May 24, 1949. E. H. CARRUTHERS 2,470,916

APPARATUS FOR SELECTIVELY PACKING PRODUCTS OF VARIABLE WEIGHT

Filed May 26, 1942 3 Sheets-Sheet 1

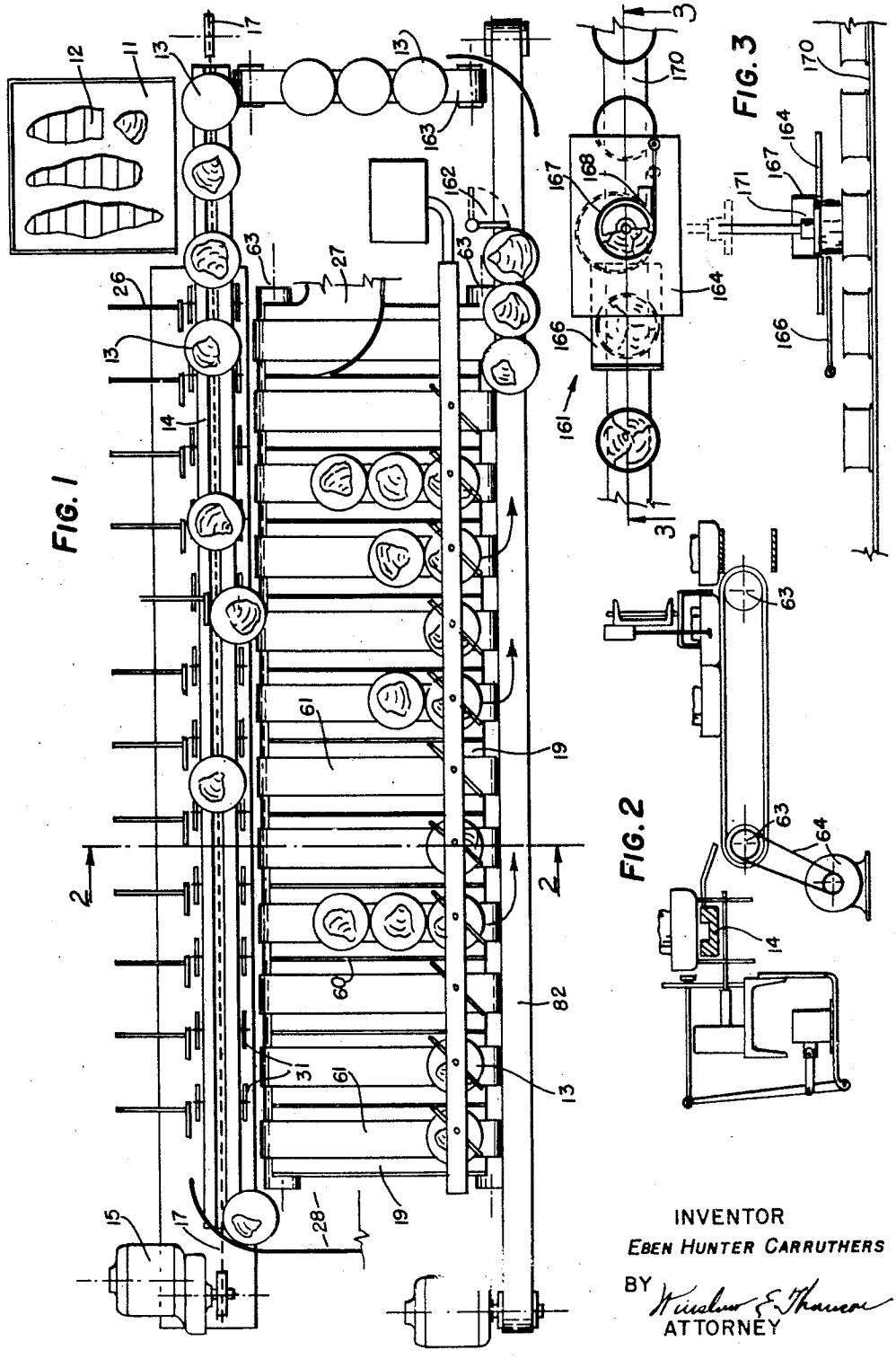


FIG. 1

FIG. 2

FIG. 3

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3 Sheets-Sheet 2

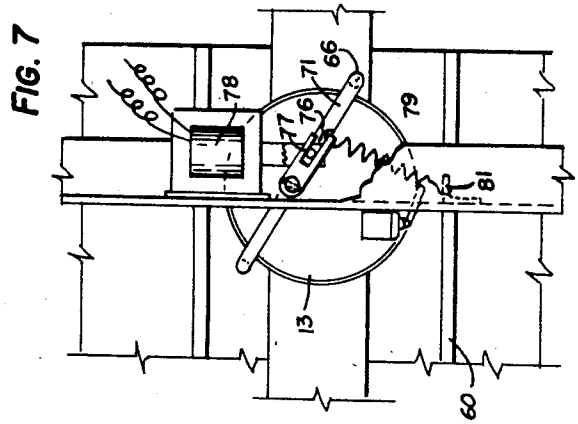


