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PATENT SPECIFICATION

DRAWINGS ATTACHED

856,568



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Improvements in or relating to machines for processing tea leaf.

COMPLETE SPECIFICATION

I, PETER CROMBIE, M.B.E., I.C.S. (Retired), of Post Box No. 280, Royal Exchange, Calcutta, West Bengal, India, a British Subject, do hereby declare the invention for which I

- 5 pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

- 10 The present invention relates to improvements in machines for processing tea leaf after withering and before drying, and has for its object to provide an improved construction of machine in which the tea leaf is subjected to a rolling, twisting, bruising and rupturing action (all hereinafter included within the term "processing"), such that when unprocessed leaf is fed continuously into one part of the machine, a corresponding quantity of processed leaf continuously issues from another part of the machine. In other words, the machine aims to effect efficient rolling, twisting, bruising and rupturing in a single continuous operation.

- 25 The present invention accordingly provides a machine for processing tea leaf after withering and before drying, comprising a stationary cylinder wholly or partially open, or adapted to be wholly or partially opened, at one end and closed at the other end and provided at said closed end with means for feeding leaf into a helical feed worm provided on a rotatable axial drive shaft, said helical feed worm being adapted to feed the leaf into an annular space formed by the cylinder bore and a substantially cylindrical extension of said rotatable axial drive shaft, said cylindrical extension being provided with a plurality of sets of vanes or the like protruding into said annular space and adapted to propel the leaf towards, and to discharge it through, said open end of the cylinder, and said cylinder bore being provided with a plurality of sets of pins or the like also protruding into said annular space.

(Price 3s. 6d.)

said sets of vanes or the like and said sets of pins or the like being staggered with respect to one another.

The invention is hereinafter described with reference to the accompanying drawings wherein:—

Fig. 1 is a sectional side view of the machine according to the invention and

Fig. 2 is an end view of the same.

As illustrated in the drawings, the machine comprises a stationary cylinder 1 which is closed at its feed end 2 but which is adapted to be partially opened at its discharge end 3, as hereinafter described. At or near the closed feed end 2 there is provided a gravity feed hopper 4 through which withered tea leaf is adapted to be fed into a helical feed worm 5 provided on a rotatable axial drive shaft 6. The helical feed worm 5 forces the leaf towards the discharge end 3 of the cylinder into an annular space 7 between the cylinder bore and substantially cylindrical extension 8 of the rotatable axial drive shaft 6. The cylindrical extension 8 is provided with a plurality of sets of vanes 9 which protrude into the annular space 7 and propel the leaf towards the discharge end 3 of the cylinder 1. The cylinder bore is provided with a plurality of sets of pins 10 which likewise protrude into the annular space 7, and it will be observed that the sets of vanes 9 and the sets of pins 10 are staggered with respect to one another.

It will be understood that being provided on the cylindrical extension of the rotatable axial drive shaft 6, the vanes 9 rotate therewith whereas the pins or the like 10, being provided on the stationary cylinder bore, do not rotate.

Preferably, the discharge or "open" end 3 is partially closed, e.g. at the top, for an area equal to about half the total area of the cylinder, and its lower half is provided with a hinged flap 11 which is biased in the closed position by an external weighted



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lever or arm 12 which provides resistance to the discharge or processed leaf.

If desired, a water jacket or like cooling means (not illustrated) may be provided outside the cylinder 1 along a part or the whole of the length thereof.

The helical feed worm 5 into which the withered tea leaf is fed by the gravity feed hopper 4, may be integral with the axial drive shaft 6, but is merely the means of introducing the leaf into the cylinder 1. Forward propulsion of the leaf towards the discharge end 3 of the cylinder 1 is effected by the sets of vanes 9 (opposed by the stationary pins or the like 10 fixed to the cylinder bore) as hereinafter described.

Each set of vanes 9 preferably comprises a number of vanes mounted on the said cylindrical extension 8 and angularly disposed to each other, and in order to impart and maintain forward movement of the leaf towards the discharge end 3 of the cylinder 1, they preferably pitched at a suitable angle to the axis of the shaft 6. For example, each set of vanes 9 may comprise four vanes disposed at about 90° to each other, and the rear surfaces of the vanes may be set at an angle of the order of 75° to the axis of the shaft 6 so that the front surfaces of the vanes would then be set at an angle of 15° to a line drawn at right angles to the axis of the shaft 6. It is of course to be understood that the invention is not limited to the specific angles mentioned and that the latter angle could be anything up to 45°.

