United States Patent

Conti

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[54] MECHANICAL FORCE SENSING DECLUTCHING MECHANISM

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[52] **U.S. Cl.** **198/221**

[51] **Int. Cl.** **B65g 25/08**

[58] **Field of Search** 198/24, 221–222; 146/DIG. 43

[56] **References Cited**

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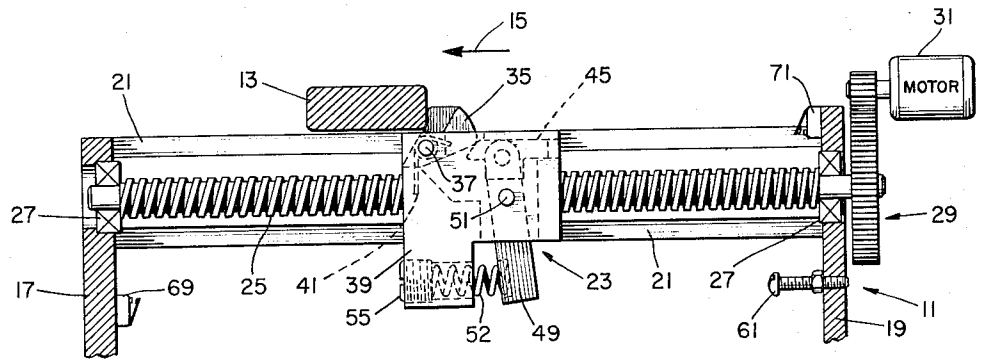
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[57] **ABSTRACT**

A declutching mechanism for use in a cycling conveyor-type feed system in which the workpiece being fed may be subjected to reaction forces due to a system blockage. A cam follower on a carrier member reacts against a cam surface on a slide member to resist normal reaction forces. When the reaction forces build up to a predetermined force, such as by a system blockage, a pivotally mounted slide actuator acting against a spring is pivoted so that the cam follower passes over the cam surface and the carrier member falls below the workpiece and is locked into a lowered position by the slide member. The work moving mechanism then continues past the stopped workpiece and continues on to the end of its travel for recycling.

17 Claims, 6 Drawing Figures



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2 Sheets-Sheet 1

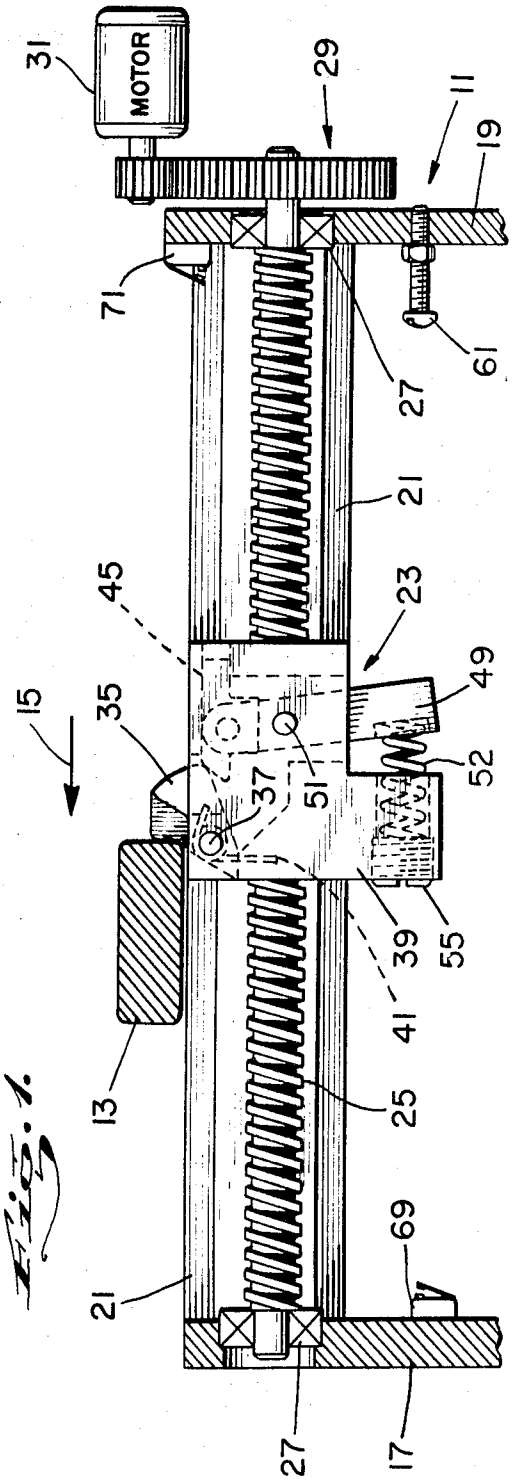


Fig. 1.

