Aug. 11, 1936. J. E. KIMBIRL 2,050,972

VALVE OPERATING MECHANISM

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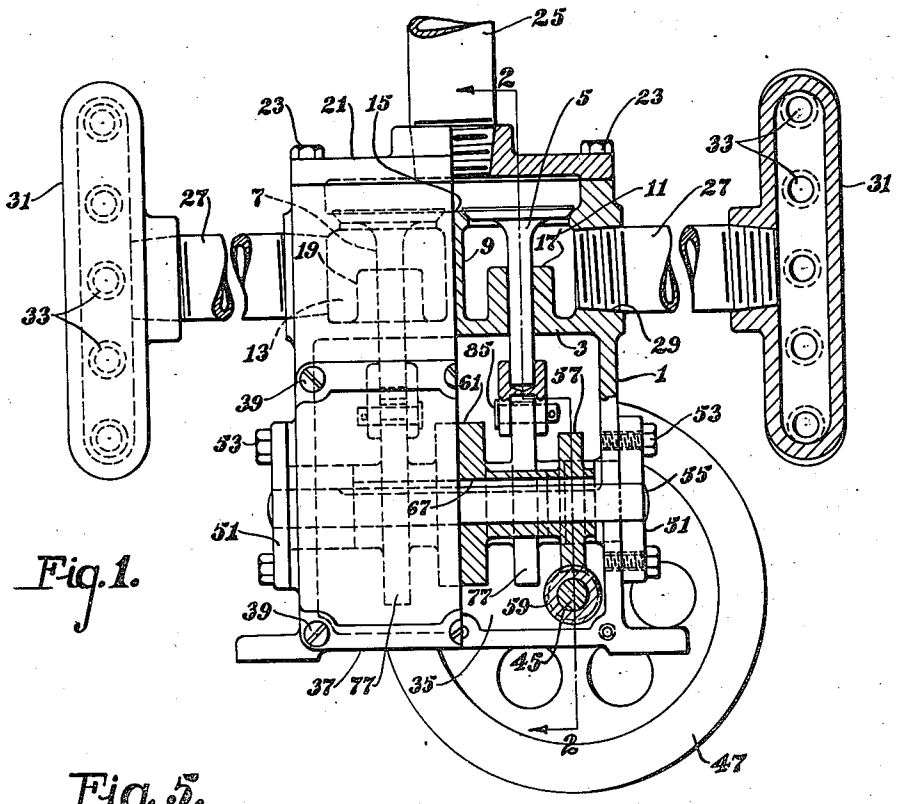
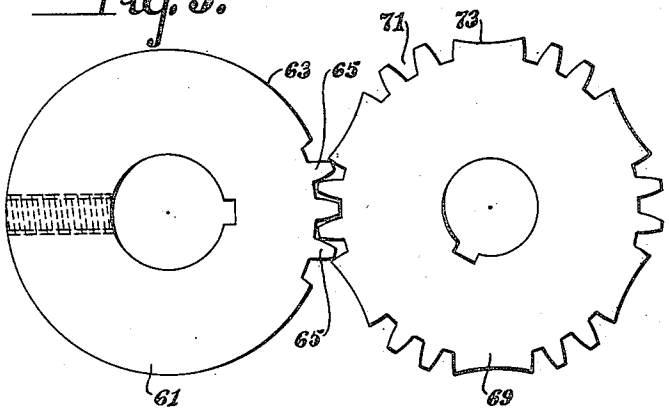


Fig. 1.

Fig. 5.



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Fig. 2.