Each set of pins 10 or the like preferably comprises four pins or the like disposed at 90° to each other. This disposition of the pins or the like facilitates withdrawal of the cylinder 1 clear of the said cylindrical extension 8 of the rotatable drive shaft 6 for cleaning, repair and maintenance.

Once the leaf has been introduced into the cylinder 1 by the helical feed worm 5, it is propelled forward by the rotating vanes 9 in a substantially spiral path towards the discharge end 3 of the cylinder 1 until it issues through the hinged discharge flap 11. During its passage through the cylinder 1, the leaf is subjected to compression, twisting and rolling. Green tea leaf when withered, i.e. after having lost upwards of 20% of its water content, has an exceedingly high coefficient of friction which results in considerable compression being generated when processed in a confined space. This compression alone is not sufficient to rupture the leaf cells adequately; there must also be a rubbing action. Such rubbing action is achieved by friction against (a) the bore of the cylinder 1, (b) the surfaces of the fixed pins 10 on the said cylinder 1, (c) the surface of the rotating cylindrical extension 8, and (d) the leaf mass within the machine. As the leaf is propelled against these

obstructions the resistance set up thereby is increased as the distance from the feed hopper 4 increases and is at maximum intensity at the point of discharge 3 through the hinged discharge flap 11 which is biased and regulated by the magnitude and position of the weight 13 on the lever or arm 12.

This breaking-up of the leaf mass is effected by means of the sets of stationary pins 10 which tend to oppose the forward movement of the leaf mass caused by the rotating vanes 9. The arrangement is such that after each set of vanes 9, there is a set of stationary pins 10 which break up the leaf mass and promote turbulence and forward movement thereof, and at the same time this gives rise to a rubbing or shearing action sufficient to rupture the cells so that fermentation may proceed as uniformly as possible.

The arrangement of alternate sets of vanes 9 and pins 10 breaks up pockets of compressed leaf and distributes the inevitable compression throughout the length of machine. As the leaf is temporarily arrested by and builds-up on a set of pins 10, the rotating vanes 9, by virtue of the angle at which they are pitched, cause the leaf to travel towards the next set of static pins 10 and thence to their adjacent rotating rotor vanes 9, and so on, until finally the leaf is discharged against the bias of the weighted lever or arm 12 and collected at the discharge end 3 of the cylinder. The action provides free contact of leaf with air which is an important aspect of processing leaf at this stage because the production of what is known in the trade as 'black tea' necessitates the expression of the juices within the leaf, which in turn should be distributed over the particles of leaf within the machines and become oxidised by surrounding air.

WHAT I CLAIM IS:

1. A machine for processing tea leaf after withering and before drying, comprising a stationary cylinder wholly or partially open, or adapted to be wholly or partially opened, at one end and closed at the other end and provided at said closed end with means for feeding leaf into a helical feed worm provided on a rotatable axial drive shaft, said helical feed worm being adapted to feed the leaf into an annular space formed by the cylinder bore and a substantially cylindrical extension of said rotatable axial drive shaft, said cylindrical extension being provided with a plurality of sets of vanes or the like protruding into said annular space and adapted to propel the leaf towards, and to discharge it through, said open end of the cylinder, and said cylinder bore being provided with a plurality of sets of pins or the like also protruding

lever or arm 12 which provides resistance to the discharge or processed leaf.

If desired, a water jacket or like cooling means (not illustrated) may be provided outside the cylinder 1 along a part or the whole of the length thereof.

The helical feed worm 5 into which the withered tea leaf is fed by the gravity feed hopper 4, may be integral with the axial drive shaft 6, but is merely the means of introducing the leaf into the cylinder 1. Forward propulsion of the leaf towards the discharge end 3 of the cylinder 1 is effected by the sets of vanes 9 (opposed by the stationary pins or the like 10 fixed to the cylinder bore) as hereinafter described.

Each set of vanes 9 preferably comprises a number of vanes mounted on the said cylindrical extension 8 and angularly disposed to each other, and in order to impart and maintain forward movement of the leaf towards the discharge end 3 of the cylinder 1, they preferably pitched at a suitable angle to the axis of the shaft 6. For example, each set of vanes 9 may comprise four vanes disposed at about 90° to each other, and the rear surfaces of the vanes may be set at an angle of the order of 75° to the axis of the shaft 6 so that the front surfaces of the vanes would then be set at an angle of 15° to a line drawn at right angles to the axis of the shaft 6. It is of course to be understood that the invention is not limited to the specific angles mentioned and that the latter angle could be anything up to 45°.

