustrated in FIG. 13.

Station E—Scrubbing and Washing

The apparatus at this station is disclosed in FIGS. 1, 2 and 13 and comprises a rotary brush 200 which is mounted on an axle extending transversely of the machine and is rotated by electric motor 202 through any suitable means. This brush is positioned midway between the movable chains and at such a height that it will enter into the central body cavity of the crab body held on the carriage cradle and remove viscera and trash therefrom, and will also preferably be sufficiently wide that it will scrub other outer parts of the crab body. The axle on which this brush is mounted is carried by an arm 204 which at its other end is pivotally mounted on the machine frame whereby the brush may be raised and lowered into and out of engagement with a crab body passing beneath it. The axle of the brush also carries a depending arm 206 having a roller 208 on its lower end which is positioned in the path of movement of the cam surfaces 112, 114 which are both end walls of each carriage and which successively engage roller 208 to lift and lower the rotating brush into and out of engagement with each crab body, thereby increasing its scrubbing action.

The crab body is held firmly on the cradle during the brushing and cleaning operation by the downward pressure of a hold down bar 210 which extends in the direction of carriage movement from the downstream end of plate 176. This bar is positioned centrally of the machine and enters the visceral cavity, and is of such length that it engages the crab body until it is finally discharged from the machine.

Streams and sprays of water are directed toward the various stations of the machine from pipes 220 and serve to flush waste matter downwardly to be removed as trash.

As each carriage passes from the scrubbing station E the rollers 104, 106, 108 on rocker arms 102 pass from under the tracks 190, 192 and the rocker arms, rockshafts 64 and movable cutter arms 66, 68 are thereby released, causing the rockshafts and the movable cutter arms to be moved by torsion springs 100 to their normal open positions shown in FIGS. 3, 4 and 5.

Automatic Adjustment to Crab Size

In accordance with an important aspect of the invention, means are provided for adjusting the crab holding and cutting means of each crab-transporting carriage to the size of the individual crab carried thereby. Such means comprise apparatus forming part of each crab-transporting carriage and cooperating means mounted on the machine frame and being fixed with respect to the moving carriages, which fixed parts control the operation of the parts on the carriage to cause them to perform the adjustment to the size of each individual crab.

The apparatus carried by each carriage for performing this function is described above and comprises the two movable frames 30, 32 the compression springs 46 which constantly urge both frames to a central, adjacent position within the carriage, the crab-carrying cradle formed by the two fixed lower cutter members 50, 52 and their associated parts, and the two movable cutter members 66, 68 and their associated parts, it being noted that both pairs of fixed and movable cutters and their associated parts are carried by the two frames whereby each pair, consisting of a lower fixed cutter and an upper movable cutter, moves as a unit toward and away from the other pair.

The fixed parts carried by the machine frame for cooperating with the parts carried by each carriage are particularly disclosed in FIG. 2 and comprise two fixed cam tracks 230, 232 at the loading end of the machine and two fixed cam tracks 234, 236 at the discharge end of the machine. The entrance ends of the tracks 230, 232 (in the direction of carriage movement) diverge, then are parallel in their intermediate parts, and then converge, these three track sections being shown at 238, 240 and 242, respectively. The cam tracks 234, 236 at the discharge end of the machine are parallel to each other at their entrance ends and throughout the greater part of their length but diverge, as shown at 244, at a point reached by each carriage after all processing at the successive stations of the machine is completed and just before the processed crab is discharged from the carriage.

Operation

During the entire operation of the machine the chains or belts move in an endless path over the sprocket wheels and throughout the length of the machine, carrying the crab-transporting carriages in an endless path. The useful part of the path extends from the loading station A to the discharge station at the other end of the machine, and the nonuseful part is the carriage return part extends from the discharge station to the loading station, all as shown schematically in FIG. 15 of the drawings.