FIG. 7

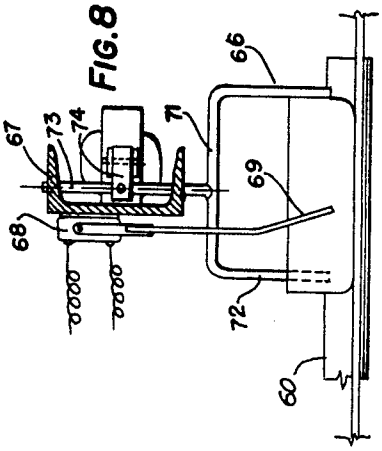


FIG. 8

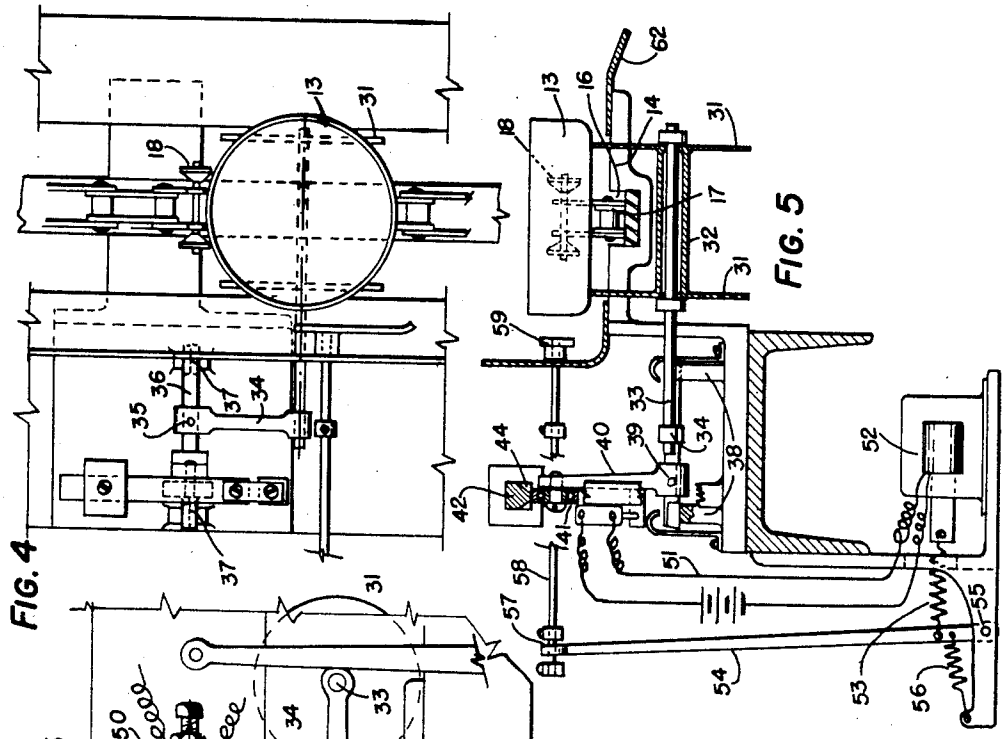


FIG. 4

FIG. 5

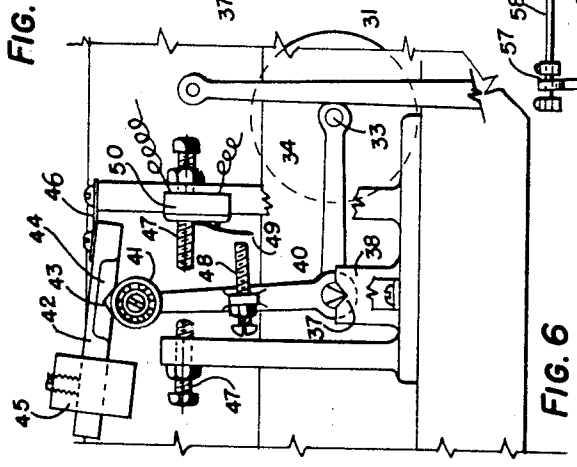


FIG. 6

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FIG. 10

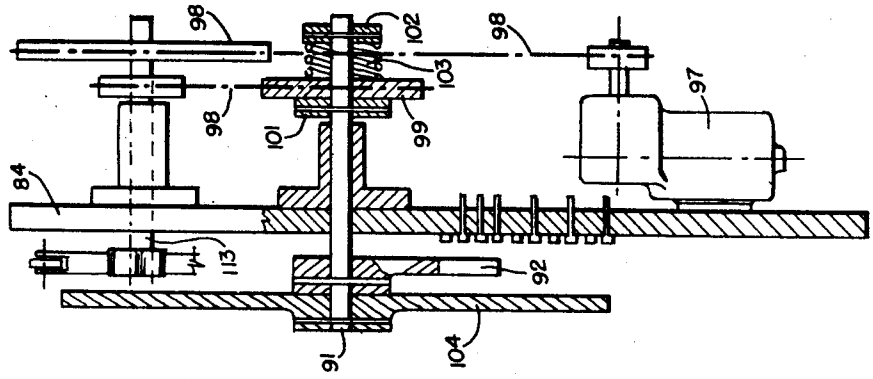
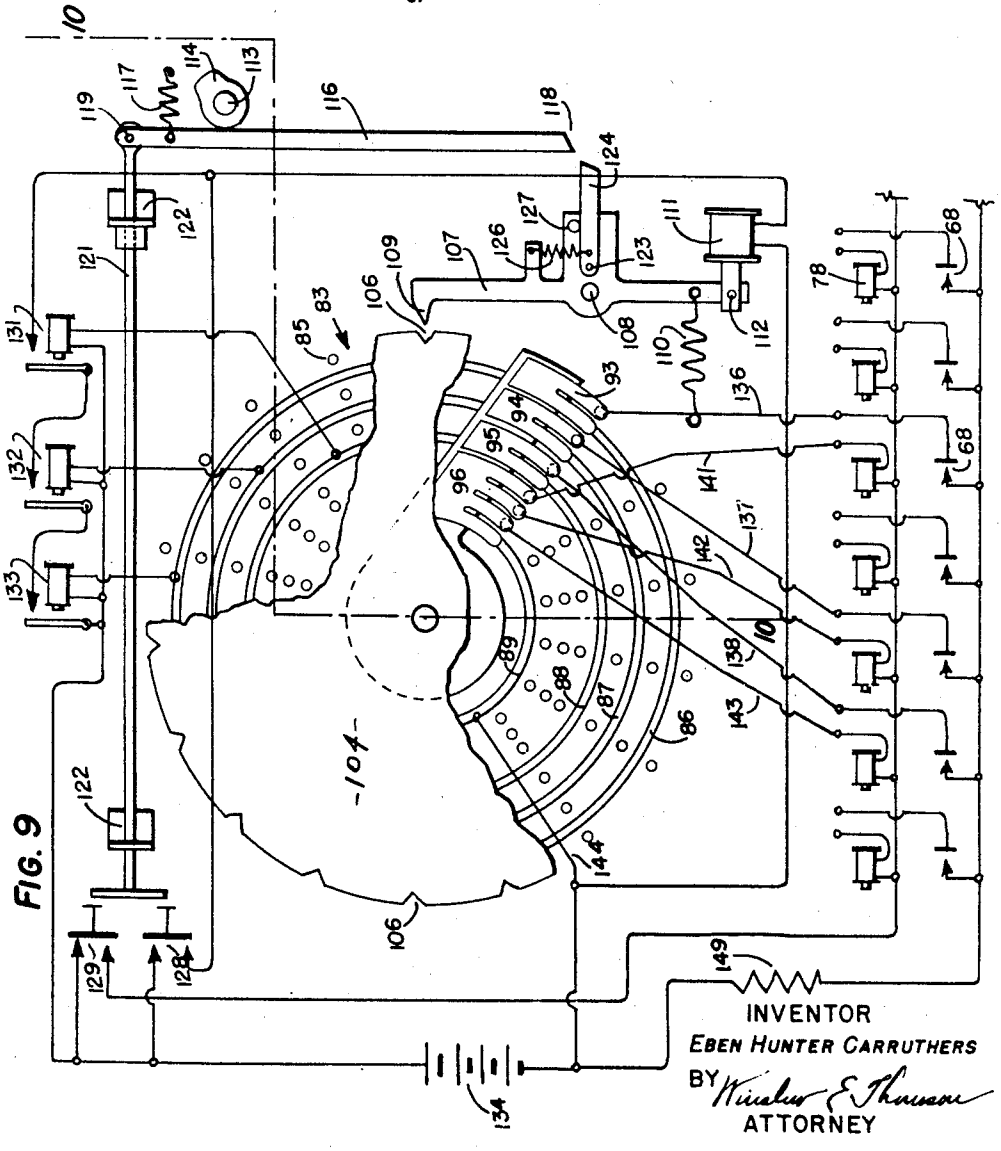


