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W. McK. MARTIN

2,227,226

METHOD OF AND APPARATUS FOR GRADING PEAS OR THE LIKE

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3 Sheets-Sheet 1

Fig. 1

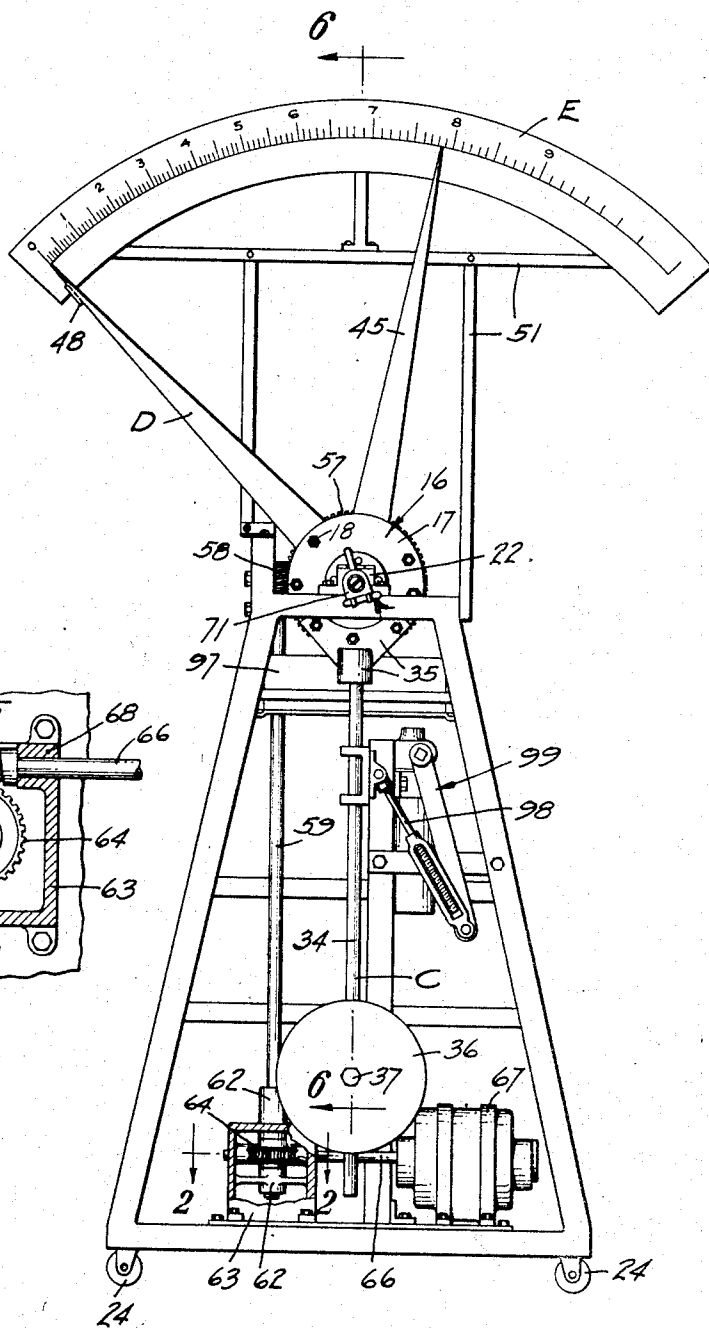
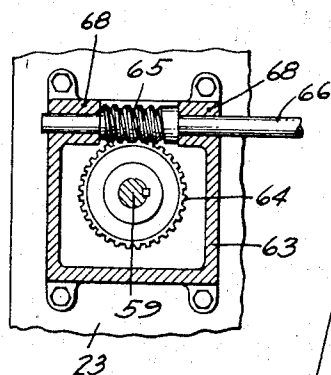