During the return movement of each carriage from the discharge station to the loading station A the springs 46 of the carriage move the two frames 30, 32 to their central positions within the carriage, in which the crab-cutting members 50, 52 and 66, 68 are positioned closely adjacent each other centrally of the carriage, as shown in FIGS. 3 and 4. As the carriage approaches the loading station the lugs 110 which depend from the outer end members 38 of each of the movable frames 30, 32 are engaged in their inner surfaces by the outer surfaces of the diverging sections 238 of the cam tracks 230, 232 and the frames are therefore pushed apart against the forces of springs 46 to their outermost, separated positions within the carriage, each carrying with it one upper and one lower cutter member and the upwardly extending points 54 and pins 58. The two

parts 50, 52 of the cradle and the two sets of points and pins are therefore moved to their most separated positions before arrival of the carriage at the loading station and are maintained in this condition until the carriage reaches a point downstream of the loading station, where the converging sections 242 of the cam tracks release the lugs 110, permitting the springs 46 to force the frames 34, 36 toward their adjacent positions centrally of the carriage.

Each crab is therefore loaded onto the cradle formed by the lower fixed cutter members 50, 52 of the carriage at a time when the cradle members and the points 54 and pins 58 are in their positions of greatest separation, as shown in FIG. 14, and in this position of the parts a crab of any size can be positioned on the cradle with each swimming leg positioned between a point 54 and a pin 58. As the carriage moves from the loading station and the converging sections 242 of the cam tracks 230, 232 release the lugs 110 the springs 46 push the frames 30, 32 toward their adjacent, central positions and urge the point 54 and pin 58 on each side of the crab tightly against the body of the crab, holding it firmly in place on the cradle formed by the cutter members 50, 52 and thus adjusting the cradle and the upper cutting knives to the actual size of the crab which is on the carriage.

The frames 30, 32 remain in this inward position, with the points 54 and pins 58 tightly holding the crab body, as the carriage proceeds through the various work stations of the machine, this being permitted by the absence in this part of the machine of any cam track operating on the lugs 110, leaving the springs 46 free to operate on the movable frames. After the carriage has passed the last work station E the inner surfaces of the lugs 110 on the movable frames are engaged by the diverging parts 244 cam tracks 234, 236 which operate on the lugs to force the frames apart against the force of springs 46, thereby moving the points 54 and pins 58 away from the crab body to release the processed crab body and permit it to fall from the machine as the carriage passes over the sprocket wheels 8. The diverging parts 244 of these cam tracks terminate at a point between the discharge and loading stations of the machine and the frames are therefore held by springs 46 in their central positions within the carriage from that point to the loading end of the machine where they are moved apart by engagement of lugs 110 with the diverging cam track sections 238 as described above.

The operations performed at the successive work stations along the length of the machine will now be described.

At station A the complete, and as yet unprocessed, crab body passes under and in contact with plate 130 which is pressed downward by springs 148, thus firmly holding the crab body on the cutter members. While the crab is held in this manner it reaches rotating saw 140 which cuts the carapace midway between its ends and cleans the visceral cavity. The crab then reaches the downturned fingers 154, 156 which, respectively, engage the edges of the two parts of the carapace, and further carriage movement causes them to rip the two parts off the crab body. At this time, and for a short further movement of the carriage, the crab body is pressed downward onto the cradle by rod 152. This completes the processing at station B.

At station C, which is illustrated in FIG. 9, the upper rollers 108 on rocker arms 102 are engaged by the cam member 160, moving the rocker arms, rockshafts 64 and cutter arms 66, 68 in a clockwise direction against the force of torsion springs 100. The position and arrangement of the parts are such that at this station the movable cutter arms are moved only to positions in which the knives carried thereby are substantially spaced above the crab body, which rests on the cradle formed by the lower cutting members 50, 52. This completes the operation at station C.

At station D-1 the rollers 90 on the rear of the movable cutter arms 66, 68 encounter the forward end part 172 of plate 170, which is inclined downwardly in the direction of movement of the carriages, and movement of these rollers along the lower surface of this section of the plate forces the

movable cutter arms partially downwardly to the initial cutting position shown in FIG. 10 in which the raised parts 74 of the movable knives 66, 68 cooperate with parts of the lower cutters 50, 52 to sever the claws from the crab body. Immediately after this occurs the rollers 88 on the rear of the pusher plate arms 78 engage the cam tracks 180 at station D-2, and as these descend in the direction of motion of the carriage the pusher arms are moved downwardly causing the pusher plates 84 to engage the two claws and forcibly remove them from the crab body. As the claws contain valuable meat they are permitted to fall into a container which is periodically removed from the machine for further claw processing. The positions and operations of the parts in cutting and pushing the claws are illustrated, respectively, in FIGS. 10 and 11.