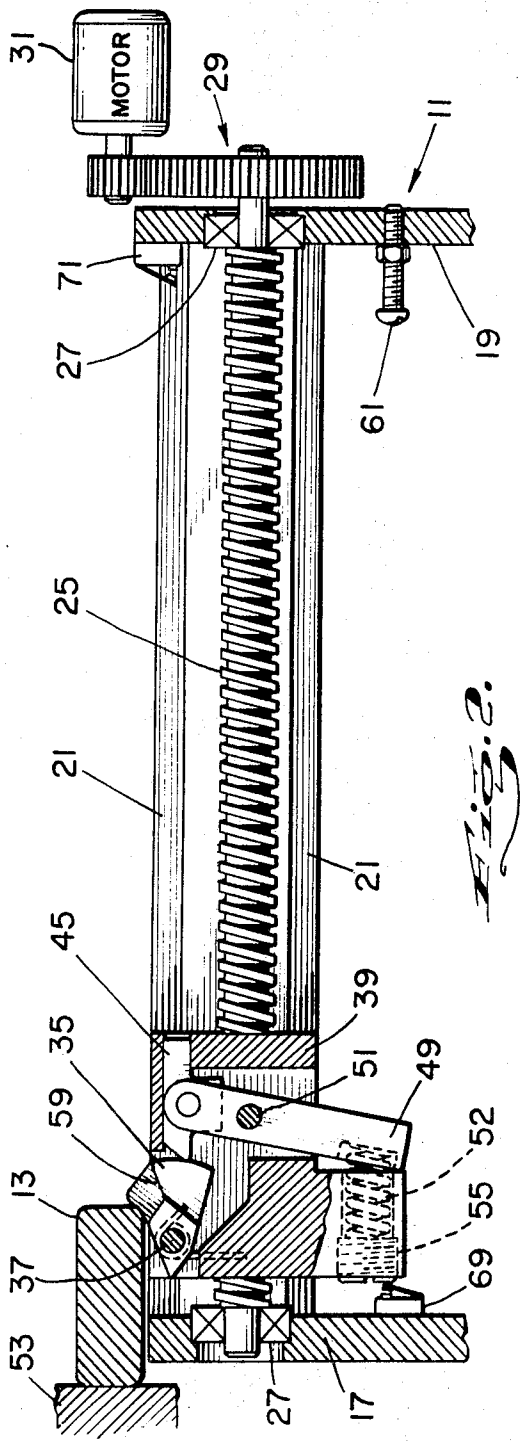


Fig. 2.

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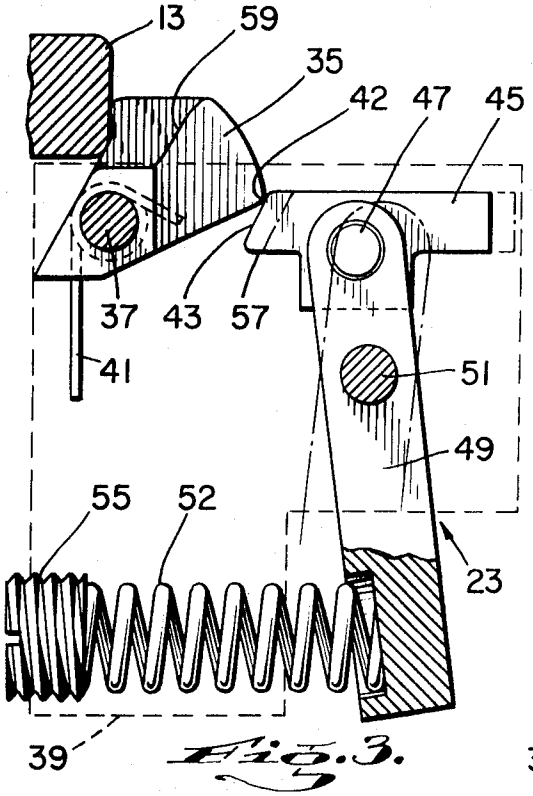


Fig. 3.