Fig. 2



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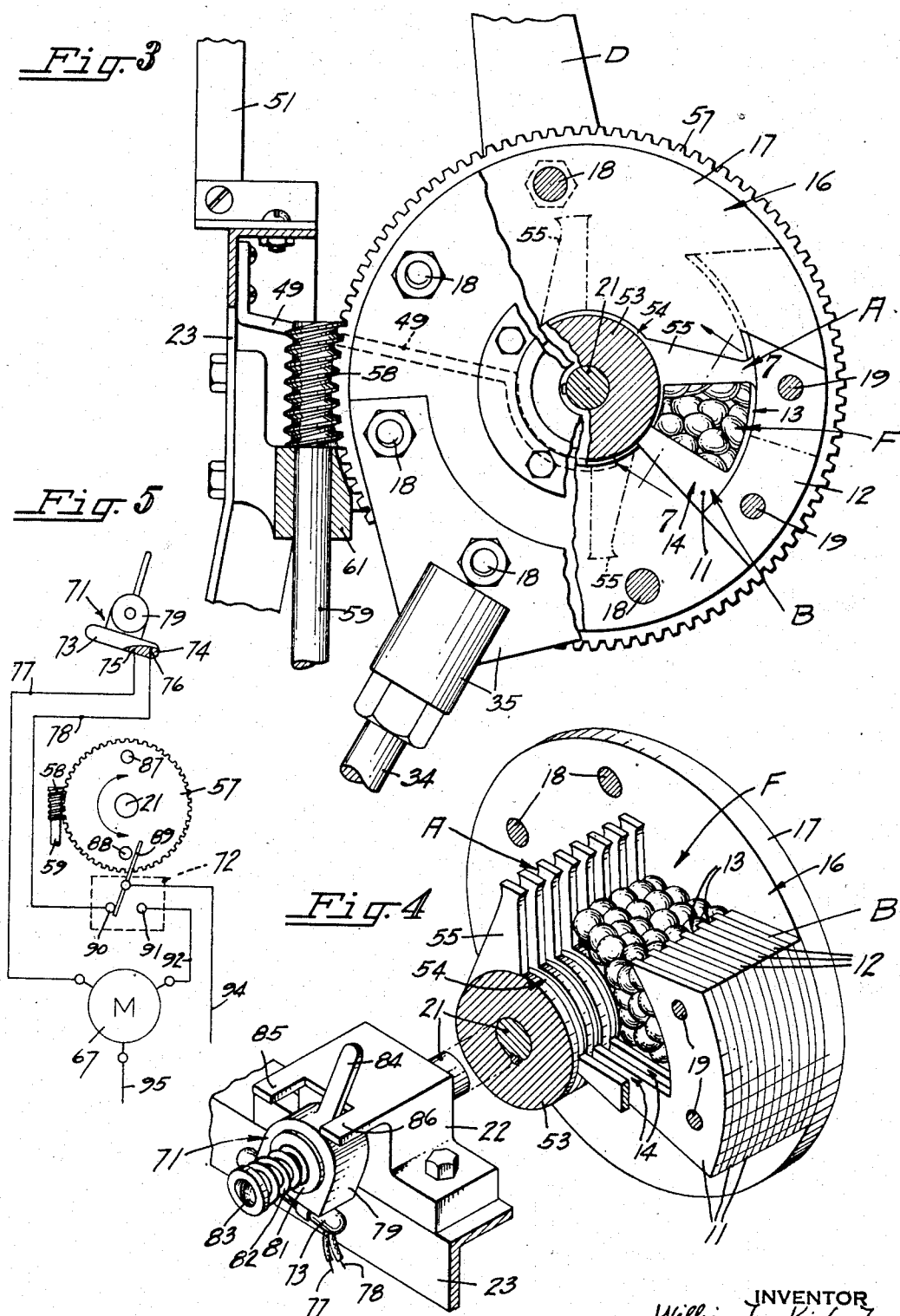
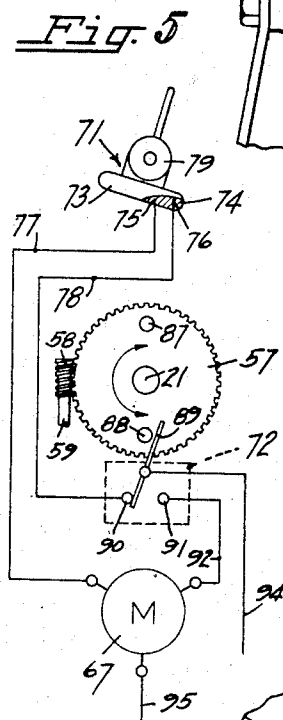
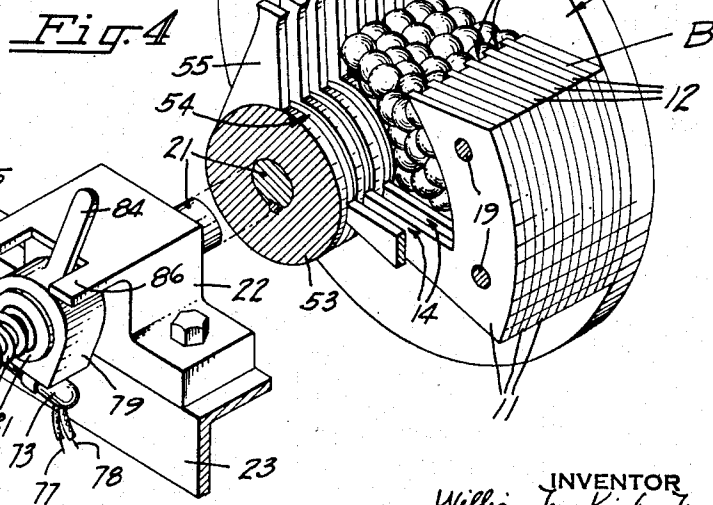
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METHOD OF AND APPARATUS FOR GRADING PEAS OR THE LIKE