FIG. 9



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UNITED STATES PATENT OFFICE

2,470,916

APPARATUS FOR SELECTIVELY PACKING PRODUCTS OF VARIABLE WEIGHT

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Application May 26, 1942, Serial No. 444,510

18 Claims. (Cl. 209—121)

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My invention relates to a sorting and selecting method and apparatus for use in the packing of a plurality of products or articles of variable weight in a single container. While the method and apparatus of my invention may have other uses, it has primarily been originated for use in the tuna industry. Reference is made to my abandoned copending application Serial No. 398,460, filed June 17, 1941, entitled Apparatus for selectively packing products of variable weight of which the present application is a continuation in part.

The present practices in the tuna industry employed in packing the fish are time consuming and expensive. The precooked fish are carefully split lengthwise into their natural quarter sections. These sections are then, after being cleaned, sliced perpendicular to their lengths into pieces of a length somewhat less than the heighth of the can or other container in which they are to be packed. It will be appreciated, since the tuna vary in size, that the quartered sections vary in size and weight. Moreover, each fish varies in cross sectional area from head to tail. These two factors result in pieces of tuna which, although of uniform length, vary greatly in size and weight.

In the present method of packing the pieces are brought to the packing employees on large trays. With the size of cans at present employed two or more (usually three or four) pieces of tuna are required to fill the can. The packer selects, for example, two pieces which partially fill the can and then attempts, judging from the space remaining, to fill the can by selecting a third piece which will fill the can. This preferably should not be done by breaking the third piece to the proper size since the price of tuna is, to a large extent, dependent on the size of the pieces. Scrap, small and broken pieces, are sold at an appreciable discount.

The selection of a third or fourth piece to fill the can requires the exercise of judgment. Moreover, this judgment is based on size alone without regard to the weight of the pieces. While the weight is to a large extent a function of the size of the piece, it is difficult for the packer to judge the size by inspection. For this reason, after the can is filled, it must be checked for weight. If the weight does not fall within predetermined limits, a small piece of fish must be taken out or added as the particular case may require. This operation is time consuming and results in further handling and breakage of the pieces.

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One of the important properties of the fish is that the grain or flake structure extends in curves or rings generally parallel to the circumference of the fish. This grain or flake structure may be deformed but such deformation should be in a direction such as increases the natural curvature of the grain or flake structure. A deformation of the grain structure in the opposite direction results in breakage into smaller pieces. Thus the pieces can be packed in circular containers providing the grain structure more or less parallels the circumference of the container and any compacting of the pieces required is done in a manner such as to increase the curvature of the grain structure. Frequently the packer is careless in packing the cans and causes a deformation of the piece such that breakage occurs.

There are then two main problems in the packing process: first, to select two or more pieces which will properly fill the can; and second, to avoid breakage when fitting the pieces into the can. This second factor arises to a certain extent because of errors in the selections. These problems have, insofar as I am aware, made the use of the known machine methods of filling cans unsatisfactory. At best the present methods are slow and costly.

An object of the present invention is to provide an improved method and apparatus which will enable the proper packing of pieces of tuna in cans by weight.

A further object of my invention is to provide a method and apparatus for sorting the pieces of tuna by weight and then selecting automatically a combination of pieces which add up to approximately the proper weight (and size) to fill the can.

My invention further contemplates an improved method and apparatus for compacting the selected pieces and placing them in the cans without breakage.

Other objects and advantages of my invention will be pointed out in the claims and will be apparent from the following description, when taken in connection with the accompanying drawings, in which:

Fig. 1 is a plan view, largely diagrammatic, showing in general the apparatus of my invention;

Fig. 2 is a sectional view taken substantially on the line 2—2 of Fig. 1 in the direction indicated by the arrows;

Fig. 3 is a sectional view taken substantially on the line 3—3 of Fig. 1 in the direction indicated by the arrows;

Fig. 4 is a detailed plan view of a portion of Fig. 1 showing the conveyor and weighing mechanism of my invention;

Fig. 5 is a sectional view of the conveyor and weighing mechanism of Fig. 4;

Fig. 6 is a view from the left of Fig. 4 showing the weighing mechanism in detail;

Fig. 7 is a plan view of a portion of Fig. 1 showing the apparatus for holding the tuna trays in their compartments and discharging them therefrom;

Fig. 8 is a side elevation of Fig. 7;

Fig. 9 is a diagrammatic view of the selector mechanism showing the multiple selector switch and the circuits therefor;

Fig. 10 is a sectional view through the multiple switch selector showing the drive therefor and taken substantially on the line 10—10 of Fig. 9.

In Fig. 1 I have indicated diagrammatically a table 11 upon which the tuna may be split into its natural quarter sections, cleaned and cut into the desired lengths, as shown at 12, to fit into the cans. The pieces are then placed in trays or supports 13 which are drawn or pushed along ways 14 most clearly shown in Fig. 5. While any suitable type of conveyor may be employed, preferably the ways are provided with a track or longitudinally extending depressed part 16 in which an endless chain 17 operates driven in any suitable manner as indicated at 15.

As shown most clearly in Fig. 4 the links of the chain may be provided at suitable intervals, with pushing elements or fingers 18 adapted to engage and propel the trays. In order to substantially center the trays with respect to the chain the pushing elements are preferably shaped to approximately fit the contour of the tray. These pushing elements or fingers may each take the form of a pair of small tapered rollers, shown most clearly in Figs. 4 and 5. Each pair of rollers is mounted on a shaft rotatably supported by brackets carried by the drive chain. By means of the chain conveyor and fingers 18 the trays are pushed along the ways to positions opposite a series of channels or compartments 19. Associated with each of the compartments is a weighing mechanism.