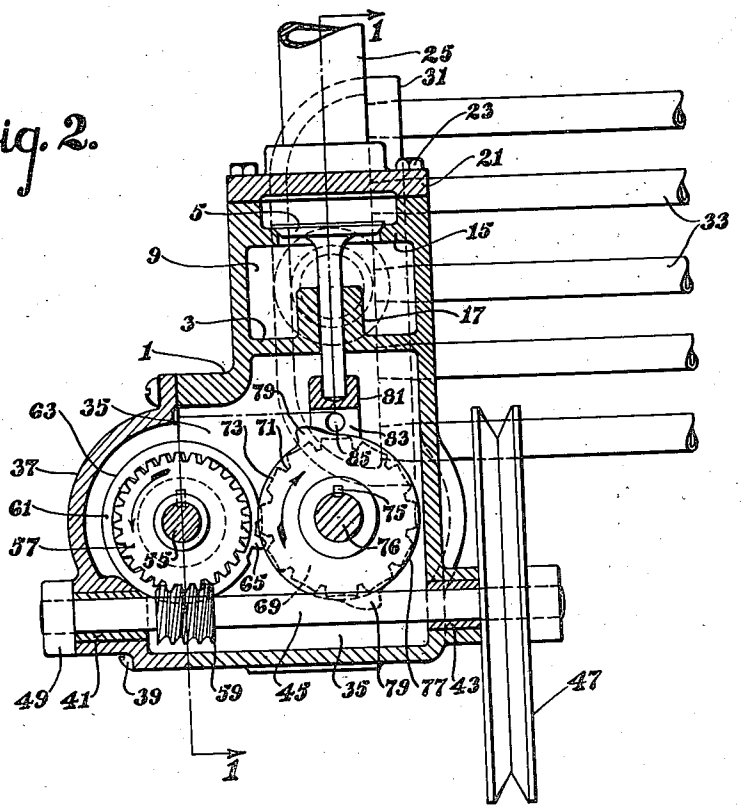
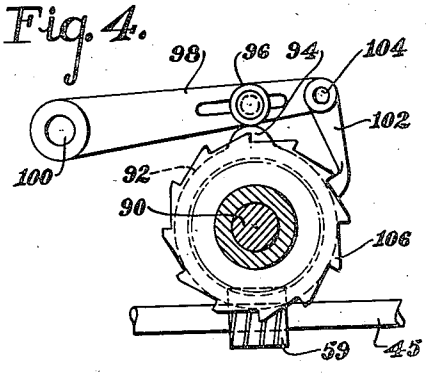


Fig. 4.



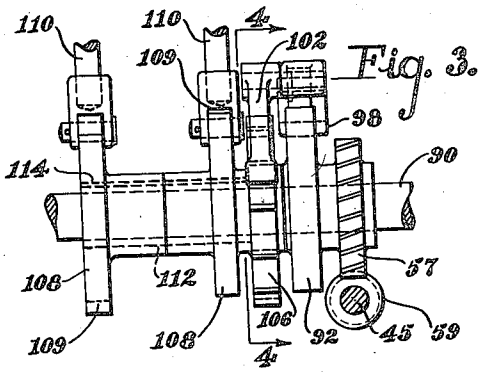


Fig. 3.

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VALVE OPERATING MECHANISM

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10 Claims. (Cl. 137—145)

The invention has relation to automatic valve-operating mechanism in general, and in particular to a mechanism of this sort peculiarly adapted to use in compressed air cleaning systems for textile machines, such as roving frames, spinning frames, warpers, and other machines handling a large number of yarns simultaneously.

In such systems, compressed air is emitted from discharge nozzles distributed at various points in the roving or spinning frame or other textile machine, and directed so as to blow off from the desired parts the lint and fly prone to collect thereon during the working of the machine. It is impracticable to maintain a constant flow of compressed air from the nozzles, because of the expense involved in maintaining such a copious supply of air under a pressure which must be considerable in order to produce a jet of sufficient intensity to perform the work of clearing the selected parts, while remaining of purely localized effect such as will not interfere with the running yarns which are or may be closely adjacent the points to be cleared. Since intermittent action of the clearing system is thus compelled on grounds of economy, it is highly desirable that the system be rendered automatic in its operation through providing means which will automatically turn on the flow of compressed air at the proper intervals, turn it off again immediately after sufficient air has been discharged to effect cleaning, and if desired attend to the distribution of the blasts to different portions of the machine independently of each other and completely in accordance with the frequency with which need arises to clean the respective portions. In further pursuance of these aims, it is to be desired that such means for timing the flow of compressed air should provide for adaptability to various installations, and easy modification of the frequency or duration of performance of its several functions, so that the timing mechanism can be installed at the most convenient location in or apart from the machine or machines it serves, and yet derive its driving impulse from any nearby going part regardless of the speed at which such going part operates, and also in order that the frequency and duration of the several operations of the timing device may be suited exactly to the needs of the parts which are to be cleaned as based on the rapidity with which lint and fly collects thereon, or with respect to the differences in the rate of collection of lint and fly at separate points of the machine, the cleaning of which is under the control of the single valve-operating mechanism. The length of time between blasts, amounting to three, five, or more minutes during which the lint accumulates to an extent justifying a clearing action, is so great relative to the brief period of the blast, which is on the order of one second, as to complicate the mechanical problem, namely that of deriving rapid and positive valve-opening and closing movement from an essentially slow-moving timing mechanism.