Each set of pins 10 or the like preferably comprises four pins or the like disposed at 90° to each other. This disposition of the pins or the like facilitates withdrawal of the cylinder 1 clear of the said cylindrical extension 8 of the rotatable drive shaft 6 for cleaning, repair and maintenance.

Once the leaf has been introduced into the cylinder 1 by the helical feed worm 5, it is propelled forward by the rotating vanes 9 in a substantially spiral path towards the discharge end 3 of the cylinder 1 until it issues through the hinged discharge flap 11. During its passage through the cylinder 1, the leaf is subjected to compression, twisting and rolling. Green tea leaf when withered, i.e. after having lost upwards of 20% of its water content, has an exceedingly high coefficient of friction which results in considerable compression being generated when processed in a confined space. This compression alone is not sufficient to rupture the leaf cells adequately; there must also be a rubbing action. Such rubbing action is achieved by friction against (a) the bore of the cylinder 1, (b) the surfaces of the fixed pins 10 on the said cylinder 1, (c) the surface of the rotating cylindrical extension 8, and (d) the leaf mass within the machine. As the leaf is propelled against these

obstructions the resistance set up thereby is increased as the distance from the feed hopper 4 increases and is at maximum intensity at the point of discharge 3 through the hinged discharge flap 11 which is biased and regulated by the magnitude and position of the weight 13 on the lever or arm 12.

This breaking-up of the leaf mass is effected by means of the sets of stationary pins 10 which tend to oppose the forward movement of the leaf mass caused by the rotating vanes 9. The arrangement is such that after each set of vanes 9, there is a set of stationary pins 10 which break up the leaf mass and promote turbulence and forward movement thereof, and at the same time this gives rise to a rubbing or shearing action sufficient to rupture the cells so that fermentation may proceed as uniformly as possible.

The arrangement of alternate sets of vanes 9 and pins 10 breaks up pockets of compressed leaf and distributes the inevitable compression throughout the length of machine. As the leaf is temporarily arrested by and builds-up on a set of pins 10, the rotating vanes 9, by virtue of the angle at which they are pitched, cause the leaf to travel towards the next set of static pins 10 and thence to their adjacent rotating rotor vanes 9, and so on, until finally the leaf is discharged against the bias of the weighted lever or arm 12 and collected at the discharge end 3 of the cylinder. The action provides free contact of leaf with air which is an important aspect of processing leaf at this stage because the production of what is known in the trade as 'black tea' necessitates the expression of the juices within the leaf, which in turn should be distributed over the particles of leaf within the machines and become oxidised by surrounding air.

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into said annular space, said sets of vanes or the like and said sets of pins or the like being staggered with respect to one another.

2. A machine as claimed in Claim 1, wherein said discharge or open end of the cylinder is adapted to be closed by a hinged flap or the like adapted to resist the discharge of processed leaf therethrough.

3. A machine as claimed in Claim 2, wherein said hinged flap or the like is biased in the closed position thereof by a lever, arm or the like adapted to have an adjustable weight mounted thereon.

4. A machine as claimed in any of the preceding claims, wherein said means for feeding leaf into the helical worm comprises a gravity feed hopper or the like.

5. A machine as claimed in any of the preceding claims, wherein a water jacket or like cooling means is provided outside the cylinder along a part or the whole of the length thereof.

6. A machine as claimed in any of the preceding claims, wherein each of said vanes is pitched at an angle to the axis of said rotatable axial drive shaft in order to impart and maintain forward movement of the leaf towards the opened or discharge end of the cylinder.

7. A machine as claimed in Claim 6, wherein each of said vanes is pitched at an angle of more than 45 degrees, preferably at an angle of about 75 degrees, to the axis of said rotatable axial drive shaft.

8. A machine as claimed in any of the

preceding claims, wherein each of said sets of vanes comprises four vanes disposed at an angle of about 90 degrees to each other.

9. A machine as claimed in any of the preceding claims, wherein each of said sets of pins or the like comprises four pins or the like disposed at about 90 degrees to each other.

10. A machine as claimed in any of the preceding claims, wherein said stationary cylinder is detachably mounted around said rotatable axial drive shaft and the cylindrical extension thereof and is adapted to be slid into and out of position over the ends thereof for purposes of cleaning, repair and maintenance.

11. A machine for processing tea leaf after withering and before drying, substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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ERRATA

SPECIFICATION NO. 856,568

Page 1, line 67, after "and" insert "a"

Page 2, line 108, for "becomes" read "become"

THE PATENT OFFICE,
14th August, 1961.

DS 95812/1(19)/R.153 200 8/61 PL

