Feb. 24, 1942. W. J. MILLER ET AL 2,274,427

MECHANISM FOR PREVENTING OVERLOADING

Filed March 30, 1939

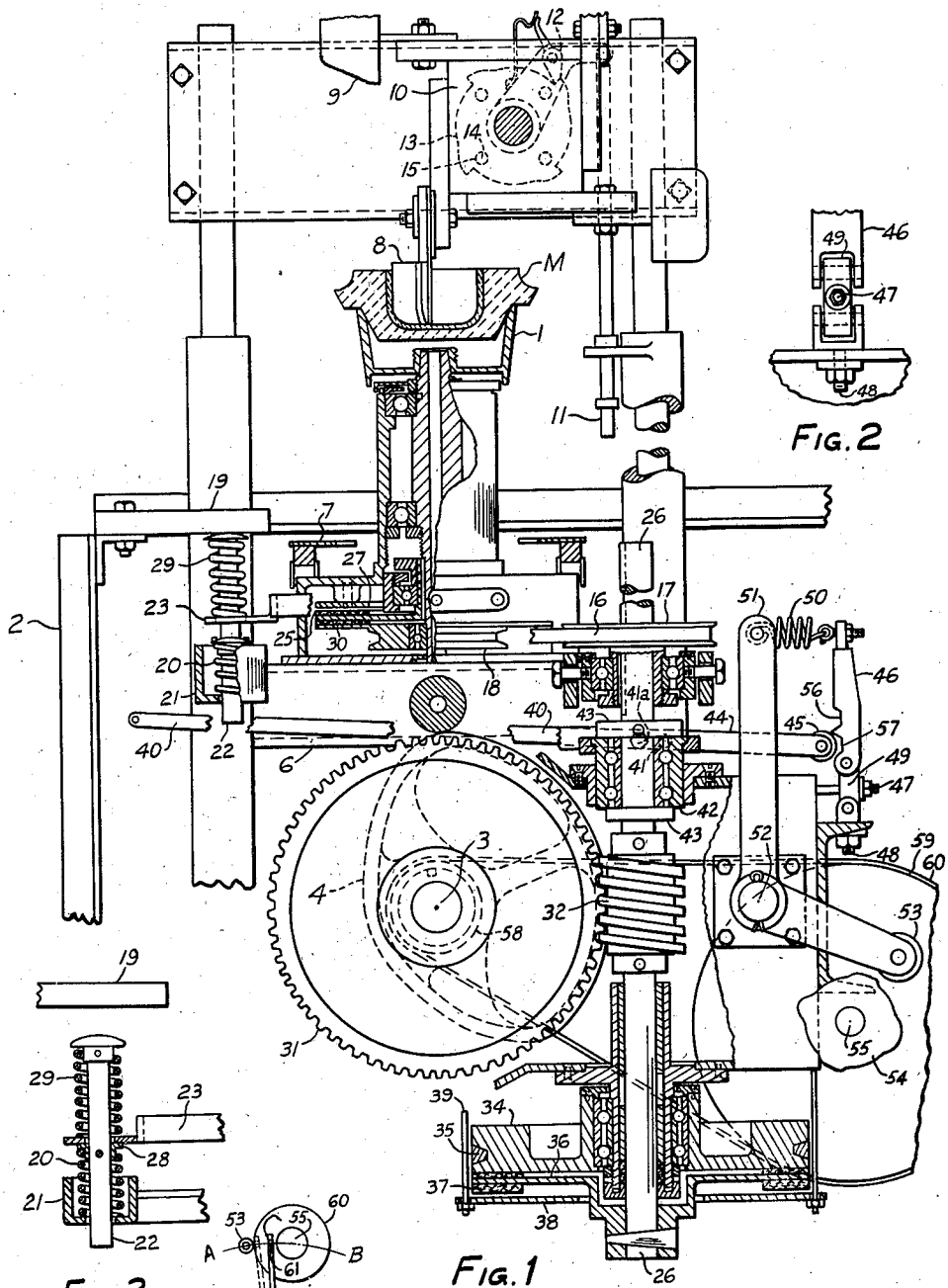

FIG. 1

FIG. 2

FIG. 3

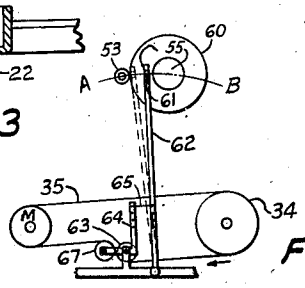

FIG. 4

INVENTOR.
WILLIAM J. MILLER
ASHLEY J. REEK
BY George J. Croninger
ATTORNEY

Patented Feb. 24, 1942 2,274,427

UNITED STATES PATENT OFFICE

2,274,427

MECHANISM FOR PREVENTING OVERLOADING

William J. Miller, Swissvale, and Ashley J. Reek, Carrick, Pa.; said Reek assignor to said Miller

Application March 30, 1939, Serial No. 264,930

14 Claims. (Cl. 192—150)

This invention relates to mechanism for protecting machinery against overloads. It has to do with a power transmission mechanism and control means therefor particularly adapted for machinery wherein the foot pounds of effort required for normal operations varies during a cycle or multiple of cycles to a predetermined extent.