A further object of the invention is to produce a valve-operating mechanism capable of fulfilling the foregoing aims, which will be relatively simple and inexpensive to manufacture, with few parts and those easy to make and install, and which can be relied upon to operate with certainty and in accurately timed relation, and with long life and freedom from repair, replacement, or adjustment. Other objects are as will appear from the accompanying specification and claims, taken in connection with the drawings.

To these ends, the invention comprises operating means which establish both the open and the closed relation of one or more valves located in the conduits of a compressed air cleaning system intermediate the distributing nozzles and the source of supply of air under pressure, characterized by the provision of a positively driven moving part such as a cam to actuate the valve or valves at the required intervals of time, and receiving its driving impulse from any suitable or available going part, such as a part of the machine to be cleaned. Preferably the valves are of poppet type, normally held to their seats and in closed relation, and hence the valve-operating means or cams are controlled throughout their movement by the drive means derived from the said going part, so as to prevent the reaction of the valve from speeding up the movement of the actuating parts, as through pressing on the cam after the high point of the latter has passed the coacting parts of the valve, and thus shortening the period in which the valve is held open; in other words, the duration of opening of the valves, as well as the frequency of its opening, is definitely correlated to the known speed of operation of the part of the machine from which the drive is taken. In the process of reducing the drive taken from the going part, in one preferred form a Geneva motion is used to produce an intermittent drive, and especially an intermittent drive which characteristically is proof against running ahead or other unintended shift of the driven parts; a system of interchangeable gears is provided whereby the frequency of operation of the mechanism may easily be varied. Also,

for certain types of installations, a simplified form embodying the general principles of the invention without the provision for preventing running ahead is set forth. Other features of the invention are as will be made plain hereinafter.

Two illustrative embodiments of the invention are shown in the accompanying drawings, in which,—

Fig. 1 is an end elevation of a valve-operating mechanism according to the invention, shown partly in vertical section on line 1—1, of Fig. 2.

Fig. 2 is a vertical side elevation made on line 2—2 of Fig. 1.

Fig. 3 is a side elevation of the operating parts of an alternative form of the invention.

Fig. 4 is a vertical section on line 4—4 of Fig. 3.

Fig. 5 is an enlarged end elevation of the Geneva motion gears.

In the particular embodiment shown in Figs. 1 and 2, the upper part of the housing 1 is divided off into a valve-chamber by a horizontal partition 3 extending across the interior from back to front and from side to side. Since the structure shown is intended to operate two valves 5, 7, in either synchronous or separately timed relation, the valve-chamber is further divided by a vertical partition 9 into two exhaust chambers 11, 13, and by a horizontal partition 15 in which are formed the seats for the respective valves 5, 7. These valves are of the usual poppet type, with their stems sliding in guides 17, 19, in connection with partition 3. A cover 21, secured by screws 23 and gasketed in air-tight relation, gives access to the valves for grinding and other purposes. A pipe 25 connected with a tank or other source of air under pressure is threaded into the sleeve formed in the cover. Nipples 27 threaded into the exhaust ports 29 of the respective exhaust chambers conduct the air passed by the valves to the manifolds 31 of the compressed air cleaning system of the co-pending application aforesaid, whence the air is distributed by pipes 33 to the various discharge nozzles.

