

PATENT SPECIFICATION

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DRAWINGS ATTACHED

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(54) IMPROVED TEA PROCESSING MACHINE WITH CUTTING MECHANISM

(71) We, TEA RESEARCH ASSOCIATION, a registered body under the West Bengal Societies Registration Act, 1961, of 6 Netaji Subhas Road, Calcutta 1, West Bengal, India, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to machines for processing tea leaf as a step in the manufacture of tea after withering and before drying the leaf.

Machines to which this invention relates have a horizontal stator cylinder or barrel which is closed at one end and provided near that end with a feed opening through which to feed tea leaf to a helical feed worm forming part of a rotor which is axially rotatable in the stator on a rotor shaft and is adapted to advance the leaf within the stator for discharge from the other end thereof, the helical feed worm of the rotor being arranged to feed the leaf into an annular space formed between a portion of the rotor which extends from the feed worm to the discharge end of the stator, and a co-extensive surrounding portion of the stator, these portions of the rotor and stator being provided with elements which project into the annular space and are adapted to propel the leaf to the discharge end of the stator, and during its passage to squeeze and twist the leaf.

One such machine is described in Patent Specification No. 865,568, in which the stator is a cylinder, and the rotor has the helical feed worm provided on a rotor shaft for part of its length and has a plurality of sets of vanes or the like projecting from the remaining length of the rotor shaft into an annular space formed by the cylinder bore and the portion of the rotor shaft which carries the vanes or the like, the cylinder being provided with a plurality of sets of pins or the like projecting into that annular space, the vanes or the like

and the pins or the like being staggered with respect to one another.

Another such machine as described in Patent Specification No. 1,099,758 incorporates a rotor attachment comprising a conical or frusto-conical member which has its curved (conical) surface fluted with the flutes helically disposed, and either forms an integral part of the rotor shaft of a machine as described in specification 865,568, replacing a vane-carrying part of that shaft which is enclosed by the discharge end portion of the stator cylinder, or is adapted to be axially mounted at the end of the rotor shaft at the discharge end of the stator cylinder and to be enclosed by an extension of the stator cylinder, in either case leaving a clearance for processed tea to discharge from around the base of the attachment. The curved surface of the conical or frusto-conical member is fluted by fixing battens to the surface.

Patent Specification No. 1,175,559 describes the provision of a sleeve slidably mounted within the stator cylinder of a machine as described in specification No. 1,099,758, in the space between the cylinder wall and the abovementioned conical or frusto-conical member forming part of the rotor of the machine. This sleeve, which thus is incorporated as part of the stator of the machine, is provided with pins projecting within the sleeve, and the curved surface of the conical or frusto-conical member is provided with pins instead of the helically disposed flutes abovementioned. The pins in the stator sleeve and on the conical or frusto-conical member of the rotor are staggered and do not come in contact.

Another such machine described in the Specification of Patent Application No. 6108/70 (Serial No. 1,274,783) comprises a stationary cylinder or barrel enclosing a feed worm or screw mounted on a rotatable shaft, and a stationary sleeve adjustably fitted to the open end of the cylinder to enclose a conical or frusto-conical attachment mounted on an

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extension of the shaft. The machine stator is thus constituted of the cylinder and sleeve but in this case, compared with the machine described in Specification 1,175,559, the length of the cylinder has been reduced to accommodate only the feed worm, and the length of the rotor has been also correspondingly reduced. The rotor is comprised of the feed worm and the frusto-conical member which is fixed to the rotor shaft next to the worm without there being any intervening portion of the rotor shaft provided with vanes.

The object of the present invention is to provide an improvement in machines as described hereinbefore for the purpose of producing processed tea leaf cut according to desired size, and to produce processed tea leaf of various sizes as required.