This invention has been particularly developed for use in connection with automatic pottery machinery and is so shown and described herein, however, it is understood that it may be applied to machinery for doing work other than making pottery.

In an automatic pottery machine, the same as in other classes of industrial machinery, if something occurs to jam the driven mechanism the resistance to the drive increases as well as the foot pounds of pressure applied by the drive mechanism and damage usually results.

The object of this invention is to protect the machinery against damage by stopping it automatically when any rise occurs in the varying foot pounds of pressure (torque) exerted against the driven mechanism during a cycle due to a rise in resistance beyond that previously predetermined regardless of the source of such increase.

In carrying out the object of this invention, we provide means for varying the applied pounds of torque in synchronism with the resistance for successive cycles having the same or a different set of resistance changes and furthermore, we utilize the driving torque to effect a discontinuation of the drive and a positive and immediate stopping of the driven parts when a predetermined overload occurs.

In the drawing, Fig. 1 is an elevation partly in section showing my improved power transmission and control mechanism incorporated in an automatic pottery fabricating machine.

Fig. 2 is a fragmentary view showing the latching member for the clutch control operating instrumentality and certain adjustment provisions.

Fig. 3 is a fragmentary view showing the chuck spindle clutch and operating mechanism in one position of reciprocation, the other position of reciprocation being shown in Fig. 1.

Fig. 4 is a diagrammatic view of a recording torquometer.

The machine shown in Fig. 1 is a pottery fabricating apparatus used for making plates, cups, saucers and kindred articles from plastic ceramic material by pressing, pressing and jiggering, or jiggering. The ware is formed in molds M which may be charged with clay and placed on and removed from the chuck 1 manually or mechanically. For a disclosure of how this may be done mechanically, reference may be had to William J. Miller's British Patent #471,589.

Mounted on the frame 2 of the machine is a cam shaft 3 with a cam 4 keyed thereon for elevating crosshead 6 to thereby lift the mold M out of the divided seat 7 into co-operation with the fabricating tool which may be a profile 8 or a die 9. A profile or die is mounted on each quadrant of the rotatable turret 10, said turret being rotated upon the rise of the crosshead 6 by means of push-rod 11, dog 12 and ratchet 13. The object of this arrangement is to enable production diversification from pressed to jiggered ware or for diverse forms of either class in succession or the performance in succession of both the operations of pressing and profiling on a single piece of ware. Thus, the arrangement may be as shown with alternate profile and die or the entire setup may consist of dies of different configuration, or profiles.

When it is desired not to diversify production, the dog 12 may be thrown out or the push-rod 11 disconnected and a locking pin 14 inserted in one of the indexing openings 15 to hold the turret stationary.

In jiggering, the mold is rotated relative to the profile in order to remove excess material and smooth the ware surface. The mold may also be rotated relative to the die when pressing or it may remain stationary, in which case the drive belt 16 is removed from the drive pulley 17 slidingly keyed on worm shaft 26 and the driven chuck spindle pulley 18 and the stop bar 19 unbolted and removed from the machine frame. This permits spring 20 seated in boss 21 to maintain thrust on pin 22 (see Fig. 3) thereby forcing pivoted clutch lever 23 up to hold the driven disc 25, on jigger spindle 18, against the stationary braking disc 27 constantly.

Normally, as the crosshead rises, pin 22 abuts against bar 19 and spring 20 is compressed as the crosshead approaches peak elevation by shoulder 28 whilst lever 23 comes up against spring 29 and is depressed thereby, thus engaging disc 25 with drive disc 30 and rotating the chuck spindle and chuck. When the crosshead lowers, spring 20 applies thrust to pin 22 and elevates the same (Fig. 3) thereby forcing lever 23 to apply the brake as aforesaid so that the rotation of the

mold may be arrested before it is deposited on the seat 7.

The mechanism for transmitting power to the cam shaft 3 comprises a gear 31 and worm 32 mounted on worm shaft 26. A clutch is mounted on the lower end of the worm shaft and comprises a drive pulley 34 freely rotatable on shaft 26 and connected to a suitable source of power by belt 35. A friction disc 36 is keyed on shaft 26 and is faced on top and bottom surfaces with friction rings 37 for driving engagement with the drive pulley 34 and a braking disc 38 respectively, which is secured to the machine frame by studs 39.