The conveyor, compartments and weighing mechanism constitute together an automatic sorting means for separating the trays into groups in accordance with the weights of the pieces of fish therein. After being sorted the trays are delivered by means of automatic selecting mechanism, to be later described, to a conveyor after which the pieces are packed in the cans either by hand or in the manner later described.

In order that the fundamentals of my novel method and machine for sorting and selecting pieces of tuna may be made more clear, the details of one particular arrangement for sorting and selecting are given. It will be understood that the details of the method are for the purpose of illustration only and not by way of limitation.

In the particular example given we will assume that the net weight of pieces of fish to be packed in the can is to be about 200 grams. Any variation from this weight should preferably be on the high side rather than on the low side so that the manufacturer may guarantee at least a minimum weight of fish being in the cans. Further in the contemplated illustration I have selected pieces of fish varying in weight between approximately 30 grams and 90 grams for packing in the cans and operation in my novel sorting and

selecting system. Pieces of tuna lighter or heavier are not used in the particular arrangement to be described, although it will be appreciated that the system may be rearranged to include lighter or heavier pieces if desired.

The sorting device or weighing mechanism is arranged, in this particular illustration, to classify the pieces in 21 separate and distinct weight groups in three gram increments of weight. The average weight of pieces in each weight group would then be 30, 33, 36, and so forth to 90 grams. Any piece of tuna in any weight group might weigh one and a half grams over the average weight of the group or one and a half grams under this average weight.

From the above figures it can be seen that there are a number of three-piece combinations that will give a total average weight of 207 grams. If it should occur that all three pieces of any combination happen to be on the low side of the average weight, the total weight of the three pieces would be 202.5 grams; likewise the maximum total of 211.5 grams might occur. Similarly in four-piece combinations, if all 4 pieces were on the low side a total weight of 201 grams might occur and if all 4 pieces were on the high side of total weight of 213 grams would be possible.

Where the pieces are selected in three gram increments from 30 to 90 grams the possible combination of three pieces are as follows:

90-87-30	87-84-36	84-81-42	81-78-48
90-84-33	87-81-39	84-78-45	81-75-51
90-81-36	87-78-42	84-75-48	81-72-54
90-78-39	87-75-45	84-72-51	81-69-57
90-75-42	87-72-48	84-69-54	81-66-60
90-72-45	87-69-51	84-66-57	
90-69-48	87-66-54	84-63-60	78-75-54
90-66-51	87-63-57		78-72-57
90-63-54			78-69-60
90-60-57			78-66-63
			75-72-60
			75-69-63
			72-69-66

It will be noted from the above table that duplication of the same weight in any combination is avoided because mechanical complications arise in releasing more than one tray at a time from any one compartment or group. In the above combination the number of times each different weight of fish appears is as follows:

90.....10 times	60.....5 times
87..... 9 times	57.....5 times
84..... 9 times	54.....5 times
81..... 8 times	51.....4 times
78..... 7 times	48.....4 times
75..... 7 times	45.....3 times
72..... 7 times	42.....3 times
69..... 6 times	39.....2 times
66..... 5 times	36.....2 times
63.....	33.....1 time
	30.....1 time

From the above figures assuming that the number of pieces in each weight group will average out, it is obvious that weights ranging from 30 grams to around 54 grams might not be included often enough in the combinations to use up these weights of fish in the quantities that they are delivered to the compartments or groups. For example, if the general run of size of pieces included approximately the same number of 30 gram sizes as 90 gram sizes, some 30 gram sizes could not enter combinations and the compartment containing this weight group would fill up. Similarly, for example, 33 gram weights of fish can enter only combinations including a 90 gram size in order to make up the desired total weight of tuna to be packed in the can.

In order that the law of probabilities shall be fulfilled, and to enable the pieces in each weight group to enter into approximately an equal num-

ber of combinations, considering the normal quantities of pieces to be expected in each weight group, combinations of four pieces should be used to a certain extent. The possible number of four-piece combinations which would add up to the desired weight is quite large and in the following table only a part of them are selected to bring the total number of times each weight of fish is used in a combination in proportion to the quantities of that weight expected in the general run of pieces. (Approximately)

87-54-36-30	72-66-39-50	66-63-48-30
84-51-42-30	72-60-45-30	66-63-42-36
81-51-45-30	72-60-39-36	66-60-48-33
81-48-45-33	72-57-45-33	66-60-45-36
78-57-39-33	72-51-45-39	66-40-42-39
78-54-45-30	69-63-42-33	66-57-54-30
75-60-42-30	69-63-39-36	66-57-51-33
75-57-42-33	69-60-48-30	66-54-45-42
75-54-42-36	69-54-51-33	63-60-51-33
75-51-42-39	69-54-48-36	63-57-54-33
	69-51-48-39	63-57-51-36
		63-57-48-39
		63-51-48-45
		60-57-48-42

When the three-piece combinations set forth before are added to the four-piece combinations, the total number of times each weight appears is as follows:

90.....10 times	60.....14 times
87.....10 times	57.....13 times
84.....10 times	54.....13 times
81.....10 times	51.....14 times
78.....10 times	48.....13 times
75.....11 times	45.....12 times
72.....12 times	42.....13 times
69.....13 times	39.....11 times
66.....15 times	36.....10 times
53.....14 times	33.....11 times
	30.....11 times

The above figures indicate that when four-piece combinations as listed are used along with possible three-piece combinations the possibilities for selection are substantially such that all pieces entering each weight group may be used.

If it should be found that for some unexpected reason a particular weight group receives more pieces of fish than other weight groups, it will be appreciated that it would be possible to rearrange the system to have this particular weight group enter into more combinations. The mechanism of my invention for making the sorting and selection may be arranged so that either three-piece of four-piece or both three and four-piece combinations may be used as the normal run of pieces requires, or as the operator desires.

In the above-mentioned application, I have described how the apparatus may be arranged to select four piece combinations. In the present application, I have shown apparatus for use only in selecting three-piece combinations since this is sufficient adequately to illustrate the invention. Moreover, I have found in practise, if any particular weight piece does not enter into enough combinations that it is simpler to add another underweight piece to that particular tray so that the fish in said tray may enter another combination rather than provide apparatus adapted to take four piece combinations. I have found it desirable to use up the underweight pieces in this way or by placing two underweight pieces in a single tray. The overweight pieces may be seppartely packed.