As the plate 172 is inclined downwardly in the direction of movement of the carriages, the continued movement of each carriage causes the rollers 90 on the movable cutter arms to cause further rotation of these arms in a clockwise direction until the rollers reach the sharply inclined part 174 at station D-3, at which point the parts are given a further and final clockwise movement causing the movable cutter knives 66, 68 to engage over their full lengths with the fixed cutter members 50, 52, thereby severing the swimming and walking legs and the lateral body ends from the crab body. The positions of the parts at this time are illustrated in FIG. 12. These legs and the body ends are not valuable and are allowed to fall from the machine to be removed as trash.

After the carriage leaves station D-3 it is desirable to maintain the movable cutter arms in fully depressed, operating positions until the discharge station is reached, and this is effected by cam rails 190, 192 which extend from station d-3 to a point adjacent the discharge station. The lower rollers 104 on rocker arms 102 engage the lower surfaces of these rails, thereby holding the rockshafts 64 and movable cutter arms 66, 68 in the fully depressed positions shown in FIG. 12, thus firmly holding the crab body on the cradle.

The final operations on the crab body are performed at station E where the body is subjected to the brushing and scrubbing action of rotating brush 200 and to streams and jets of water. The brush is positioned to extend into the central cavity of the crab body to remove the viscera, and is broad enough to remove the lungs and other debris on the exterior of the body.

When the carriage leaves station E the processing of the crab body by the machine is complete, and the sole remaining function is removal of the body from the machine. At the discharge station the rollers on rocker arms 102 pass out from under tracks 190, 192 and the torsion springs 100 rotate the rock shafts 64 and the movable cutter arms 66, 68 in a counterclockwise direction, causing the movable cutters to assume the fully open, inoperative positions shown in FIGS. 3 and 5, thus releasing the crab body from the holding action of the movable cutter arms and knives. The diverging cam tracks 244 also engage the lugs 110 on the movable carriage frames 30, 32, as fully described above, to move the frames and the cradle parts apart, thereby fully releasing the crab body and permitting it to fall from the machine as the carriage passes over the sprocket wheels at the discharge station.

I claim:

1. A machine for processing whole, cooked, hard crabs, comprising an elongated supporting frame, a plurality of work stations spaced along the length of the machine, two parallel endless chains supported at opposite ends of the frame and having elongated sections thereof extending adjacent the work stations, a plurality of crab-supporting carriages mounted on said chains and spaced along the lengths thereof, means for moving the chains along their endless paths to bring each carriage successively to the work stations, means at each work station for performing an operation on the crab carried by each carriage, said machine being characterized by the provision on each carriage of means for supporting a crab thereon and means for cutting parts from the crab, and means opera-

work stations for adjusting the supporting and cutting means of each carriage to the size of the individual crab on the carriage.

2. A machine according to claim 1, in which the crab supporting and cutting means on each carriage comprises a two-part cradle for supporting a crab, two movable cutting knives which are movable together from in operative positions to operative positions in which they respectively cooperate with the two parts of the cradle to provide a cutting operation on the crab supported by the cradle, means on the carriage supporting the two parts of the cradle and the two cutting knives for simultaneous movement of the cradle parts and the cutting knives toward and away from each other to adjust the size of the cradle and the distance between the cutting knives.

3. A machine according to claim 1, in which each carriage is a rectangular open structure attached to the endless traveling chains, two supporting frames mounted in the carriage for movement laterally thereof and of the machine, two vertical, outwardly convex members respectively carried by the two frames and forming a cradle for supporting a crab with the points of its carapace extending laterally of the length of the machine, two cutting knives pivotally mounted respectively on the two frames and being positioned for movement from inoperative positions removed from the cradle to positions in cutting relation to the outwardly convex members forming the cradle, means constantly urging the two frames and the crab supporting members toward each other thereby tending to provide a cradle of minimum transverse size, and means on the machine frame and on the two frames for moving the frames apart against the force of the constantly urging means.

4. A machine according to claim 1, in which the means for supporting the crab comprise two cutting members forming a crab-supporting cradle, means constantly urging the two cutting members to closely adjacent positions, means on the machine frame for moving the cutting members to widely spaced positions to receive a crab thereon, and other means on the machine frame to release said last named means to permit the constantly urging means to close the cradle on the crab.