According to the present invention there is provided a machine for processing tea leaf after withering and before drying, having a horizontal stator cylinder or barrel closed at one end and provided near that end with a feed opening through which to feed tea leaf into the stator, a fixed cutter plate secured to and closing the other end of the stator, a rotor axially rotatable in the stator on a rotor shaft and having a helical feed worm arranged to feed the leaf into an annular space formed between a portion of the rotor which extends from the feed worm to the fixed cutter plate, and a coextensive surrounding portion of the stator, said portions of the rotor and stator being provided with elements which project into said annular space and which are adapted to propel the leaf towards the fixed cutter plate and to squeeze and twist its passage thereto, the fixed cutter plate having openings of predetermined dimensions there-through disposed opposite said annular space for passage of processed tea leaf under propulsion from the rotor to a co-operating rotatable cutter plate which has openings of predetermined dimensions therethrough complementary to the openings in the fixed cutter plate and is rotatably mounted coaxially with the rotor and in surface contact with the fixed cutter plate at the outside face thereof remote from the rotor, whereby to coact with the fixed cutter plate for cutting the processed leaf and discharging cut processed leaf from the machine, and means for rotating the rotor and the rotatable cutter plate.

The rotatable cutter plate may be fixed to an extended portion of the rotor shaft which must then pass through an opening necessarily provided therefor in the fixed cutter plate closing the discharge end of the stator. In this embodiment, therefore, there will be no rotational speed differential between the rotor and the rotatable cutter plate since both are driven by the rotor shaft. The size of the processed tea leaf cut by the machine will be determined by the disposition and size of the openings in the fixed cutter plate and the rate at which

leaf is pushed out of the machine by the rotation of the rotor.

In a preferred embodiment of the invention, the rotor shaft is made hollow and the rotatable cutter plate is fixed to an independent drive shaft therefor which runs through the hollow rotor shaft. Thereby the rotational speed of the rotatable cutter can be made independent of that of the rotor of the machine. In this embodiment, the size of the leaf particles produced by the machine will be variable with the speed differential imposed on the rotatable cutter plate. The rotor shaft and the shaft for the rotatable cutter may be adapted to be driven at different rotational speeds from a single drive source in a known manner.

The machine may be provided with a single set of fixed and rotatable cutter plates as described. Alternatively, however the fixed cutter plate which closes the discharge end of the stator, together with its associated rotatable cutter plate, may constitute the first set of a bank of more than one such set (preferably 3 or 4 sets) arranged in series axially spaced from each other. In the latter case there may be provided a hub disposed axially in the space between adjacent sets, and preferably with leaf propelling vanes fitted onto said hub. A cover is desirably provided to enclose the assembly of sets of cutter plates.

The invention will be described with reference to the accompanying drawings, by way of illustration, wherein

Fig. 1 shows one embodiment of a tea processing machine according to the invention;

Fig. 1A shows the plan of a fixed cutter plate;

Fig. 1B shows the plan of a rotatable cutter plate;

Fig. 2 shows another embodiment of a machine according to the invention; and

Fig. 3 shows a further embodiment of a machine according to the invention.

In the drawings like parts are denoted by like reference numerals and letters.

In the drawings the particular means shown for processing (i.e. squeezing and twisting) the tea leaf have been chosen, merely as an example for the purpose of illustrating the invention.

The machine in each of the embodiments of Figs. 1, 2 and 3 has a stator constituted of a stationary cylinder C and a sleeve S fitted in the discharge end of the cylinder. The machine rotor has a rotor shaft R carrying a feed worm F next to a frusto-conical member A surrounded by the sleeve S at the discharge end of the cylinder C. The frusto-conical member A is provided with battens B on its curved (conical) surface, and the sleeve S is provided with pins P projecting within the sleeve into the annular space between the sleeve and the member A.

The discharge end of the stator is closed by a fixed cutter plate 1 secured to cylinder

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C, this cutter plate having openings H_1 (shown in detail in Fig. 1A), therethrough opposite the space between sleeve S and member A. Co-operating with the fixed cutter plate 1 is a rotatable cutter plate 2 having openings H_2 , shown in detail in Fig. 1B, complementary to the openings H_1 in cutter plate 1. In the embodiment shown in Fig. 1, the rotatable cutter plate 2 is fixed to an extended portion of the rotor shaft R of the machine. In this case, therefore, the rotatable cutter plate 2 rotates at the same rotational speed as that of the rotor shaft R and the feed worm F and frusto-conical member A of the rotor mounted on said rotor shaft R.