The weighing and sorting system is shown diagrammatically in Fig. 1. It comprises a number of weighing devices, the preferred construction of which will later be described, arranged so that the loaded trays are drawn or pushed successively across them. Each weighing scale in succession is set to trip and to actuate operating mechanism at a slightly lighter load. The operating mechanism pushes or discharges the loaded tray into

the corresponding channel or compartment which its weight dictates. In Fig. 1 I have shown only eleven weight compartments, whereas for the actual combinations set forth above, twenty-one compartments would be required. In the illustration given the average maximum weight of fish is ninety grams and from this weight three-gram decrements are employed. The greatest weight of fish which would be discharged into any one compartment would be ninety-one and a half grams.

The first weighing scale would therefore, in the present illustration, be adjusted to displace trays containing pieces of fish weighing greater than ninety-one and a half grams. The actuating mechanism associated with this weighing scale is indicated diagrammatically in Fig. 1 by the numeral **26**. Any piece of fish weighing more than ninety-one and a half grams would be discharged through a by-pass channel **27**. Thus the first compartment would contain pieces of fish weighing between eighty-eight and a half and ninety-one and a half grams. The weighing mechanism associated with the second compartment would be set so as to trip its operating mechanism and discharge into the second compartment any pieces of fish weighing in excess of eighty-five and a half grams. Succeeding weighing mechanisms would be set to trip at lower weights in three gram decrements as suggested above. Pieces weighing less than twenty-eight and a half grams would be discharged from the system through a by-pass **28** and might be separately packed or be used in combinations in another system.

While I have shown and described the system as operating with only a single piece in each tray, it would be possible to operate the system with two or more pieces in a tray. This would enable using up pieces smaller than twenty-eight and a half grams since the weighing and selecting system would treat two or more pieces in a tray as a single piece. I have found this the most convenient way of using up the undersize pieces.

Any suitable type of weighing mechanism may be employed, however, for reasons which will be obvious, it is desirable that the weighing mechanism be particularly designed so as to trip abruptly and actuate mechanism to discharge the tray into its proper compartment quickly and at the proper time. In Figs. 5 and 6 I have shown in some detail the construction of a preferred form of weighing mechanism. Each scale comprises two discs **31** located substantially equal distances on opposite sides of the chain conveyor **17**. The discs **31** may be tied together through a common sleeve **32** which is freely rotatable on a shaft **33**. The wheels or discs **31** are located so that, when they are in their normal rest positions, portions of their peripheries project slightly above the ways **14** (see Fig. 5).

As the tray moves along the ways pushed by the fingers **18** projecting from the chain links, the tray arrives at a pair of discs associated with one of the scales, rides up upon them and is carried or pushed over the other side. Since the discs revolve freely upon their shaft **33** the discs offer but slight resistance to the propulsion of the trays by the chain fingers. Whatever slight pressure is exerted on the discs is in a direction substantially normal to the direction of gravity and does not to any appreciable extent affect the total load on the discs.

The use of rollers instead of rigid finger elements, as in the above mentioned application, permits the trays to be rolled over the discs with

but a slight amount of friction since the roll fingers may freely rotate on the sides of the trays.

The fingers 18 are arranged, as previously mentioned, so as to at all times maintain the trays substantially centrally located with respect to the chain so as to insure that the trays will engage both discs. Regardless of the position of the piece of fish in the tray and regardless of whether the tray is accurately centralized with respect to the chain and discs, the weighing lever 34 to which the shaft 33 is secured, will at some point in the travel of the tray across the discs "feel" the total weight of the tray and its contained piece of fish. Since all of the trays are the same weight they do not affect the weighing operation and their weight is a constant factor which can be allowed for in setting the scales. It will be observed that the maximum weight is "felt" when the trays reach a position on the discs such that a line through the center of gravity of the tray and its load combined, lies directly above the axis of the shaft 33. The arrangement described provides a constant lever arm regardless of the position of the articles in the tray. Moreover, the use of the complicated linkages, often used in weighing devices, is eliminated.

The lever arm 34 is rigidly secured, as indicated at 35, to a horizontal shaft 36. Rigidly secured to the shaft 36 are two fulcrum elements having fulcrum points 37 which engage a support 38 (see Fig. 5). Rigid with the shaft 36, as indicated at 39 (Fig. 5) is an arm 40 upon the upper end of which a roller 41 is mounted. The roller is adapted to ride along a lever 42 and for the purpose of decreasing friction and insuring a snap action of the parts, the roller is preferably ball bearing mounted. A notch 43 is provided in the lever in which the roller 41 normally rests. It will be noted that the lever is cut away on both sides, as indicated at 44 so that the lever makes substantially line contact with the roller for the purpose of further decreasing friction. A counter weight 45 is adjustable along the lever to vary the weight of tray and fish which will actuate the weighing mechanism. The lever 42 is attached to its support by means of a flexible strip or spring 46. Instead of a flexible strip, a plain pin bearing might be used. However, this would cause friction since side locating collars would be required. A knife edge bearing might also be employed but such an arrangement would require stops and locators to keep the knife edge in position. The flexible strip has the advantage of providing a substantially frictionless positively located fulcrum for the arm 46. The spring load on the arm may be made constant and may be arranged to either add or subtract load on the weight arm 46. That is, the spring normally aids in maintaining the roller in position in the notch. However, as soon as the roller rides out of the notch the spring will snap the roller to the limit of its movement.

Movement of the lever 40 is limited by a pair of adjustable stops 47. It will be noted that the lever 42 extends in a position inclined to the horizontal so that as soon as the weight has been removed from the discs 31 the roller will ride to the left, the stop 47 at the left of Fig. 6 being arranged so as to insure that the roller will seat itself in the notch. It will be appreciated that the torque on the shaft 36 produced by the proper weight of the tray and fish will cause the roller 41 to pull out of its notch 43 with a snap action. As soon as the tray has been discharged, in a manner about to be described, the roller immediately snaps back to its proper position.

Fixed to the arm 40 is an adjustable screw 48 which is an overbalanced position engages the spring actuating arm 49 of a sensitive contact switch 50. When the switch is closed a circuit, generally indicated by the numeral 51, is completed through a solenoid 52. Action of the solenoid through a spring connection 53 actuates an arm 54 pivoted at 55. A spring 56 returns the arm 54 to its normal position as shown in Fig. 5.