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3 Sheets-Sheet 2



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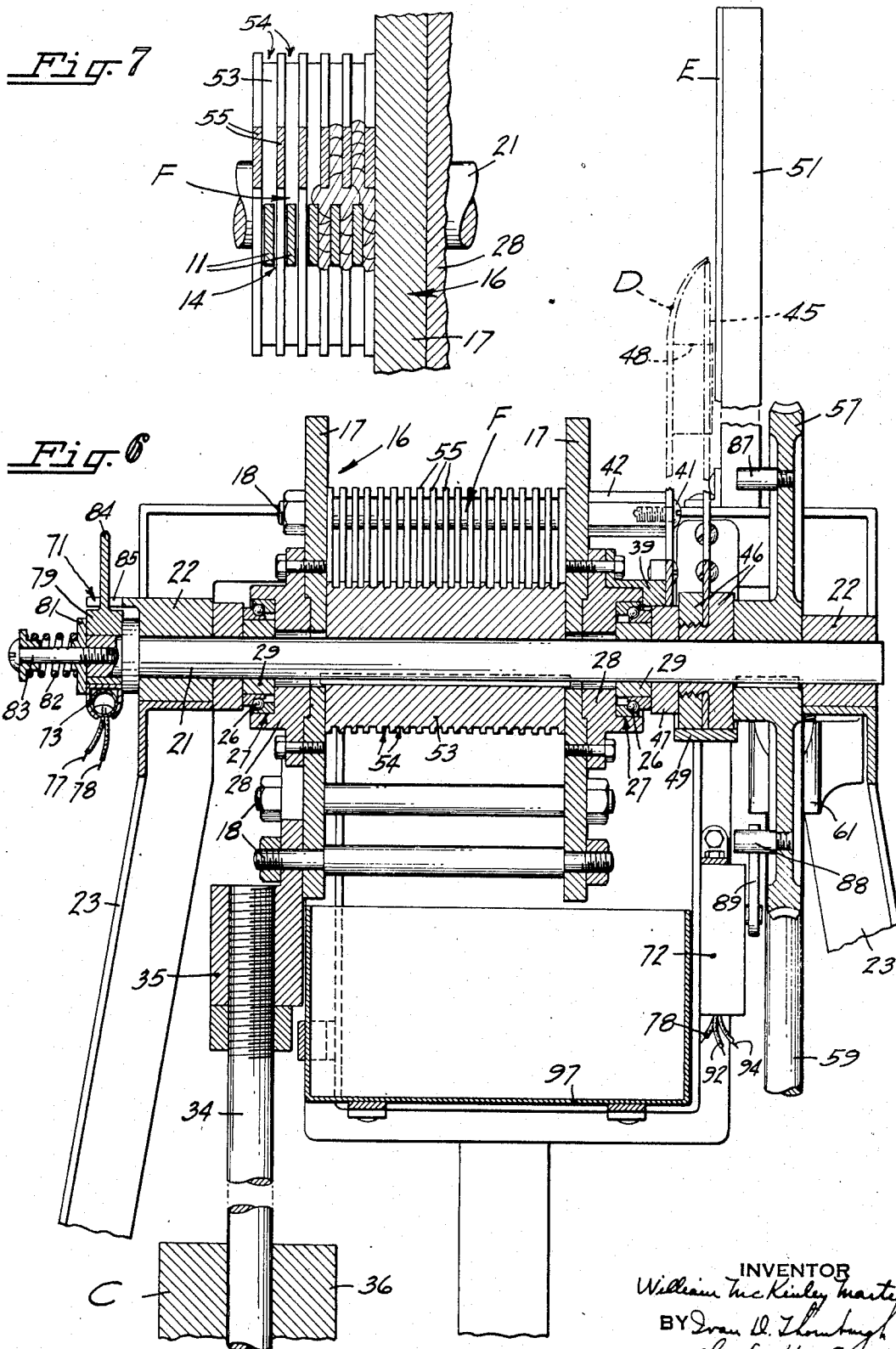
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METHOD OF AND APPARATUS FOR GRADING PEAS OR THE LIKE