The clutch is engaged by raising the shaft 26 vertically by means of a bifurcated lever 40 fulcrumed at 41 on the machine frame. The lever pivotally on trunnions 41a supports a floating cartridge bearing 42, vertically positioned on the shaft 26 by collars 43. When the handle is lowered, the clutch is disengaged and the brake set to thereby stop the rotation of shaft 26 as well as the motion of the driven parts.

To hold the lever 40 in clutch engaging position, it is provided with an extension 44 having roller 45 mounted at the end thereof for cooperation with the notches 56 and 57 of a latching member 46 pivotally mounted on link 49, adjustably secured to the frame of the machine by screws 47 and 48. The latching member is held against roller 45 by an adjustable tension spring 50 secured to one arm of bellcrank 51 pivotally mounted on stub shaft 52, the other arm having a roller 53 which engages cam 54 mounted on jack shaft 55. Jack shaft 55 is driven in synchronism with cam shaft 3 by sprockets 58 and 59 and chain 60. Cam 54 periphery is suitably contoured for applying correct predetermined variable disengagement restraining pressure on the latch 46 through tension control of spring 50.

Owing to the raising and lowering of the crosshead, the starting and stopping of the chuck drive and the pressure required to press the clay under the die, the foot pounds of resistance to the drive fluctuates considerably during a machine cycle. Co-incidently, the foot pounds of torque delivered to drive the mechanism varies. Thus, at a low load period when delicate apparatus are functioning, a very slight overload will be provided to stop the machine and avoid breakage of apparatus, whereas, without this variable feature the peak torque would be applied. Thus, each revolution of shaft 3 provides a certain set of changes in resistance or torque requirements, and the value and instant of occurrence ascertained by instrumentation or calculation but preferably by a recording torquometer. (See Fig. 4.)

The preferred method of laying out the periphery of cam 54 is to mount a cam blank 60 on shaft 55 with one side surface chalked and to then locate the stylus 61 of the torquometer, Fig. 4, on arc A—B midway between the centers of of shaft 55 and roller 53 positioned at the cam periphery with the scribe bar 62 radial to the arc.

Belt 35 goes over floating roller 67 and under fixed roller 63 and when the drive is clutched in, the scribe bar is oscillated by frame 64, link 65 and compression spring 66 in response to variations in torque as transposed into variations in pull on the lower run of belt 35. The throw of the scribe bar may be varied by repositioning link 65. It is understood that the machine is operated under normal operating pressures when the recording is made. When shaft 55 has made one complete revolution, the blank is removed and the cam periphery machined to the line scribed thereon.

When successive cycles have similar torque phases and values, the cam 54 preferably is rotated at the same speed as cam shaft 3. However, when succeeding cycles have dissimilar characteristics then the ratio of cam rotation to that of shaft 3 rotation and various sets of cam contours formed on cam 54 should coincide, to always apply a predetermined limit of excess torque and when this is exceeded, the excess axial pressure applied by the worm 32 to gear 31 disengages latch 46 from lever 44, thereby disengaging the clutch 36, gear 31 ceases rotating and the worm through momentum will screw shaft 26 and disc 36 down against brake disc 38 thereby preventing further movement of the driven mechanism through momentum. Meantime roller 45 snaps into the upper notch 56 of the latch and locks the operating handle against displacement until the trouble is cleared.

One advantage of this invention is that the driven machinery is instantaneously stopped before any damage to operating parts can occur upon an abnormal rise in operating pressures. This is exceptionally advantageous in the case of pottery machinery wherein a crushed or broken mold may occasion several minutes delay cleaning the fragments out of the chuck and other parts of the mechanism with consequent loss of production during the interval. Pottery molds are made of plaster and have little or no bending movement and they burst if loaded sufficiently in pressure, particularly if the pressure is localized.

The invention is applicable to a wide variety of industrial machinery having power characteristics comparable to those of the machine illustrated. For instance, the invention could be applied to a lathe and a number of interchangeable cams provided to control the torque application in accordance with the requirements of the work.

It is to be understood that the structure herein shown has been selected for the purpose of illustration or example and that various changes in size, shape and arrangement of parts may be made without departing from the spirit of the invention or the scope of the appended claims.

Having thus described our invention, what we claim is:

1. In apparatus of the class described, a driven mechanism, a drive mechanism therefor, a clutch for releasably coupling said driven and said drive mechanisms together and means for varying the torque transmitting ability of the clutch whilst the driving connection subsists including a cam having a working surface developed according to the normal resistance changes imposed by the driven mechanism on the drive during an operations cycle.

2. In apparatus of the class specified, a driven mechanism, a drive mechanism, a clutch for releasably coupling said driven and said drive mechanism together, means for varying the torque transmitting ability of the clutch whilst the driving connection subsists including a cam having a working surface developed according to the normal resistance changes imposed by the driven mechanism on the drive mechanism during a succession of operations cycles.