The arm 54 is connected, preferably in the manner indicated at 57 to a rod 58 the end 59 of which is adapted to engage the tray 13 and push the tray 13 and push the loaded tray off the scale discs into the adjoining channel or compartment.

The adjoining channels or compartments are separated from each other by spacing elements 60, space sufficient to freely accommodate the diameter of the trays being provided. In the above mentioned application I have shown the compartments as inclined so that the trays will readily slide downward toward the bottom thereof. However, in the present application I have shown a transverse belt 61 in each of the compartments which is adapted to pick up the trays after they leave an apron 62. The impetus imparted to the trays by the tray engaging elements 59 is sufficient to carry the trays over the apron 62 and on to the transverse belts 61. The belts 61 are continuously operated, their supporting shafts 63 being driven in any suitable manner as by a motor and belt 64 (Fig. 2). Thus the trays are positively carried to the ends of the compartments or channels.

Referring now to Figs. 7 and 8, a stop 66 is shown located adjacent the end of each compartment. These stops engage the tray at the end of each compartment and prevent the discharge of the trays from the compartments until desired. Mounted on a frame member 67 is a sensitive snap action switch 68 which has an actuating member 69 depending therefrom. The end of the actuating member 69 is adapted to engage a tray in the position shown in Fig. 7 which moves the actuating member, or bar, 69 laterally causing the switch contacts of the sensitive switch 68 to close. The contacts open again as soon as the side thrust of the tray is removed. The elements described comprises a detecting means for determining when a tray is in position in a compartment, the purpose of which will be later described.

The stop 66 is connected by a bar 71 to a combined tray pushing element and second stop 72. The bar 71 is connected to a shaft 73 which is pivoted in the frame member 67. Rigidly secured to the shaft 73 is a slotted element 74 into the slot 76 of which a pin 77 extends. The pin 77 is connected to the core of a solenoid 78 which is actuated in a manner to be later described. A spring 79 having one end secured to the frame, as indicated at 81, has its other end secured to the bar 71 so as to normally restore the stop 66 and the tray pushing element 72 to their normal positions as indicated in Fig. 7. When the solenoid is actuated the bar 71 is rotated in a counter-clockwise diretion, as viewed in Fig. 7 so as to remove the stop 66 and cause the tray pushing element or second stop 72 to engage the tray and, together with the transverse belt, discharge it from the compartment. The tray is then carried by the belt 61 to a longitudinally extending belt or conveyor 82. The primary function of the second stop 72 is to prevent the discharge of a second or third tray when the stop 66 is in a discharge position.

In Figs. 9 and 10 I have shown diagrammatically the solenoid control mechanism and circuits for selecting the trays to be discharged from the compartments. The control of the circuits operating the tray releasing solenoids is by a single multiple switch mechanism generally indicated by the numeral 83. In Fig. 9 I have diagrammatically shown the solenoids 78 and the detector switches 68. In the drawings I have shown only a few of the solenoids and detector switches, but it will be appreciated that a solenoid and switch is provided for each of the compartments and in the particular example given, 21 such solenoids and detector switches would be required.

The multiple switch, indicated generally by the numeral 83, comprises a panel member 84 (Fig. 10) which has mounted thereon a number of radial rows of contacts 85. In the arrangement shown, using three piece combinations, 37 radial rows of contacts would be required, one for each combination. In the above-mentioned application where the machine is designed also for four-piece combinations, 72 radial rows of contacts would be required. Each radial row has six contacts, three of which are connected to the detector switches 68 while the other three are connected to the solenoids 78. There are also provided four contactor rings 86, 87, 88 and 89.

As shown most clearly in Fig. 10, mounted rigidly on a shaft 91 is an arm 92 which carries four sets of brushes 93, 94, 95 and 96. Each set of brushes is electrically insulated from the other sets and from the arm 92 which carries them. Each set of brushes serves to make electrical connection between its corresponding row of contactors and the adjacent contactor ring, the inner brush 96 having three contact fingers engaging contacts while a fourth contact finger makes contact with the contactor ring 89.

As shown in Fig. 10, the arm 92 carrying the sets of U-shaped brushes is pinned to the shaft 91 which is rotated by a motor 97. A reduction in speed from the motor 97 to the shaft 91 is secured through a chain and sprocket speed reduction generally indicated by the numeral 98. The sprocket 99 which is mounted on the shaft 91 is loose with respect thereto and is driven by friction. The friction drive is secured by a collar 101 and a collar 102 mounted on and fixed to the shaft 91 and a spring 103 lying between the sprocket 99 and the collar 102.

Rigidly secured to the shaft 91 so as to rotate with the arm 92 is a serrated disc 104 which has serrations or teeth 106 corresponding in number to the number of radial rows of contacts. Mounted adjacent the serrated disc is a lever 107 pivoted at 108. The latter carries a stop 109 which is adapted to engage in the teeth or serrations 106 so as to stop the rotation of the disc 104 and the brush carrying arm 92. When the stop 109 engages in a serration in the disc, the friction drive permits continued rotation of the sprocket 99 wtihout rotating the shaft 91 and the parts mounted thereon. The stop 109 is engaged in one of the serrations upon actuation of a solenoid 111, the core of which is pivoted to the lever 107, as indicated at 112. As soon as the disc and associated parts are stopped the brushes are maintained in engagement with one of the radial rows of contactors 85. A spring 110 restores lever 107 to its normal position when solenoid 111 is deenergized.

Driven from the motor 97 is a shaft 113 upon which a cam 114 is rigidly secured. The shaft 113

and the cam 114 are driven at a slightly higher rate of speed than the shaft 91 and the parts mounted thereon. Moreover, the shaft 113 is positively driven so that as long as the motor 97 is operating the cam 114 rotates. A lever 116 mounted adjacent the cam 114 rides on the cam and is actuated thereby. A spring 117 having one end fixed and the other end attached to the lever 116 maintains the lever in engagement with the cam. One end 118 of the lever 116 is free and the other end is pivoted as shown at 119 to a rod 121 slidably mounted in brackets 122. It will be noted that the spring 117 not only maintains the lever in contact with the cam, but also maintains the slidable rod normally in a right hand position as viewed in Fig. 9.