Filed June 22, 1937

3 Sheets-Sheet 3



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METHOD OF AND APPARATUS FOR GRADING
PEAS OR THE LIKE

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17 Claims. (Cl. 265—17)

The present invention relates to a method of and apparatus for grading peas and the like and has particular reference to evaluating their tenderness property by measuring their resistance to a shearing action.

In the pea-canning industry great importance is attached to the proper grading of peas in accordance with their tenderness. In the United States Agriculture Department grade standards more than one-third of the total quality score is given for tenderness. To be more exact out of a score of 100 points allowed for the various factors contributing to the quality of canned peas, 35 are allowed for tenderness, 25 for flavor, 15 for clearness of liquor, 15 for absence of defects and 10 for uniformity of size and color. Thus it will be seen that tenderness is the most important single factor. In some respects the tenderness factor has become regarded as being synonymous with quality. This is especially true in the grading of the raw peas as they come from the field to the canning factory.

The problem of evaluating tenderness of peas is therefore of considerable importance to the canner. In both the production and canning operations, the grower and the canner have heretofore been dependent very largely on the vagaries of human judgment in grading the peas as they are received at the factory. The canner therefore usually pays the grower on guess work as to what grade the peas will run or is required to wait until the peas have been canned and then sample cans have to be opened and judged as to what at best is an arbitrary and uncertain classification. This reliance on human judgment is not susceptible to uniformity.

An object therefore of the present invention is the provision of a method of and apparatus for determining the tenderness of peas or the like mechanically and positively and wherein human judgment is entirely eliminated.

Another object is the provision of such a method of and apparatus for determining the tenderness of peas or the like by subjecting a predetermined confined quantity of the peas to a shearing action and then measuring the resistance against shearing.

Another object is the provision of a method and apparatus of this character wherein the shearing of the peas or the like is effected entirely automatically, the apparatus visually registering the maximum shearing force required for a batch of peas under test so that this measurement may be read off at the conclusion of the test.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

Referring to the drawings:

Figure 1 is a front elevation of a machine embodying the instant invention;

Fig. 2 is an enlarged sectional detail taken substantially along the horizontal line 2—2 in Fig. 1, with parts broken away.

Fig. 3 is a partial front elevation drawn on an enlarged scale of certain movable parts which are principally associated with the shearing portion of the machine, the view showing the front portion of the machine frame and other parts broken away and with parts shown in section;

Fig. 4 is a perspective view of certain of the machine parts shown in Fig. 3 with the addition of a portion of the front frame and a mercury switch which are not shown in Fig. 3;

Fig. 5 is a wiring diagram of the electric apparatus utilized in the machine;

Fig. 6 is an enlarged vertical section taken substantially along the line 6—6 in Fig. 1, with parts broken away; and

Fig. 7 is an enlarged fragmentary view showing a sectional detail taken substantially along the line 7—7 in Fig. 3.

The drawings illustrate a preferred embodiment of an apparatus for carrying out the various method steps of the instant invention. The apparatus includes a positively movable grid unit A (Figs. 3 and 4) and a yieldable grid unit B, the latter grid unit being mounted on a pendulum C which tends to hold the grid relatively stationary. The grid units are shaped to confine between them a predetermined mass or quantity of peas to be tested or graded for tenderness.

The positively movable grid unit A is adapted to be rotated relative to the yieldable grid unit B so that the confined peas will be cut through with a shearing action. The resistance of the peas to this shearing action effects a movement of the yieldable grid against the action of the pendulum C. The force required to overcome this resistance is indicated by a pointer D (Fig. 1) on a calibrated scale E so that it can be easily read. The measure of this force is taken as a function of the tenderness properties of the peas, the force being directly proportional to the toughness and inversely proportional to the tenderness.

The yieldable grid unit B comprises a plurality of thin flat L shaped grid plates 11 (Figs. 3, 4 55

and 7) held in spaced and parallel relation by spacer blocks 12 which are interposed between them. The spacer blocks are formed to provide grooves 13 between the upright legs of the plates adjacent their inner faces and also spaces 14 between the horizontal legs of the plates for the passage therethrough of the grid unit A as will be hereinafter explained.