The gear-case 35 in the bottom part of the housing has a removable convex end-portion or gear-cover 37 fixed on by screws 39. In a bushed bearing 41 in this cover, and in a corresponding bushed bearing 43 at the opposite side of the gear-case (Fig. 2) is mounted a worm-shaft 45 driven by a V-pulley 47, herein, (or by a flat pulley or gear if desired, depending on the nature, speed, and proximity of the going part selected as the driving element on the textile or other machine from which power is taken). A collar 49 is on the other end of the worm-shaft.

The gear-cover 37 has semi-circular end-portions or flanges in the planes of, and forming continuations of, the sides of the gear-case 35. In bearings formed half in the sides of the gear-case and half in these end-portions or flanges of the gear-cover is mounted for rotation a counter-shaft 55, on which is mounted a worm-gear 57, meshing with a worm 59 fixed on worm-shaft 45. Also on this shaft, spaced away from the worm-gear 57, is a wheel 61 having a mainly concentric periphery 63 outwardly beyond which latter extends at least one projection or tooth 65. The worm-wheel 57 and wheel 61 may be formed integral with each other, but preferably will be separate and fixed to shaft 55 by a key 67, the hubs of the respective members being prolonged to keep the members properly spaced along the shaft 55, as shown.

A wheel 69 has in its periphery a number of notches 71 to receive the projection 65 on the co-acting wheel 61, the portions 73 of the periphery of such wheel 69 between adjacent notches 71 being concaved on the same radius as that of the concentric periphery 63 of the other wheel, so that the wheel 69 will be moved at the exact speed of travel of wheel 61 through an angle substantially equal to the angular travel of the projection 65 while the latter remains in contact with a given notch 71, and thereafter the wheel 69 will be positively held against rotation in either direction by the opposition of the concentric portion 63 of the driving wheel 61, which portion conforms to the concavity 73 between notches, blocking rotation of wheel 69 until the recesses in the periphery 63 adjacent the projection 65 permit the corners of the portion 73 to pass within the circle of the periphery 63 of the driving member. This step-by-step impulsion of the driving wheel, with accompanying locking of the latter between movements, is the familiar Geneva motion, so-called.

The wheel 69 of the Geneva motion is fixed by a key 75 upon a shaft 76 mounted in the housing 1 parallel to shaft 55 in flanged bearings 51 which are mounted in two suitable apertures in the ends of the gear-case 35, and fixed in place by screws 53, and so that its axis will be intersected by the axes of the several valves 5, 7. Turning with the driven wheel 69 of the Geneva motion are one or more cam-wheels 77, one to each valve, and each having one or more valve-operating cams 79 formed on their peripheries, the number depending on the frequency of desired operation of the valves. To provide an anti-friction engagement between the valves and lifting cams 79, the lower end of each valve-stem is fitted into a hole in the top of a member 81 which is formed at 83 to straddle the rim of the cam-wheel 77, and a pin 85 is fitted loosely through the holes in the two sides of the forked portion and maintained in place by a cotter-pin, to roll upon the cam with accompanying rotation in its holes. As is obvious, each time the cam portion or portions of each cam-wheel 59 engage the pin 85, the valve will be lifted off of its seat and the compressed air allowed to pass from the pipe 25 and the compression chamber into the exhaust chambers 11, 13, thence through nipple 27 and manifolds 31 to the distributing pipes 33, whence it issues through the discharge nozzles.

A feature of the present invention is that no springs are needed to operate the valves, the air pressure on the tops of the valve-heads serving with complete adequacy to effect prompt and air-tight seating of the valve. Another and still more immediate result under the present arrangement is that whenever the valve-stems are slid upward in their guides 17, 19, to open the valves, the air pressure in the exhaust chambers simultaneously is raised above atmospheric pressure, with the result that the grease or oil necessarily provided in the gear-case is prevented from rising through the guides and being picked up by the air stream and discharged through the discharge nozzles on to the parts of the textile machine being cleaned of lint and fly; unless such spraying of grease and oil on to the parts of the machine which the organization is intended to clean be positively prevented, as by the present arrangement, the cleaning devices would defeat their own purpose, and be worse than useless. If the joints in the gear-case do not permit

escape of the minute amounts of air under pressure passing down the valve-guides, a breather aperture will be provided to prevent building up of back pressure tending to force the lubricant upward around the valve-stems.