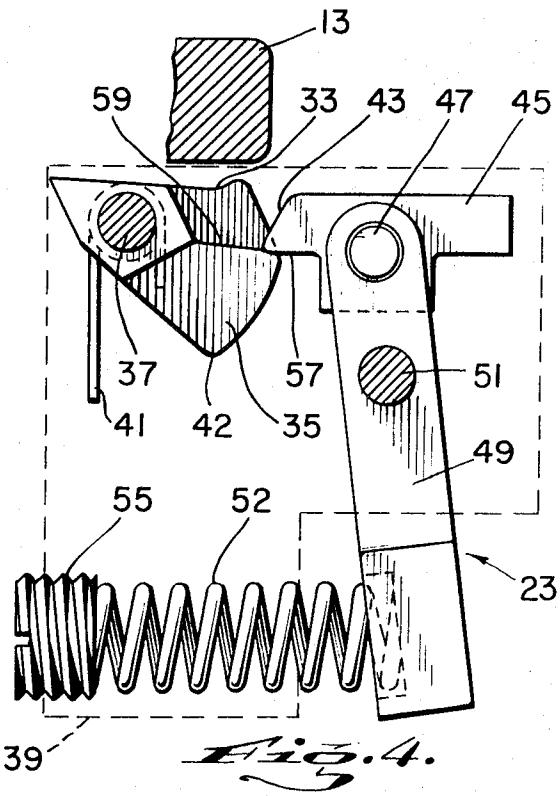


Fig. 4.

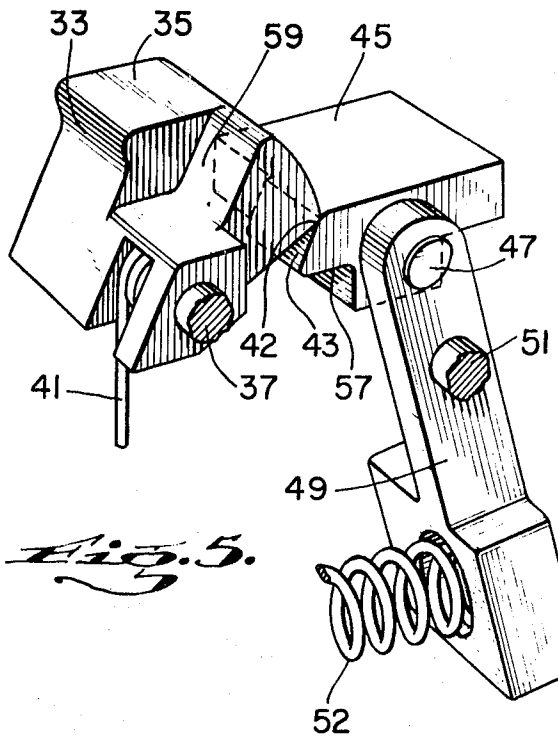


Fig. 5.

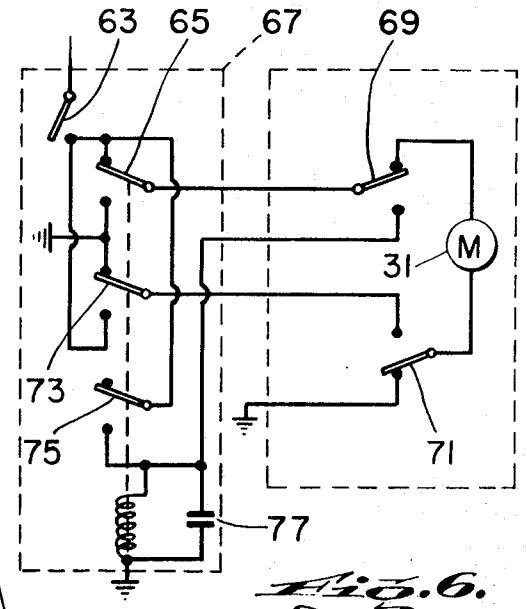


Fig. 6.

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MECHANICAL FORCE SENSING DECLUTCHING MECHANISM

BACKGROUND OF THE INVENTION

In any feed system wherein a workpiece is to be moved from a first position to a second, the system is subject to blockage if one of the workpieces should become jammed in any way. When this occurs, it is usually preferred that the workpiece be driven no further and that feeding be stopped nearly instantaneously so that the blockage can be cleared. In a system in which workpieces are moved in cycles rather than on a continuous basis, instantaneous stoppage of the machine requires expensive and complicated signaling systems. It is usually preferable to allow the machine to continue through its cycle, although not driving the workpiece, and return to its starting position so that, when the blockage is cleared, it can be restarted with no further loss of time.