The grid plates 11 and spacer blocks 12 are carried in a cradle 16 comprising a pair of discs 17 which are held in spaced and parallel relation by tie bolts 18. Similar bolts 19 tightly clamp the grid plates and spacer blocks against shifting between the discs.

Cradle 16 is freely mounted on a horizontal shaft 21 which is carried in bearings 22 bolted to the top of a main frame 23. The frame is preferably mounted on rollers 24 (Fig. 1) to provide for portability of the apparatus. Cradle 16 is carried on ball bearings 26 (Fig. 6) which are disposed in recesses 27 formed in hubs 28 bolted to the outer faces of the discs 17. The ball bearings in turn are mounted on bushings 29 which surround the shaft 21. The shaft extends through clearance holes provided at the center of the discs and hubs to reduce friction to a minimum.

Pendulum C is connected to the cradle 16 as hereinbefore mentioned. The pendulum comprises a depending rod 34 having its upper end threaded into a bracket 35 which is secured to the forward cradle disc 17 by three of the tie bolts 18. At its lower end the rod carries a weight 36 which is adjustable on the rod and which is adapted to be fastened in place after setting by a clamp screw 37.

Pointer D is connected with the cradle 16 adjacent the rear disc 17. The lower end of the pointer is secured to a bracket 39 (Fig. 6) which is bolted to the disc. Just above this connection the pointer is also secured by a screw 41 to an extended head 42 of one of the tie bolts 18.

A drag pointer 45 is provided for cooperation with pointer D in registering on the calibrated scale E the limit of travel of pointer D in any given test this being the maximum shearing force required in the test. This drag pointer is secured to a lock-nut bushing 46 (Fig. 6) which is freely carried or loose on shaft 21 adjacent the cradle 16, a collar 47 being interposed between cradle and bushing. When pointer D first moves forward, a lug 48 (see also Fig. 1) formed on the pointer engages against drag pointer 45 and both pointers then move forward in unison.

A leaf spring 49 (Figs. 3 and 6) frictionally bears against the bushing 46 to prevent turning of the drag pointer with the shaft 21 and to frictionally hold the drag pointer in position when brought into place by pointer D. This spring is secured to the main frame 23 as shown in Figs. 3 and 6.

The scale E is mounted adjacent the ends of the pointers and is supported on an auxiliary frame 51 (Figs. 1 and 6) which is carried on top of the main frame 23. This scale is calibrated directly in pounds of force required to effect the shearing action of a given test.

The positively movable grid unit A operating in cooperation with the yieldable grid unit B to effect the shearing action of the peas under test, is carried within the cradle 16 adjacent the yieldable grid unit. The grid unit A is formed with a hub 53 (Figs. 3, 4, 6 and 7) having a plurality of annular grooves 54 equally spaced along

its length. These grooves receive and guide the ends of the horizontal legs of the plates 11 of yieldable grid unit B.

Between the grooves 54, radially extending spaced and parallel fingers or grid bars 55 are formed on the hub. These fingers align with the guide grooves 13 and spaces 14 provided between the plates 11 of the yieldable grid unit B and pass therethrough. In one position of fingers 55, as at the beginning of a test, they extend upwardly as shown in Fig. 4 to cooperate with the grid plates 11 of yieldable grid unit B in forming a pocket F for the reception of a quantity or mass of peas to be tested.

The hub 53 of grid unit A is mounted on and keyed directly to the horizontal shaft 21 for positive rotation about the axis of the shaft. For this latter purpose the shaft 21 carries a worm wheel 57 (Figs. 1, 3 and 6) which meshes with a worm 58 mounted on the upper end of a vertical driven shaft 59. The upper end of this shaft is carried in a bearing 61 which is bolted to the main frame 23. The lower end of the shaft is carried in bearings 62 formed in a cage 63 which is bolted to the base of the main frame.

The lower end of the driven shaft 59 carries a worm wheel 64 which meshes with a drive worm 65 (see also Fig. 2). This worm is mounted on a drive shaft 66 of a reversible electric motor 67 which is bolted to the base of the main frame 23, the end of the drive shaft being carried in bearings 68 formed in the cage 63.

