June 3, 1969 E. J. MORIARTY 3,447,706

BAG OPENING AND EMPTYING MACHINE

Filed Oct. 9, 1967 Sheet 1 of 5

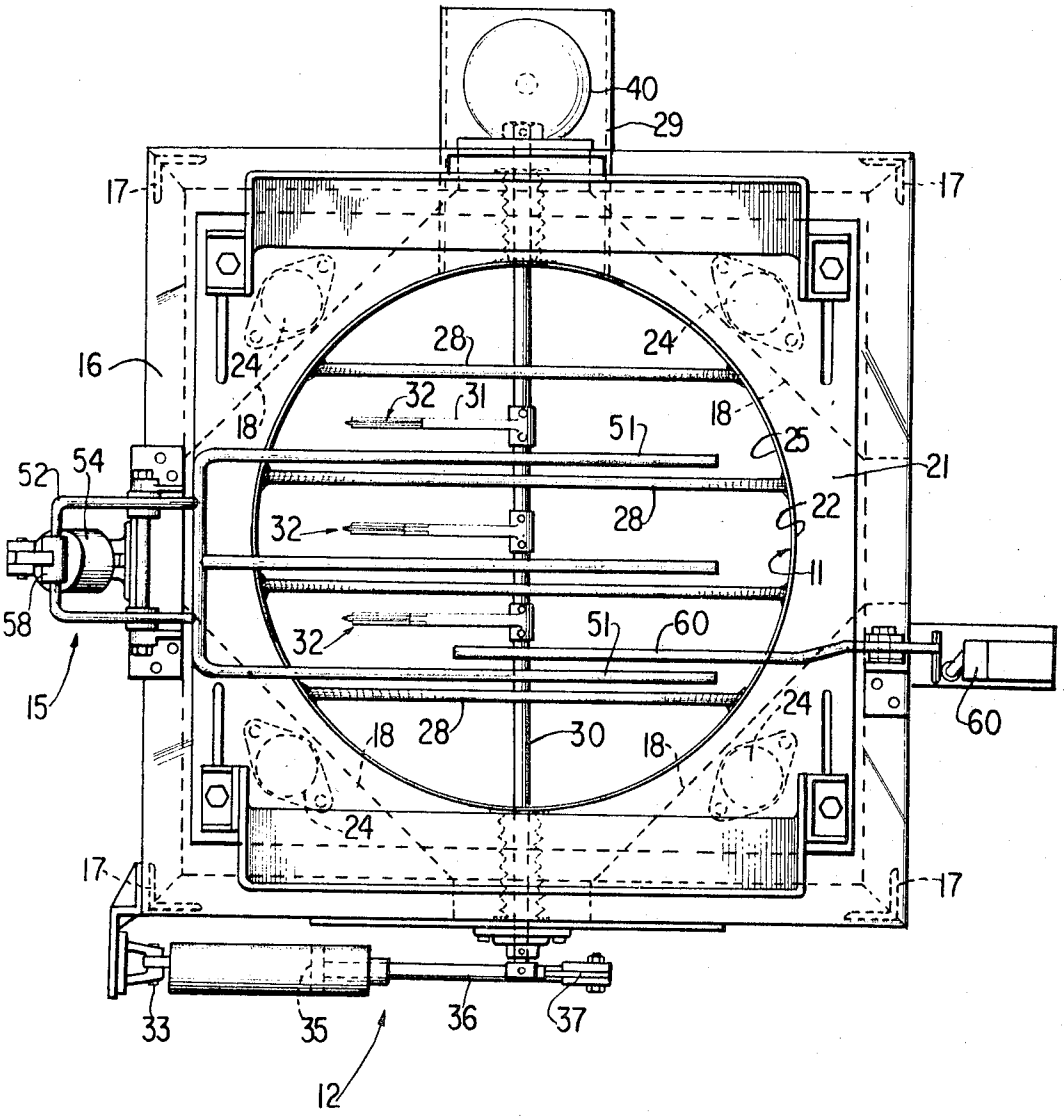

FIG. 1

INVENTOR
EDWARD J. MORIARTY
BY Ernest J. Oberman