On the other hand, it is also desirable that the feed system be able to overcome normal resistance forces without discontinuing the feed cycle and without requiring large structural machine components.

In many such feed systems which are presently known, it has been accepted practice to provide a spring member which can be overcome by a resistance force of a predetermined size. These spring members cannot produce an instantaneous declutching due to normal spring movement, however, and the systems cannot be used to move fragile workpieces which could be damaged under the continued motivational force of the drive system.

In other devices, cam-surface declutching mechanisms have been used which provide nearly instantaneous declutching, but which are subject to declutching by normal movement resistance forces unless relatively large structural components are used.

SUMMARY OF THE INVENTION

In the present invention, a conveyor body is cyclically driven back and forth below a work moving area. A workpiece carrier is pivotally mounted on the body and is biased by a spring into a position in which it extends into the work moving area. A cam follower on the workpiece carrier acts against a cam surface on a slide member which is pivotally mounted on a slide lever. The slide lever is, in turn, pivotally mounted on the conveyor body and is acted upon by a compression spring to hold the slide against the carrier. When the reaction forces exerted by the workpiece on the carrier reach a predetermined amount, the cam follower will move completely across the slide cam in nearly instantaneous fashion, causing the carrier to pivot to a position beneath the work moving area and away from the driving relationship with the workpiece. The slide member then latches the carrier in the lowered position due to a pivotal action of the lever under the force of the compression spring. The body then completes the cycle, returning to the start position.

The use of a cam surface and lever in the manner described herein, produces a declutching mechanism which operates nearly instantaneously and which can be adjusted to provide a very large force advantage, such as 10:1, to overcome the normal resistance forces created by movement of the workpiece. This concept allows relatively large, heavy workpieces to be moved by small, lightweight structural components. The structure is operative without requiring expensive and complex sensing or signaling devices and can be manufactured so as to reset the workpiece carrier into the operative position when the body is returned to the cycle start position.

Further objects and advantages of this invention will become obvious to those skilled in the art through perusal of the Detailed Description and accompanying drawings which illustrate a preferred embodiment of the best mode contemplated for utilizing the novel principles set forth in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1 and 2 are side elevations of a work feeding machine utilizing the principles of the present invention, illustrating the work feeding structure in various positions assumed during a work feed cycle;

FIGS. 3 and 4, taken together, illustrate, in said elevation, the operation of the declutching structure;

FIG. 5 is an isometric illustration of the work feeding structure in the operative position; and

FIG. 6 is a schematic illustration of a control circuit which may be used with the present invention.

DETAILED DESCRIPTION

A work feeding machine **11** is shown in FIGS. **1** and **2** moving a workpiece **13** in the direction of arrow **15**. Basically, the machine **11** comprises a pair of frame members **17** and **19** connected together by structural members **21** which, if desired, may form ways or guides for a work feed member **23**, as well as supports for workpiece **13**. A threaded feed shaft **25** is mounted within bearings **27** in the frames **17** and **19** for rotation by a gear train **29** driven by a motor **31**.

The workpiece **13** may, if desired, also or alternatively be supported by any suitable roller means or similar device (not shown). The trailing edge of the workpiece is moved by means of contact with a pushing surface **33** (FIG. **5**) on a carrier **35** of work feed member **23**. The carrier is pivotally mounted on a shaft **37** fixed within a conveyor body **39**. The carrier is biased to the position shown in FIGS. **1**, **3**, and **5** by a spring **41** acting between the carrier and the body.

On the opposite end of the carrier **35** from the pushing surface **33**, an integral cam follower **42** acts against a cam surface **43** on a slide **45**; the slide is reciprocally mounted in the body **39**. A pivot pin **47** connects the slide **45** to a slide actuator **49** which is also pivoted to the body **39** by means of a rod **51**. If necessary, a longitudinal slot (not shown) may be provided in the actuator **49** to accommodate pin **47**. The slide is maintained in the position illustrated in FIGS. **1**, **3**, and **5** by the slide actuator under the influence of a compression spring **52**, acting between the body **39** and the actuator **49** so as to maintain the cam surface **43** tightly against the cam follower **42**.

In operation, motor **31** causes rotation of feed shaft **25** through gear train **29**. An internal mating thread (not shown) in the body **39** grips the feed shaft and causes the work feed member to move in the direction of arrow **15**, forcing the workpiece **13** in that direction.