The gear-engagement of the driver 61 with the driven element 69 of the Geneva motion effectually prevents the cam-wheels from running ahead under valve-pressure on the cams, while the locking engagement of the periphery 63 of the driving element with the concave parts 73 of the driven element between driving impulses from the driver 61 prevents all shift of the cam-wheels at these moments, because the cam-wheels are keyed to the shaft 76 or otherwise fixed to turn in exact unison with the driven wheel 69. Thus, regardless of the air pressure on the valves, or the vibration to which the device may be subjected, the duration of opening of the valves is determined exactly by the speed of rotation of the part on the textile machine from which power is taken off to run the valve mechanism.

Because of the great number of points at which the driving ratio may be varied, almost any desired absolute or relative frequency or duration of valve opening may be attained, regardless of the speed of rotation of the part chosen for taking off the power. The arrangement of the parts shown in Figs. 1 and 2 is such that where the duration or dwell of the valve in closed relation is for example three minutes, the driven wheel 69 and its cam-wheel 77 will be moved in a single continuous movement to cause its cam to lift and open the valve and thereafter to lower and permit closing of the valve, within a space of 1¼ seconds. The points at which the ratio may easily be changed include the diameter of the pulley 47 or equivalent gear wheel, the pitch of the worm 59, the relative diameters of the driving wheel 61 and driven wheel 69 of the Geneva motion, the length of the projection 65 of the driving member 61, the shape and number of the cams 79 on each cam-wheel 77, the lost motion existing between the cam and its follower represented by the pin 85 or between the member 81 and the end of the valve-stem, and the number of teeth or projections on the periphery 63 of the driving wheel 61 of the Geneva motion. This last point has been found to afford an easy and standardized method of varying the timing of the valves in practice. With all the other ratios in the valve-operating mechanism representing fixed and known quantities, a change in the angular displacement of the driven wheel 69 of the Geneva motion at each rotation of the driving member 61 can easily be effected by the mere substitution of standardized parts, and affords a method easily comprehended by the average mechanic, and the results of which can be forecast simply and without resort to elaborate calculations. This is made plain by Fig. 5, which shows a Geneva motion in which the single tooth 65 of Fig. 2 is replaced by three teeth on the driver 61. Obviously, the pitch of the teeth being the same, the driver in Fig. 5 will produce about twice the angular displacement of the driven wheel 69 at each rotation of shaft 55 as will occur in Fig. 2, which means that the cam-wheel 77 will be rotated twice as fast, and hence the valve will be open twice in the construction of Fig. 5 during the same interval required for a single opening of the valve in the arrangement of Fig. 2 and optionally provides for the use of a cam with a broader high point to increase the duration of the blast.

Another embodiment of the features of the invention is shown in Figs. 3 and 4, which affords a simplified method of employing the invention principles where it is not essential to maintain the valve-opening cam against running forward under the pressure of the valve-stem after the latter has passed the high point of the cam, as for instance where slide-valves are to be used, or where a cam with a sharp drop immediately following its high point can be employed. In this form, the worm-shaft 45, worm 59, and worm-wheel 57 are as before, but the worm-wheel is free on the shaft 90, being formed integrally with a cam-wheel 92 having a cam 94 protruding above its general periphery, which at each rotation of the worm-wheel and cam-wheel engages a follower or roll 96 located at an intermediate point in a pawl-arm 98 in the shape of a lever pivoted at 100. The pawl-arm has a gravitating pawl 102 pivoted at 104 on its extremity, which pawl rests against the periphery of a ratchet 106 formed integrally or fixed to turn in unison with one or more cam-wheels 108 which have cams which may operate the valves through pressure on their stems after the manner set forth in connection with the form previously described, or which may be cam-grooves to move the valves in both opening and closing directions.