ATTORNEY

June 3, 1969 E. J. MORIARTY 3,447,706

BAG OPENING AND EMPTYING MACHINE

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FIG. 4

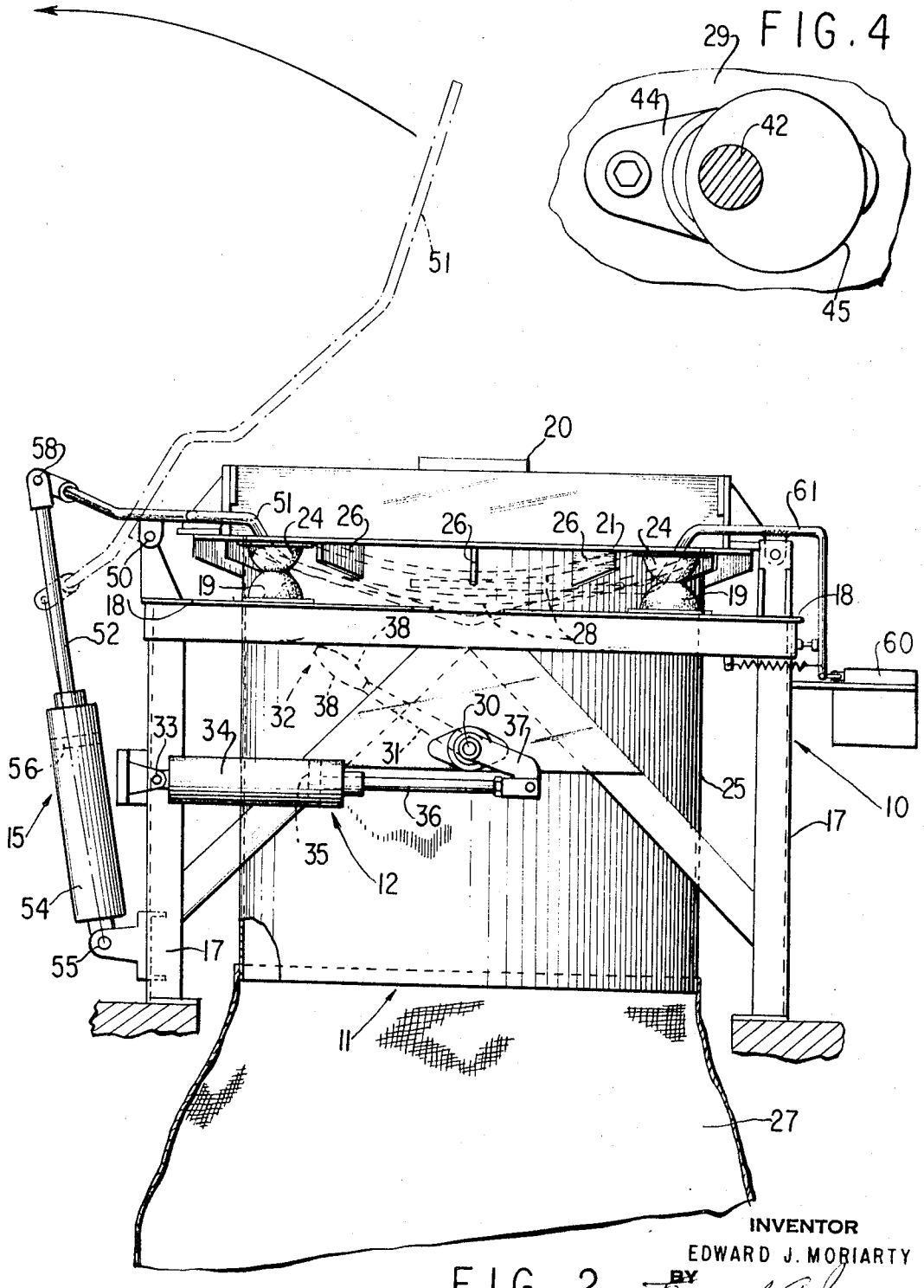

FIG. 2

INVENTOR