When the workpiece **13** is stopped through contact with an abutment, indicated at **53** only for illustrative purposes in FIG. **2**, the resistance force will become larger as the work feed member **23** continues to move to the left due to the reaction to the force exerted by the member. If desired, the abutment **53** can be cyclically moved so that the workpiece **13** can be removed while causing the conveyor to always return to the cycle start position in a recessed condition.

When the resistance force reaches a predetermined amount, which may be adjusted by changing the degree of compression in spring **52** by means of a set screw **55**, carrier **35** will be rotated against the force of spring **41** about the pivot **37**. A proper selection of the angle of cam face **43** and the shape of cam follower **42** will cause the clockwise rotation of the carrier from the position of FIG. **3** to that of FIG. **4** to be nearly instantaneous and "snap-action" in effect.

During the rotation of the carrier, the slide and actuator will be moved to the position shown in detail in FIG. **2** and in phantom in FIG. **3**. When carrier rotates past the position illustrated in FIG. **2** and into the position of FIG. **4**, the slide will return to its normal position and a latching surface **57** on the slide will move into a latching slot **59** on the carrier due to the influence of spring **52**. An incline at the upper or outer end of the latching slot **59** cooperates with a slightly rounded face on the lower end of latching surface **57** to drive carrier **35** down into the position shown in FIG. **4**. This causes the carrier to be locked in the lowered position in which the pushing surface **33**

cannot contact the workpiece 13 and no further movement of the workpiece will be accomplished during that cycle.

When the work feed member is moved back to the cycle starting position, i.e., adjacent the frame 19, an adjustable abutment member 61 will act upon the slide actuator 49 against the force of spring 52 to pivot the actuator about its pivot point 51, moving it and the slide 45 to the position illustrated in phantom in FIG. 3. When the latching surface 57 is completely removed from contact with the latching slot 59, spring 41 will cause the carrier 35 to be rotated counterclockwise to the previously described work-pushing position.

In FIG. 6, a simplified electrical circuit has been illustrated which may be used to operate the above described work feeding machine. In this illustration, a main power switch 63 may be manually or automatically closed, causing power to flow to a switch 65 in a relay 67. Power is also transmitted through a switch 69 mounted on frame 17 and normally maintained in the position shown, to the motor 31, which is grounded through a switch 71 on frame 19. The switch 71 is held in the position shown in FIG. 6 by a body 39 when member 23 is in the cycle start position, but is so designed that it snaps and normally remains in the opposite position as soon as a cycle begins. When the member 23 returns to the start position at the end of the cycle, switch 71 is forced back to the position shown in FIG. 6 by body 39.

As the feed shaft 25, driven by motor 31, moves the work feed member 23 in the direction of arrow 15, switch 71 is released from abutment with body 39 and switches to the opposite position. This causes the motor 31 to be grounded through switch 71 and switch 73 of relay 67. When the declutching conveyor mechanism reaches the extreme work feed position, switch 69 will be reversed by contact with body 39, actuating the relay 67 to move switches 65, 73, and 75 to the opposite positions from those shown in FIG. 6, providing reverse polarity to the motor 31. This causes the motor to turn in the opposite direction and return the declutching mechanism to the cycle start position. Switch 75 acts as an interlock switch to hold the relay 67 energized through well-known use of capacitor 77.

When the work feed member 23 returns to the cycle-start position, switch 71 is reversed, opening the circuit and stopping the motor. The circuit may be reset for the next cycle by opening switch 63, thereby releasing relay 67 to allow switches 65, 73, and 75 to return to the positions shown. The actuation of switch 63 may be performed by a variety of well-known means, such as a photocell device which indicates that another workpiece has been positioned for movement by the machine.

Upon reviewing the above description of the electrical circuitry which could be utilized with this machine, it will be obvious to those skilled in the art that any suitable circuit could be designed for recycling and operating the machine and the described systems should only be considered to be exemplary.

Thus, the Applicant has disclosed an embodiment in the art of work feed mechanisms which provide a true advance in that art. A variety of modifications and alterations of that embodiment will be obvious to those skilled in the art, wherefore,

What is claimed as the invention is:

1. Apparatus for moving a workpiece comprising
a base member,
means for supporting a workpiece on said base member for movement relative thereto,
drive means mounted on said base member,
a workpiece moving means operatively connected to said drive means for movement relative to said base member and comprising
workpiece pushing means mounted on said moving means and normally extending into a first, workpiece moving position relative to said supporting means and
mechanical advantage means tending to maintain said pushing means in said first position until the force exerted against said pushing means by workpiece movement resistance exceeds a predetermined amount, and
cam means acting between said pushing means and said mechanical means and formed so as to allow substantially instantaneous movement of said pushing means from said first position to a second position in which it is withdrawn from contact with a workpiece on said support means when the resistance force exceeds the predetermined amount.