The lever 107 has pivoted thereto as shown at 123, a trigger 124 which is adapted to engage the free end 118 of the lever 116. A spring 126 normally maintains the trigger 124 in engagement with a stop 127. It will be observed that when the lever 107 is in the position shown in Fig. 9, that the lever 116 may be actuated by the cam 114 without engaging the trigger 124. As soon, however, as the lever 107 is actuated by the solenoid 111 the trigger moves to a position counterclockwise, as viewed in Fig. 9, in which position it may be engaged by the lever 116 upon the cam 114 rotating so that its high point engages the lever 116. The trigger 124 then acts as a stop to limit the movement of the free end 118 of the lever and causes the motion thereof to be imparted to the rod 121 to shift that member to the left, as viewed in Fig. 9. It will be observed, should the high point of the cam be in engagement with the lever 116 when the lever 107 is actuated by the solenoid, that the trigger will pivot about shaft 123 and the end thereof will ride on the end 118 of the lever 116 until the lever 116 drops off the high point of the cam.

Movement of the rod 121 to the left closes two switches 128 and 129. Mounted in circuit with the solenoid 111 are three relays 131, 132 and 133. The solenoids of the relays 131, 132 and 133 are connected, respectively, to the contactor rings 88, 87 and 86. Through the brushes 93, 94 and 95 the contactor rings are in circuit with the detector switches 68. It will be appreciated that the relays 131, 132 and 133 are in series and that the circuit through the solenoid 111 and through the battery 134 can not be closed until all three relays are actuated.

By way of illustration I have shown three leads 136, 137 and 138 which are connected to selector switches 68 which are associated with compartments, the combined weight of whose pieces of fish is approximately the desired weight. As soon as each of these three compartments has a tray in position, the detector switch is closed and upon the brushes sweeping over the corresponding row of contacts, the circuits to the relays 131, 132 and 133 are closed, thus completing the circuit through the solenoid 111. Upon actuation of the solenoid 111 the serrated disc 104, together with the brush carrying arm 92, is stopped, and upon continued rotation of the cam 114 the end 118 of the lever 116 engages the trigger 124 which shifts the rod 121 to the left, as viewed in Fig. 9, thus closing switches 128 and 129. Closing of switch 128 maintains the current through the locking solenoid 111 after the trays have started to move out of the channels, since this movement allows the detector switches to open and deenergize the detector relays 131, 132 and 133.

Upon closing the switch 129 the circuits through the solenoids 78 are completed. This is accomplished through leads 141, 142 and 143, the contacts of the contactor switch 83, and the contactor ring 89 to the battery through a lead 144. Upon actuation of the solenoids 78 the stops 66 (Fig. 8) are withdrawn and the tray pushing elements 72 push the trays onto the conveyor 82.

It will be appreciated that the cam 114 acts as a timing device to permit sufficient time for the trays to be discharged from their compartments. As soon as the cam has rotated to a position such that the lever 116 drops off the high point of the cam, the spring 117 moves the rod 121 to the right as viewed in Fig. 9, thereby breaking the circuit through the locking solenoid 111 and through the tray releasing solenoids 78. Deenergizing the solenoid 111 permits the spring 110 to remove the stop 109 from engagement with the serrated disk, thereby permitting the serrated disk, together with the arm 92, to be rotated through its friction drive. The arm 92, together with the brushes, continues to rotate until it reaches another radial row of contactors, whose corresponding compartments contain trays of fish, the combined weight of which substantially equals the desired weight total. The detector switches corresponding to these compartments detect this condition, actuate the relays 131, 132 and 133 to again complete the above described circuits and discharge from the compartments another group of trays.

It will be particularly noted that all three relays 131, 132 and 133 must be energized before the locking solenoid 111 is energized. Should the brushes pass over a radial row of contacts, only two of whose detector switches, for example, are closed, the circuit through the locking solenoid 111 will not be completed so that the rotation of the arm 92 will not be interrupted. It will further be observed that the cam 114 times or regulates the discharge of trays from the compartments by insuring the elapse of an interval between successive energizations of a combination of discharge solenoids 78. It will be appreciated that the cam 114 may be driven at any desired speed to insure proper timing of the operation. The resistance 149 is not entirely necessary. It does, however, act to reduce the current in the detector circuits and cuts down the arcing at the brushes while the switch is hunting a complete combination.

After being discharged onto the conveyor 82 the pieces are carried to a packing position generally indicated by the numeral 161. It will be appreciated that the speed of travel of the conveyor 82 must be timed with relation to the speed of rotation of the cam 114, so that a group of trays will be carried to the packing position without interference from a succeeding group of trays discharged onto the conveyor 82. A stop 162 engages the trays and holds them in position until the trays are emptied. The empty trays may then be returned to the starting point by a conveyor 163. While the pieces of fish may be packed into the cans by hand, I prefer to use the mechanical compacting and packing device shown.

A table 164 has an opening therein normally covered by a sliding plate 166. A flexible band 167 having one end 168 rigidly secured to the table and its other end movable is arranged above the opening in the table. The pieces of fish are then placed in the flexible band and the free end 169 drawn taut so as to compact the fish. The sliding plate 166 is then withdrawn and a plunger

171 actuated so as to push the compacted mass of fish out of the flexible band through the opening and into the cans in the manner illustrated in Fig. 3. The cans may be fed to the filling position by a conveyor 170. It will be observed that by means of the compacting device the pieces of fish may be readily compacted in a manner such as to increase the natural curvature of the grain structure of the fish. This results from the fact that the flexible band acts on all sides of the mass of fish as the flexible band is tautened. Moreover, by the flexible band the diameter of the mass may be made slightly smaller than the diameter of the cans so that the mass may be readily transferred as a unit to the can.

It will be appreciated that I have provided a novel method and mechanism particularly useful in the tuna industry for sorting pieces of fish by weight and selecting a plurality of pieces whose combined weight approximately equals the desired weight to be packed in a container. It will moreover be appreciated that I have provided novel means for compacting the mass of fish and filling the cans. It will be further understood that various modifications and changes may be made, particularly in the form and relationship of parts, without departing from the spirit of my invention as set forth in the appended claims.

I claim:

1. An apparatus for use in packing a predetermined weight of articles of variable weight in a single container comprising, in combination, means including weighing mechanism for sorting the articles into groups by weight, and means for automatically and simultaneously selecting a plurality of said articles whose combined weight substantially equals the desired weight to be placed in the container.

2. An apparatus for use in packing a predetermined weight of articles of variable weight in a single container comprising, in combination, means including weighing mechanism for sorting the articles into groups by weight, means for automatically selecting a plurality of articles from several of said groups whose combined weight approximately equals the desired weight to be packed in the container, and means for insuring the elapse of at least a predetermined period of time between successive operations of said selecting means.