In operation, as is obvious, the cam 94 rotating with the worm-wheel 57 moves the pawl-arm upward once during each rotation, which advances the ratchet one tooth. At least once in every rotation depending upon the number of cams 109 provided on the periphery of each cam-wheel 108, the valves are lifted or moved into open position. As will be apparent, the ratchet 106 may be formed integrally with the two cam-wheels 108; but preferably the ratchet will be provided with a long sleeve 112 turning freely on the shaft 90, to which sleeve the two cam-wheels 108 will be separately applied and fixed by a key or spline 114. Adjustment of the frequency or duration of valve-opening to the needs of the specific installation may thus be made by substituting ratchets having different spacings of their teeth, and in this connection it is contemplated to use concurrently a plurality of pawls of different lengths hung from the same pawl-arm 98, to act in well-known manner to advance the ratchet for intervals of fractions of the space between teeth. The pivot 100 and the follower 96 both have capacity for movement to adjust the throw of the pawls, and hence the degree of angular rotation of the ratchet, imparted at each revolution of the cam-wheel 92.

What I claim as my invention is:—

1. Valve-operating devices having in combination a constantly rotated wheel having a mainly concentric periphery interrupted by at least one projection outward beyond such periphery, a valve-operating wheel, and means engaged by such projection to rotate the valve-operating wheel with positive control of its angular position in a continuous movement to effect both the opening and the closing of the valve during the said continuous movement.

2. Valve-operating devices having in combination a constantly rotated element having a mainly concentric periphery interrupted by at least one projection outward beyond such periphery, a

valve-operating wheel, and means engaged by such projection to rotate the valve-operating wheel and by the concentric periphery to prevent rotation of the valve-operating wheel.

3. Valve-operating devices having in combination a constantly driven worm, a worm-wheel constantly rotated thereby, an element rotating with the worm-wheel and having a mainly concentric periphery interrupted by at least one projection outward beyond such periphery, a valve-operating wheel alternately rotated by and held from rotation by such element, and means engaged by such projection to rotate the valve-operating wheel.

4. Valve-operating devices having in combination a constantly driven shaft, a worm thereon, a worm-wheel continuously driven by the worm, a valve-operating wheel, and means for transmitting step-by-step movement from the worm-wheel to the valve-operating wheel, and operative connections between the valve and the valve-operating wheel timed to establish both the open and the closed relations of the valve through a single continuous movement of the valve-operating wheel derived from the worm-wheel.

5. Valve-operating devices for compressed air cleaning apparatus having in combination a valve-operating wheel, a constantly-driven part, and a Geneva motion transmitting intermittent motion to the valve-operating wheel from the driven part.

6. Valve mechanism for compressed air cleaning apparatus having in combination a chamber in communication with a source of compressed air, a discharge chamber, a lubricant-containing gear-box below and separate from the latter, a valve controlling the flow of air from the first to the second chamber, and having a stem extending out from the discharge chamber into the gear-box, gears within the gear-box, and means actuated through such gears periodically opening the valve, whereby gravity and the air under pressure co-operate to prevent entry of the lubricant into the discharge chamber.

7. Valve-operating devices for compressed air cleaning apparatus having in combination a chamber in communication with a source of compressed air, a plurality of valves therein, discharge chambers associated with the respective valves, a continuously rotated member having a mainly concentric periphery and at least one projection outward beyond such periphery, a wheel rotated step-by-step by the travel of such projection, and cams moved by such wheel coacting with the several valves to establish both the open and the closed relation of the latter during a continuous movement of the wheel under an impulse derived from the travel of the said projection.

8. Valve-operating devices for compressed air cleaning apparatus having in combination a valve-operating cam, a wheel fixed to the cam and determining the angular position and movement of the cam, and a constantly rotating element alternately rotating the wheel and holding the wheel from rotation.

9. Valve-operating devices for compressed air cleaning apparatus having in combination a valve-operating cam, and a constantly rotating element alternately moving the cam and holding the cam from movement.

10. Valve-operating devices for compressed air cleaning apparatus having in combination a rotary valve-operating cam, a cam-operating wheel fixed to such cam, and a constantly rotating element having an intermittent rolling driving engagement with the wheel continuing through an angular movement of the cam as great as the angular extent of the working portion of the cam.

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