2. The apparatus of claim 1 including
means for adjusting the force which said mechanical advantage means exerts on said pushing means to maintain said pushing means in said first position.

3. The apparatus of claim 1 including
means for causing said pushing means to be moved from said first position to a second position in which it is withdrawn from workpiece pushing relationship relative to said supporting means.

4. The apparatus of claim 1 including
means for locking said pushing means in said second position when moved thereto by said movement causing means.

5. The apparatus of claim 1 wherein
said drive means actuates said moving means in a reciprocal cycle having
a first, workpiece movement, direction of motion and
a second direction of motion by means of which said moving means returns to the starting position of the cycle.

6. The apparatus of claim 5 including
means for withdrawing said pushing means from said first position, at the conclusion of the motion of said moving means in said first direction, to a second position in which it is unable to contact a workpiece on said supporting means.

7. The apparatus of claim 6, including
means for returning said pushing means to said first position at the conclusion of the motion of said moving means in said second direction.

8. The apparatus of claim 6 including
means for positively retaining said pushing means in said second position during the period when said moving means is being driven in said second direction.

9. The apparatus of claim 5 including
means for withdrawing said pushing means from said first position to a second position in which it is unable to contact a workpiece on said supporting means when movement of such a workpiece becomes obstructed.

10. The apparatus of claim 6 including
means for positively retaining said pushing means in said second position, when such a workpiece becomes obstructed, throughout the remainder of the period in which said moving means is driven in said first direction.

11. The apparatus of claim 10 including
means for returning said pushing means to said first position when said moving means is returned to the starting position of the cycle.

12. Apparatus for conveying a workpiece including
a base member,
means for supporting a workpiece in a workpiece movement path relative to said base member,
conveyor means mounted on said base member and comprising
reciprocally movable carrier means,
means for moving said carrier means,
pusher means mounted on said carrier means for movement from
a first position in which it extends into the workpiece movement path to
a second position in which it is withdrawn from the workpiece movement path,
said pusher means having
a cam follower thereon,
means for biasing said pusher means toward said first position,
cam means reciprocally mounted on said carrier means,

lever means pivotally mounted on said carrier means and acting upon said cam means to sense and control the reciprocal movement thereof, and

means acting upon said lever means for biasing said cam means into contact with said cam follower, thereby maintaining said pusher means in said first position until a reaction force is exerted on said pusher means which is substantially greater than the force exerted by said biasing means.

13. Apparatus for moving a workpiece comprising a base member,

means for supporting a workpiece on said base member for movement relative thereto,

drive means mounted on said base member,

a workpiece moving means operatively connected to said drive means for movement relative to said base member and comprising

workpiece pushing means mounted on said moving means and normally extending into a first, workpiece moving position relative to said supporting means,

mechanical advantage means tending to maintain said pushing means in said first position until the force exerted against said pushing means by workpiece movement resistance exceeds a predetermined amount,

cam means tending to maintain said pushing means in said first position, and

means for biasing said cam means into contact with said pushing means.

14. The apparatus of claim 13 wherein said biasing means include

a force advantage lever means acting upon said cam means and

a spring acting against said force advantage lever means.

15. The apparatus of claim 13 including

cam follower means on said pushing means acting against said cam means.

16. Apparatus for moving a workpiece comprising

a base member,

means for supporting a workpiece on said base member for movement relative thereto,

drive means,

a workpiece moving means operatively connected to said drive means for movement relative to said base member and comprising

workpiece pushing means mounted on said moving means and normally extending into a first, workpiece moving position relative to said supporting means, and

mechanical advantage force multiplication means tending to maintain said pushing means in said first position until the force exerted against said pushing means by workpiece movement resistance exceeds a predetermined amount including

lever means,

means biasing said lever means in a first direction, and

means for multiplying the force exerted by said lever means on said workpiece moving means.

17. The apparatus of claim 16 wherein said force multiplying means further includes

means for preventing any movement of said pushing means until the predetermined workpiece movement resistance force reaches said predetermined amount and for allowing said pushing means to move to a second position in which it cannot push a workpiece at the instant that the predetermined workpiece resistance force is exceeded.

* * * * *