The electric motor 67 is operated by electric energy transmitted through certain electric circuits (Fig. 5) the establishment of which is effected by manipulation of a mercury starting switch 71 and a reversing switch 72. The starting switch includes a glass tube 73 (see also Figs. 4 and 6) containing a globule of mercury 74 (Fig. 5) which is adapted to make contact with a pair of wire terminals 75, 76 sealed in the tube, when the latter is tilted in the proper direction. Switch terminal 75 is connected by a wire 77 to one terminal of the motor 67. The other terminal 76 is connected by a wire 78 to a contact of the reversing switch 72.

The glass tube of switch 71 is carried in a tiltable bracket 79 which is freely mounted on a shouldered portion of the forward end of the horizontal shaft 21. The bracket is adapted to frictionally turn with the shaft through a part of its rotation and for this purpose there is provided a washer 81 and a spring 82 which is clamped against the side of the bracket by a screw 83 threaded in the end of the shaft. A handle 84 is provided on the bracket for tilting the switch into motor starting position. This handle extends up between a pair of spaced stop lugs 85, 86 formed on the adjacent bearing 22.

The reversing switch 72 is bolted to the main frame 23 adjacent the worm wheel 57. This switch is operated by diametrically spaced upper and lower pins 87, 88 (Figs. 5 and 6) which are threaded in the side of the worm wheel. When the worm wheel rotates, the pins are adapted to engage against and throw a switch lever 89 which makes contact with one of two switch contacts 90, 91 contained within the switch box 72. Contact 90 is connected with wire 78. Contact 91 is connected by a wire 92 to the motor.

The electric energy for operating the motor is received from any suitable source of supply and is transmitted along main supply wires 94, 95. Wire 94 is connected to the switch lever 89. Wire 95 is connected directly to the motor.

When a batch of peas is to be tested for tenderness, a specimen quantity is loaded into the pocket F between the grid units A, B. The starting switch 71 is then manually thrown into motor starting position as shown in Figs. 4 and 5 with the switch handle 84 in engagement with stop lug 86. This movement of the switch causes the mercury contained in the glass tube 73 to make contact with terminals 75, 76. The reversing switch 72 is in the position shown in Fig. 5. With switches 71, 72 closed electric energy flows from main supply wire 94 through reversing switch lever 89, contact 90, wire 78, starting switch 71, wire 77, motor 67, returning along main return wire 95.

This passage of electric energy operates the motor and causes the connecting worms and worm wheels to rotate the horizontal shaft 21 and the grid unit A carried thereby in a clockwise direction (as viewed in Figs. 3 and 4).

This positive movement of the grid unit A forces its grid fingers 55 against the mass of peas confining a predetermined quantity in what will then be the closed pocket F. The confined peas are thus pressed against the grid plates 11 of the yieldable grid unit B. Shearing of the peas does not take place immediately but the resistance against shearing (which is a function of tenderness) is sufficient to cause the yielding grid unit B to move with the unit A this being against the action of the pendulum C which also moves.

As the pendulum rises the shearing forces increase until a point is reached where the shearing actually takes place, the fingers 55 cutting through the peas. This terminates the forward movement of the grid B and also the lifting of pendulum C. This is the maximum shearing pressure the measure of which indicates the tenderness property of the peas. This maximum pressure is visually registered by the drag pointer 45 on the calibrated scale E so that it can be readily read off by the operator. The spring 49 bearing on the drag pointer 45 frictionally holds this pointer in its maximum position.

After shearing through the peas, the positively moving grid unit A carries its fingers 55 through the spaces 14 and between the plates 11 of yieldable grid unit B, the fingers being guided in the grooves 13 adjacent the inner faces of the plates. This continues until grid unit A has completed its forward cycle which corresponds to a half revolution of the worm wheel 57.

During this movement the upper switch pin 87 on worm wheel 57 moves to the bottom and the lower switch pin 88 moves to the top of the wheel. The switch pin 87 striking against the switch lever 89 moves it out of engagement with contact 90 and into engagement with contact 91. This places the reversing switch 72 in the opposite position from that shown in Fig. 5 and thus breaks the motor circuit and stops all forward movement. Movement of the switch also closes a reversing circuit through the motor.

Current for the reversing circuit then follows along main supply wire 94, switch lever 89, contact 91, wire 92, motor 67, returning along main supply wire 95. This operates the motor in the opposite direction and rotates the positively movable grid unit A in a counter-clockwise direction (as viewed in Figs. 3, 4 and 5) for its backward half revolution.