3. In apparatus of the class specified, a driven mechanism, a drive mechanism, said driven

mechanism having variations in the foot pounds of resistance during a cycle and means including a cam for effecting changes in torque applied by the driving mechanism conforming to the instant and amount of change in the normal resistance of the driven mechanism whereby fluctuations in resistance will be compensated for by fluctuations in torque to a previously predetermined and required amount and means operable in response to a deviation therefrom for discontinuing the application of torque to the driven mechanism.

4. In a machine wherein the driven mechanism operates in successive cycles, mechanism for automatically discontinuing the drive in response to deviations in resistance from that normally imposed on the drive mechanism thereby which comprises, a releasable means for discontinuing the drive and means for imposing a restraining pressure thereon including a cam having a working surface developed in accordance with the resistance changes imposed by the driven mechanism in one or more cycles.

5. In apparatus of the class described, a cam shaft, a cam mounted on said cam shaft for actuating machine components, an endwise displaceable worm shaft for driving said cam shaft, a clutch for said worm shaft, means for engaging and disengaging said clutch, mechanism for locking said means in clutch engaging position by preventing endwise displacement of said worm shaft, said means comprising a latching mechanism on which the pressure is varied as the working torque is varied on the cam shaft and means for transmitting pressure from said cam shaft to said latching mechanism including a cam having a working surface developed in accordance with the variations in working torque imposed on the cam shaft a pivoted lever and a resilient member connecting said lever to said latching mechanism.

6. In apparatus of the class described, a driven mechanism, a cam shaft, a cam mounted on said shaft for actuating said driven mechanism, a clutch and a brake, an endwise displaceable drive shaft for actuating said cam shaft, means for engaging and disengaging said clutch which includes an operating handle connected to said drive shaft for raising and lowering the same, a latch member adapted to co-operate with one end of said handle, resilient means for imposing a restraining pressure on said latch member for retaining the latch member in latched position and means for varying the tension on said resilient member comprising a lever and a cam having a working surface developed in accordance with the changes in torque imposed by the driven mechanism on the drive, said latch member being adapted to yield in response to a deviation in torque from that applied to meet the normal resistance of the driven mechanism to disengage said clutch and set said brake.

7. In apparatus of the class described, a driven mechanism, a drive shaft therefor, a clutch, means for engaging and disengaging said clutch and releasable means for locking said clutch in engaged position including a latch member, a restraining means therefor and means for varying the restraining pressure imposed on said latch member comprising, a cam mounted for rotation in unison with said driven shaft, said cam having a surface developed substantially in accordance with the torque changes imposed on the drive shaft by said driven mechanism.

8. Apparatus of the class described, in combination, a driven mechanism, a drive mechanism, a clutch for coupling said mechanisms together automatically disengageable when the normal torque is exceeded and means which automatically varies the value of the working torque at which the clutch may disengage from overload throughout the cycle of operations of the driven mechanism.

9. In apparatus of the class described, in combination, a driven mechanism, a drive mechanism, a clutch automatically disengageable when the resistance to the working torque becomes excessive and means which automatically varies the value of the torque at which the clutch disengages.

10. In apparatus of the class described, in combination, a driven mechanism, a drive mechanism, a clutch for coupling said mechanisms together automatically disengageable when the resistance to the working torque becomes excessive, a brake assembly automatically engageable when the clutch is disengaged for holding the driven mechanism stationary and means which automatically varies, during the cycle of operations of the driven mechanism, the value of the torque at which the clutch may disengage and the brake engage.

11. In combination with apparatus for the manufacture of pottery ware, the combination which comprises a driven mechanism, a drive mechanism, a clutch for coupling said mechanism together automatically disengageable when the resistance to the working torque becomes excessive and means which automatically varies the value of the working torque at which the clutch may disengage during the cycle of operations of the driven mechanism.

12. In apparatus of the class described, in combination, a driven mechanism, a drive mechanism, a clutch for coupling said mechanisms together automatically disengageable when the resistance to the working torque becomes excessive and means which automatically varies the value of the torque at which the clutch disengages including a cam having a working surface developed in accordance with the resistance changes imposed by the driven mechanism on the drive mechanism during a cycle of operations.

13. In apparatus of the class described, in combination, a driven mechanism, a drive mechanism, a clutch for coupling said mechanisms together automatically disengageable when the resistance to the torque transmitting ability of the clutch becomes excessive and means which automatically increases and decreases the value of the torque transmitting ability of the clutch and the value of the torque at which the clutch may disengage.

14. In apparatus of the class described, in combination, a driven mechanism, a drive mechanism, a clutch for coupling said mechanism together automatically disengageable when the resistance to the working torque becomes excessive and means which automatically varies the value of the torque at which the clutch may disengage and the torque transmitting ability of the clutch during the cycle of operations of the driven mechanism.

WILLIAM J. MILLER.
ASHLEY J. REEK.