5. A machine according to claim 4, in which the last-named means comprise downwardly extending lugs on each frame of each carriage, and cam tracks mounted on the machine frame to engage said lugs to thereby operate the carriage frames.

6. A machine according to claim 5, comprising in addition a loading station for the machine, and in which the cam tracks are so constructed and arranged that they cause the lugs and their connected carriage frames to be moved apart just upstream of the loading station and release them for movement toward each other just downstream of the loading station.

7. A machine according to claim 3, comprising in addition an upwardly extending point on each of the outwardly convex members which form the cradle located at the downstream end thereof, and two upwardly extending lugs carried respectively by the carriage frames and each being positioned outwardly and downstream from the point carried by the same carriage frame, each of said point and lug pairs being positioned to receive between them the rear swimming and walking legs of a crab.

8. A machine according to claim 1, in which the means at the successive work station comprise, first, means to cut the carapace in half midway between its lateral points and simultaneously clean the visceral cavity, then means to remove the halves of the carapace, then means to cut the claws from the body of the crab, then means to remove the claws, then means to cut the swimming and walking legs from the body, and then means to scrub and wash the remainder of the body.

9. A machine according to claim 8, in which the means to cut the carapace comprise a rotary saw disposed midway between the endless chains and mounted on an axis transverse to the chains, means for rotating the saw, and means resiliently supporting the axis of the saw.

10. A machine according to claim 8, in which the means to

tending hook means disposed in the path of movement of the carapace of a crab on a carriage, means for holding the crab on the carriage, and means to cause movement of the carriage and crab to rip the carapace from the crab as the carapace is held by the hook means.

11. A machine according to claim 10, in which the means for holding the crab on the carriage comprises a rod mounted midway between the endless chains and extending in the same direction and being mounted for vertical floating movement.

12. A machine according to claim 2, in which the two movable cutting knives are outwardly convex with their concave sides facing each other, each of said knives comprising a cutting edge having a protruding part for making an initial cut of the claw of a crab and a nonprotruding part for making a secondary cut of the swimming and walking legs of a crab.

13. A machine according to claim 8, in which the means for cutting and removing the claws comprises fixed and movable knives mounted on each carriage, means holding the fixed knives in positions forming a support for a crab, means normally holding the movable knives in positions removed from the fixed knives, means at a work station for moving the movable knives into cutting engagement with the fixed knives to cut the claws from the body, a claw pusher plate pivotally mounted on each movable knife, and means at a second work station for moving the pusher plates into positions adjacent the engaged knives to remove the cut claws.

14. A machine according to claim 1, in which each crab-supporting carriage comprises a rectangular open structure, two rectangular open frames mounted in said structure for sliding movement toward and away from each other, resilient means constantly wiging the frames toward each other to a central position, fixed upwardly directed outwardly arcuate knives mounted on adjacent parts of said frames and normally

positioned adjacent each other to form a cradle for supporting a crab, a rockshaft mounted in said structure and spaced from the fixed knives, two knives mounted on said rockshaft, and being shaped correspondingly to the fixed knives and being positioned to be moved into and out of engagement therewith, means constantly urging the rockshaft and movable knives to a position removed from the fixed knives.

15. A machine according to claim 14, comprising in addition means mounted on the rockshaft and positioned to engage means at the work stations for operating the rockshaft and the movable knives.

16. A machine according to claim 14, comprising in addition an upstanding point on the upstream end of each fixed knife, and an upstanding lug positioned adjacent each point and connected to the frame which supports said fixed knife.

17. A machine according to claim 16, in which each lug is positioned laterally outwardly and downstream of the adjacent point.

18. A machine according to claim 14, comprising in addition means on the machine frame and on the carriage frames for moving the frames toward and away from each other.

19. A machine according to claim 14, comprising in addition means at a work station for moving the movable knives into partial cutting relation to the fixed knives, and means at the next work station for moving the movable knives into full cutting engagement with the fixed knives.

20. A machine according to claims 1 and 14, comprising in addition means at a work station for moving the movable knives into partial cutting relation to the fixed knives, and means at the next work station for moving the movable knives into full cutting engagement with the fixed knives.

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