During this return movement of grid unit A the grid fingers 55 repass through the spaces 14 between plates 11 of yieldable grid unit B. The

backs of the returning fingers engage under the mass of sheared peas previously left on grid plates 11 and lift the massed peas free of the plates leaving the plates clean. The peas are carried up with the moving fingers 55 and fall away from the back of the fingers as the latter approach their original upright position. The mass of peas falls into a tray 97 (Figs. 1 and 6) which is supported under the grid units on the main frame 23.

The reverse rotation of worm wheel 57, in returning the grid fingers 55 to their original upright position, carries the switch pin 87 back into its original position at the top of the wheel. At the same time it returns the switch pin 88 to its original position at the bottom of the wheel causing it to move the switch lever 89 back into its original position as shown in Fig. 5. This breaks the reversed motor circuit and causes the motor 67 to stop. The grid unit A is now in its original position.

Simultaneously with the return of grid unit A to its original position, the starting or mercury switch 71 is shifted by frictional engagement with the returning horizontal shaft 21, until the switch handle 84 engages against the stop lug 85 of bearing 22. The starting switch is then in its original non-starting position. This shifting of the switch causes the mercury contained in the tube 73 to recede from the contact wires 75, 76 thereby breaking the starting circuit.

During the return of the grid unit A and beginning with the shearing action already described, the pendulum C is swinging back and returning the yieldable grid unit B to its original position. The backward swing of the pendulum is preferably retarded as by air pressure or in other manner so that it returns slowly without undue swinging. For this purpose the rod of the pendulum may be connected by an adjustable arm 98 (Fig. 1) to a suitable check mechanism 99 which is supported on the main frame 23. This check mechanism may be in the nature of a hydraulic shock absorber. A mechanical governor of suitable construction will also provide the proper check action.

With the full return of the grid units A and B to original position and with pendulum C at the bottom as in Fig. 1, the apparatus is in readiness for another test.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction, and arrangement of parts of the apparatus mentioned herein and in the steps and their order of accomplishment of the process described herein, without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the apparatus and process hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. A method of determining the tenderness of peas and the like which comprises confining a mass of peas and subjecting the same to a shearing action during bodily movement of the confined peas in response to the shearing pressure, and measuring the force required to overcome the resistance of the peas to the pressure of said shearing action.

2. A method of determining the tenderness of peas and the like which comprises subjecting a confined predetermined mass of the peas to a shearing action during bodily movement of the

peas in a circular path of travel in response to the shearing pressure, and measuring the force required to overcome the resistance of the peas to the pressure of said shearing action.

5 3. A method of determining the tenderness of peas and the like which comprises confining a specimen mass of peas to be tested, subjecting said confined mass of peas to a shearing action during bodily movement of the confined peas in response to the shearing pressure, measuring the force required to overcome the resistance of the peas to said shearing action, and temporarily registering said force to permit the same to be visually ascertained.

10 4. A method of determining the tenderness of peas or the like, which comprises confining a specimen mass of peas between a pair of shearing units, forcing said units through said confined mass of peas to cut through the peas with a shearing action, and measuring the force required to overcome the resistance of the peas to said shearing action.

20 5. A method of determining the tenderness of peas or the like, which comprises confining a predetermined mass of peas between a positively movable unit and a yieldable unit held in a state of equilibrium by gravity, forcing said positively movable unit through said confined mass of peas against the resistance of said yieldable unit to subject the peas to a shearing action, and measuring by the angular displacement of said yieldable unit the force required to overcome the resistance of the peas to the shearing action.

30 6. A method of determining the tenderness of peas or the like, which comprises confining a definite mass of peas between a pair of shearing units, forcing said units through said confined mass of peas and through each other to subject the peas to a shearing action, measuring the force required to overcome the resistance of the peas to said shearing action, and returning the units after the shearing action by re-passage through each other to remove the sheared mass of peas therefrom.

40 7. An apparatus for determining the tenderness of peas and the like, comprising in combination means for confining a mass of peas to be tested, said means having a plurality of shearing edges, elements cooperating with the shearing edges of said confining means and movable in a circular path for shearing through said mass so that the peas are severed with a shearing action, and instrumentalities for measuring the resistance of the peas to the shearing action.

50 8. An apparatus for determining the tenderness of peas and the like, comprising in combination a pair of grid units cooperating to confine between them a mass of peas to be tested, actuating means for effecting relative movement between said grid units so that the confined peas will be subjected to a shearing action, and instrumentalities cooperating with one of said grid units for measuring the resistance of the peas to said shearing action.