3. An apparatus for use in packing a predetermined weight of a plurality of articles of variable weight in a single container comprising, in combination, a conveyor, a plurality of compartments arranged adjacent said conveyor, means for sorting the articles and transferring them from said conveyor to said compartments in accordance with their weight, a second conveyor arranged adjacent said compartments and means for selecting a plurality of articles from said compartments whose combined weights substantially equals the desired weight to be placed in the container and transferring them to said second conveyor.

4. An apparatus for use in packaging a plurality of articles of variable weight in a single container comprising, in combination, a plurality of compartments for maintaining articles of different weights separated, a stop for each compartment adapted normally to maintain the articles therein, a normally open switch associated with each compartment and arranged to be closed by an article in the compartment, a plurality of sets of movable contacts, a plurality of sets of stationary contacts, a solenoid for actuating each

of said stops, means including circuits for interconnecting said switches, contacts and solenoids in a manner such that the solenoids of only the compartments of whose switches have been closed may be energized as the movable contacts successively engage the stationary contacts, and means for energizing a plurality of said solenoids simultaneously to discharge an article from each of a plurality of compartments, said plurality of solenoids being associated with compartments the total weight of whose discharged articles approximately equals the desired weight to be packed in the container.

5. Apparatus for use in packing a predetermined weight of articles of variable weight in a single container comprising, in combination, means including weighing mechanism for sorting the articles into groups by weight, and means for automatically selecting a plurality of articles from said groups whose combined weight is approximately the desired weight to be packed in the container, said means being so constructed and arranged that an article from a particular weight group may be combined with articles from a plurality of weight groups to substantially equal the desired combined weight.

6. An apparatus for use in packing a predetermined weight of articles of variable weight in a single container comprising, in combination, means including weighing mechanism for sorting the articles into groups by weight, and means comprising an intermittently operated movable member for automatically selecting a plurality of said articles from different weight groups whose combined weight substantially equals the desired weight to be placed in the container.

7. An apparatus for use in packing a predetermined weight of articles of variable weight in a single container comprising, in combination, a standard weight support for each of the articles, means for weighing the articles together with the supports as they travel through a predetermined path, means actuated by the weighing means for discharging said supports together with the articles in an approximately horizontal direction out of said predetermined path, and means associated with the weighing means for automatically selecting a plurality of supports whose articles are of different weight but the combined weight of whose articles substantially equals the predetermined weight.

8. An apparatus for use in packing a predetermined weight of components of variable weight comprising, in combination, means for sorting said components according to weight, means for segregating separately components of like weight, means for predetermining a plurality of groups of components each group including components from a plurality of segregated weight groups which combine to add to a predetermined total weight, and means responsive to said predetermining means for selecting from said segregating means a group of components which combined add substantially to said predetermined total weight.

9. An apparatus for use in packing a predetermined weight of components of variable weight comprising, in combination, means for sorting said components according to weight, means for segregating separately components of like weight, means for predetermining a plurality of groups of components each group including components from a plurality of segregated weight groups which combine to add to a predetermined total weight, means responsive to said predetermining means for selecting from said segregating means a group of components which combined add substantially to said predetermined total weight, and means for insuring the lapse of a time interval between the successive selection of groups of components.

10. An apparatus for use in packing a predetermined weight of components of variable weight comprising, in combination, means for sorting said components according to weight, means for segregating separately components of like weight, means associated with said segregating means for selecting therefrom successive groups of components each group when the components thereof are combined adding substantially to said predetermined total weight, and means for insuring the lapse of a time interval between the successive selection of groups of components.

11. Apparatus for use in packing a predetermined weight of components of variable weight in a container comprising, in combination, means for sorting and segregating components of like weight, means for predetermining a plurality of groups of components each group containing components from a plurality of segregations and each group adding to substantially the same predetermined weight of components, and means responsive to said predetermining means for selecting a group of components.

12. Apparatus for use in packing a predetermined weight of components of variable weight in a container comprising, in combination, means for sorting and segregating components of like weight, means for predetermining a plurality of groups of components each group containing components from a plurality of segregations and each group adding to substantially the same predetermined weight of components, and means in connection with said predetermined means for enabling at least some of the components to enter into more than one group in order to make up the desired total weight.

13. Apparatus for use in packing a predetermined weight of components of variable weight in a container comprising, in combination, means for sorting and segregating components by characteristics which are functions of weight to segregate separately components of substantially like weight, means for predetermining a plurality of groups of components each group containing components from a plurality of segregations and each group adding to substantially the same predetermined weight of components, and means responsive to said predetermining means for selecting a group of components in accordance with the availability of the entire group and preventing the selection of any of said group unless the entire group is available.

14. Apparatus for use in packing a predetermined weight of components of variable weight in a container comprising, in combination, means for sorting and segregating components by characteristics which are functions of weight to segregate separately components of substantially like weight, means for predetermining a plurality of groups of components each group containing components from a plurality of segregations and each group adding to substantially the same predetermined weight of components, means for enabling at least some of the components to enter into more than one weight group in order to make up the desired total

weight, and means responsive to said predetermining means for selecting a group of components in accordance with the availability of the entire group and preventing the selection of any of said group unless the entire group is available.

15. Apparatus for packing a predetermined weight of components of variable weight comprising, in combination, and means for sorting components in accordance with their weight, means for segregating components of like weight, means for selecting therefrom a group of components which combined add substantially to a predetermined weight, and means cooperating with said selecting means for retaining in said segregating means the components of a group which add to said predetermined total weight unless all of the components in said group are available in said segregating means.

16. Apparatus for packing a predetermined weight of components of variable weight comprising, in combination, means for segregating separately components of like weight, means for selecting therefrom a group of components which combined add substantially to a predetermined total weight, and means cooperating with said selecting means for testing the segregations to determine the availability of components therein.

17. Apparatus for use in packing a predetermined weight of components of variable weight comprising, in combination, means for sorting said components in accordance with their weight, means for segregating and retaining separated components of like weight, means associated with said segregating means for successively selecting and releasing from said segregating means combinations of components, each combination of components adding to substantially the same predetermined weight, and means cooperating with said segregating means for retaining the components in said segregating means unless a combination is present in the segregating means.

18. Apparatus for use in packing a predetermined weight of components of variable weight comprising, in combination, means for sorting said components in accordance with their weight, means for segregating and retaining separated components of like weight, and means associated with said segregating means for successively selecting and releasing from said segregating means combinations of components, each combination of components adding to substantially the same predetermined weight, and said selecting means including means enabling at least some of the components to enter into more than one combination.

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