In each of the embodiments shown in Figures 2 and 3 the rotatable cutter plate 2 is fixed to a drive shaft 3 which passes through a hollow rotor shaft R of the machine, and which drive shaft 3 is driven independently of the rotor shaft R.

In the alternative embodiment shown in Fig. 3, instead of a single set of two cutter plates 1 and 2 as in Figs. 1 and 2, three such sets are provided at the discharge end of the cylinder C. As shown, such sets are arranged in series axially spaced from each other and between each two adjacent sets of cutter plates a hub 4 is provided, fitted with propelling vanes 4A. The entire assembly is enclosed by a cover 5.

Similar cutting arrangements may be provided in any of the other constructions of tea processing machines as described hereinbefore.

In any embodiment of this invention, the tea leaf arriving at the discharge end of the stator, after being processed therein, will be cut according to desired size when propelled by the rotor through the openings provided in the cutter plates, and the rotatable one of which is rotated in surface contact with the fixed one.

For instance, with reference to the machines illustrated in Figs. 1, 2 and 3, tea leaf will be fed through a hopper (not shown) into the stationary cylinder C and such leaf will be fed and propelled towards the discharge end of the machine by the feed worm F, and will pass through the space between the stator sleeve S (provided with pins P) and the frusto-conical member A (provided with battens B) of the rotor which is being rotated by the rotor shaft R. The tea leaf, after being processed between sleeve S and member A, will be delivered to the fixed cutter plate 1 of the cutter arrangement constituted by the cutter plate 1 and rotatable cutter plate 2. The processed tea leaf then comes out through the openings H_1 and H_2 provided in the cutter plates 1 and 2 respectively (shown in Figs. 1A and 1B), and due to the rotation of plate 2 in relation to plate 1, the tea leaf is cut according to desired size, the size of the leaf particles depending on the disposition and dimensions of the openings H_1 and H_2 , and the rate at which

the leaf is pushed out of the machine by the rotor.

In the embodiment shown in Fig. 1, the cutter plate 2 is fixed to the rotor shaft R of the machine. Therefore, in this case it is not possible to vary the size of the leaf particles by varying the rotational speed of the rotor shaft. This is made possible by the alternative arrangement shown in Figs. 2 and 3, wherein the cutter plate 2 (Fig. 2) or plates 2 (Fig. 3) is (are) fixed to a separate drive shaft 3 running through a hollow rotor shaft R of the machine.

In the particular embodiment shown in Fig. 3, wherein a plurality of sets of said cutter plates are provided, it is possible to cut the leaf particles according to desired size stepwise by providing openings of different dimensions in different sets of cutter plates, the propelling of the leaf particles between one set to another being facilitated by the propelling vanes 4A provided on the hubs 4.

WHAT WE CLAIM IS:—

1. A machine for processing tea leaf after withering and before drying, having a horizontal stator cylinder or barrel closed at one end and provided near that end with a feed opening through which to feed tea leaf into the stator, a fixed cutter plate secured to and closing the other end of the stator, a rotor axially rotatable in the stator on a rotor shaft and having a helical feed worm arranged to feed the leaf into an annular space formed between a portion of the rotor which extends from the feed worm to the fixed cutter plate, and a coextensive surrounding portion of the stator, said portions of the rotor and stator being provided with elements which project into said annular space and which are adapted to propel the leaf towards the fixed cutter plate and to squeeze and twist the leaf during its passage thereto, the fixed cutter plate having openings of predetermined dimensions therethrough disposed opposite said annular space for passage of processed tea leaf under propulsion from the rotor to a co-operating rotatable cutter plate which has openings of predetermined dimensions therethrough complementary to the openings in the fixed cutter plate and is rotatably mounted coaxially with the rotor and in surface contact with the fixed cutter plate at the outside face thereof remote from the rotor, whereby to coact with the fixed cutter plate for cutting the processed leaf and discharging cut processed leaf from the machine, and means for rotating the rotor and the rotatable cutter plate.