60 9. An apparatus for determining the tenderness of peas and the like, comprising in combination a yieldable grid unit, a positively movable grid unit cooperating with said yieldable grid unit for confining a predetermined mass of peas therebetween actuating means for moving said positively movable grid unit to shear through said confined mass of peas while pressing the peas against said yieldable grid unit, and measuring instrumentalities cooperating with said

yieldable grid unit for measuring the resistance of the peas to the shearing action.

10. An apparatus for determining the tenderness of peas and the like, comprising in combination a yieldable grid unit, a pendulum secured to said yieldable grid unit for yieldably holding the latter stationary, a positively movable grid unit cooperating with said yieldable grid unit for confining a predetermined mass of peas therebetween, means for moving said positively movable grid unit to force the confined mass of peas against said yieldable grid unit whereupon the resistance against shearing which is set up by said pea mass causes angular movement of said yieldable grid unit against the inertia of said pendulum until shearing of the peas takes place, and measuring instrumentalities cooperating with said yieldable grid unit for measuring the force required to shear said peas.

15 11. An apparatus for determining the tenderness of peas and the like, comprising in combination a pair of grid units cooperating to confine between them a mass of peas to be tested, actuating means for affecting relative movement between said grid units so that the confined peas will be subjected to a shearing action, a pointer movable by one of said grid units for visually registering the force required to shear said peas, and a calibrated scale adjacent said pointer for indicating the measure of the force registered by said pointer.

25 12. An apparatus for determining the tenderness of peas and the like, comprising in combination a pair of grid units cooperating to confine between them a mass of peas to be tested, actuating means for effecting relative movement between said grid units so that the confined peas will be subjected to a shearing action, a pointer movable by one of said grid units for visually registering the force required to shear said peas, a calibrated scale adjacent said pointer for indicating the measure of the force registered by said pointer, and a frictionally held drag pointer which is set by said movable pointer to maintain the registration of said scale of the maximum shearing force.

40 13. An apparatus for determining the tenderness of peas and the like, comprising in combination a yieldable grid unit, a pendulum secured to said yieldable grid unit for yieldably holding the latter stationary, a positively movable grid unit cooperating with said yieldable grid unit for confining a predetermined mass of peas therebetween, means for moving said positively movable grid unit to force the confined mass of peas against said yieldable grid unit whereupon the resistance against shearing which is set up by said pea mass causes angular movement of said yieldable grid unit against the action of said pendulum until shearing of the peas takes place, said pendulum also acting to return the yieldable grid unit to its original position after the shearing of the peas, measuring instrumentalities cooperating with the movement of said yieldable grid unit for measuring the force required to shear said peas, and means for retarding the return movement of the pendulum to prevent undue swinging thereof.

50 14. An apparatus for determining the tenderness of peas and the like, comprising in a combination a cradle freely mounted on a horizontal shaft, a pendulum cooperating with said cradle for yieldably maintaining the latter stationary, a grid unit fixed in and movable with said cradle, a positively movable grid unit also located

in said cradle adjacent said first mentioned grid unit and secured to said shaft, said grid units cooperating to form a pocket between them for the reception of a specimen mass of the peas to be tested, means for rotating said shaft to force said positively movable grid unit through said peas and through said first mentioned grid unit with a shearing action so that the resistance of the peas to said shearing action causes angular displacement of said cradle and said pendulum, and instrumentalities for measuring said angular displacement.

15. An apparatus for determining the tenderness of peas and the like, comprising in combination a pair of grid units adapted to intermesh and pass through each other and cooperating to confine between them a specimen mass of peas to be tested, a reversible electric motor for causing relative intermeshing movement between said grid units so that the confined peas will be subjected to a shearing action, and devices for reversing said electric motor to cause relative return movement between said grid units to clean the same of the sheared mass of peas.

16. An apparatus for determining the tenderness of peas and the like, comprising in combination a pair of grid units adapted to intermesh and pass through each other and cooperating to confine between them a specimen mass of peas to be tested, a reversible electric motor for effecting relative intermeshing movement between said grid units so that the confined peas will be subjected to a shearing action, devices for reversing said electric motor to cause relative return movement between said grid units whereby the sheared mass of peas is removed therefrom and said grid units cleaned, and means for receiving the removed mass of peas cleaned from said grid units.

17. A device for testing the toughness of peas and the like comprising means for receiving and confining a promiscuous batch thereof, means for piercing the promiscuous batch thus confined to thereby effect random piercing of the elements within the batch, and means for measuring the resistance offered by said batch to the piercing operation.

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