2. A machine according to claim 1 wherein the rotatable cutter plate is fixed to an extended portion of the rotor shaft so that the rotor and the rotatable cutter plate are driven by the rotor shaft at the same rotational speed.

3. A machine according to claim 1 wherein the rotor shaft is hollow and the rotatable cutter plate is fixed to an independent drive shaft



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C, this cutter plate having openings H_1 (shown in detail in Fig. 1A), therethrough opposite the space between sleeve S and member A. Co-operating with the fixed cutter plate 1 is a rotatable cutter plate 2 having openings H_2 , shown in detail in Fig. 1B, complementary to the openings H_1 in cutter plate 1. In the embodiment shown in Fig. 1, the rotatable cutter plate 2 is fixed to an extended portion of the rotor shaft R of the machine. In this case, therefore, the rotatable cutter plate 2 rotates at the same rotational speed as that of the rotor shaft R and the feed worm F and frustoconical member A of the rotor mounted on said rotor shaft R.

In each of the embodiments shown in Figures 2 and 3 the rotatable cutter plate 2 is fixed to a drive shaft 3 which passes through a hollow rotor shaft R of the machine, and which drive shaft 3 is driven independently of the rotor shaft R.

In the alternative embodiment shown in Fig. 3, instead of a single set of two cutter plates 1 and 2 as in Figs. 1 and 2, three such sets are provided at the discharge end of the cylinder C. As shown, such sets are arranged in series axially spaced from each other and between each two adjacent sets of cutter plates a hub 4 is provided, fitted with propelling vanes 4A. The entire assembly is enclosed by a cover 5.

Similar cutting arrangements may be provided in any of the other constructions of tea processing machines as described hereinbefore.

In any embodiment of this invention, the tea leaf arriving at the discharge end of the stator, after being processed therein, will be cut according to desired size when propelled by the rotor through the openings provided in the cutter plates, and the rotatable one of which is rotated in surface contact with the fixed one.

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the leaf is pushed out of the machine by the rotor.

In the embodiment shown in Fig. 1; the cutter plate 2 is fixed to the rotor shaft R of the machine. Therefore, in this case it is not possible to vary the size of the leaf particles by varying the rotational speed of the rotor shaft. This is made possible by the alternative arrangement shown in Figs. 2 and 3, wherein the cutter plate 2 (Fig. 2) or plates 2 (Fig. 3) is (are) fixed to a separate drive shaft 3 running through a hollow rotor shaft R of the machine.

In the particular embodiment shown in Fig. 3, wherein a plurality of sets of said cutter plates are provided, it is possible to cut the leaf particles according to desired size stepwise by providing openings of different dimensions in different sets of cutter plates, the propelling of the leaf particles between one set to another being facilitated by the propelling vanes 4A provided on the hubs 4.

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2. A machine according to claim 1 wherein the rotatable cutter plate is fixed to an extended portion of the rotor shaft so that the rotor and the rotatable cutter plate are driven by the rotor shaft at the same rotational speed.

3. A machine according to claim 1 wherein the rotor shaft is hollow and the rotatable cutter plate is fixed to an independent drive shaft

therefor running through the hollow rotor shaft.

4. A machine according to claim 3 wherein the rotor shaft and the shaft for the rotatable cutter plate are adapted to be driven at different rotational speeds from a single drive source.

5. A machine according to any one of the preceding claims wherein said fixed and rotatable cutter plates together constitute the first set of a bank of more than one such set arranged in series axially spaced from each other.

6. A machine according to claim 5 wherein a bank of three or four sets of cutter plates is provided.

7. A machine according to claim 5 or 6

wherein a hub is disposed axially in the space between adjacent sets.

8. A machine according to claim 7 wherein the hub is fitted with leaf propelling vanes, and a cover is provided to enclose the assembly of sets of cutter plates.

9. A machine according to claim 1 substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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