EDWARD J. MORIARTY
BY
ATTORNEY

June 3, 1969 E. J. MORIARTY 3,447,706

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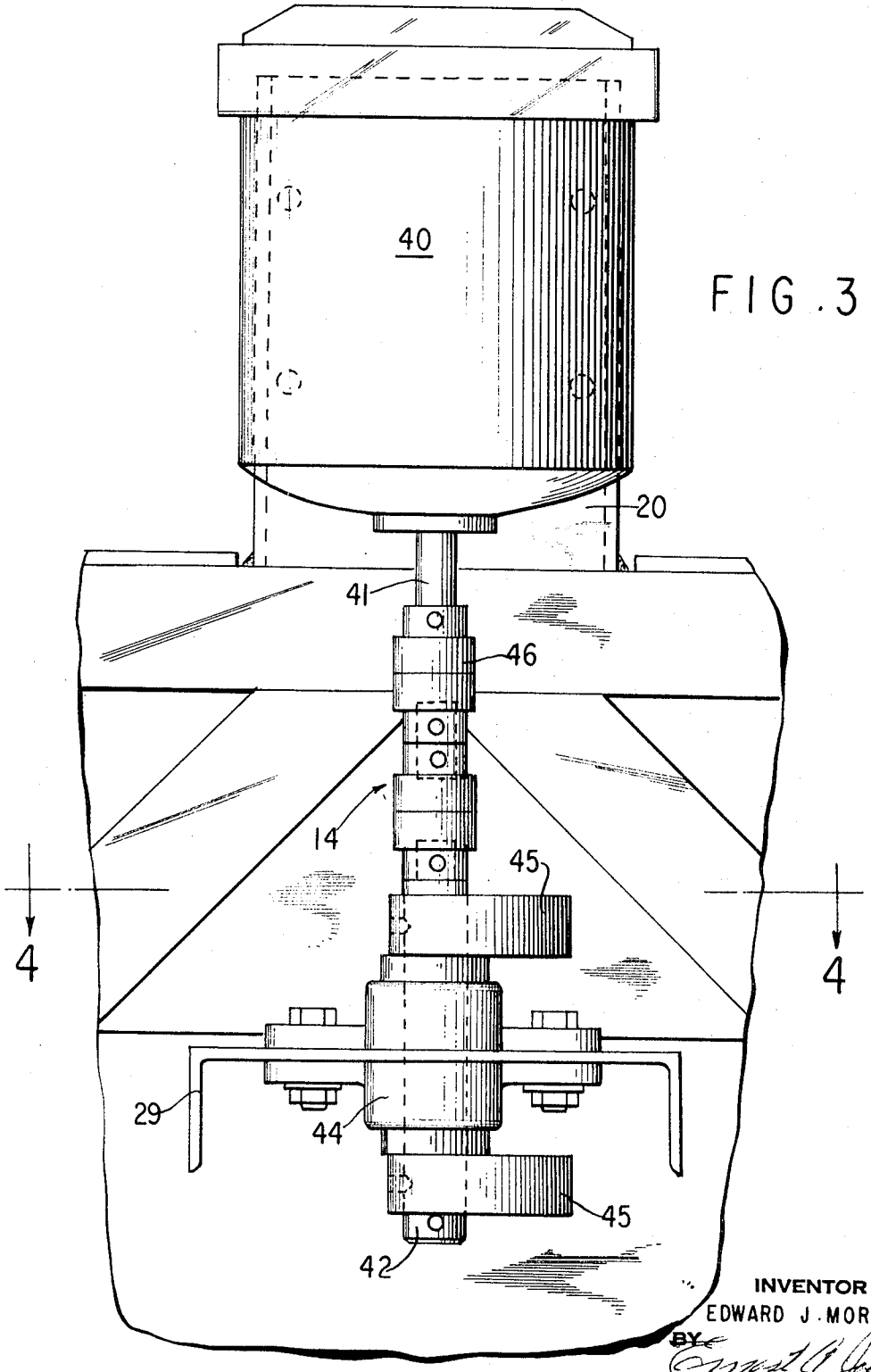

FIG. 3

INVENTOR
EDWARD J. MORIARTY
BY
ATTORNEY

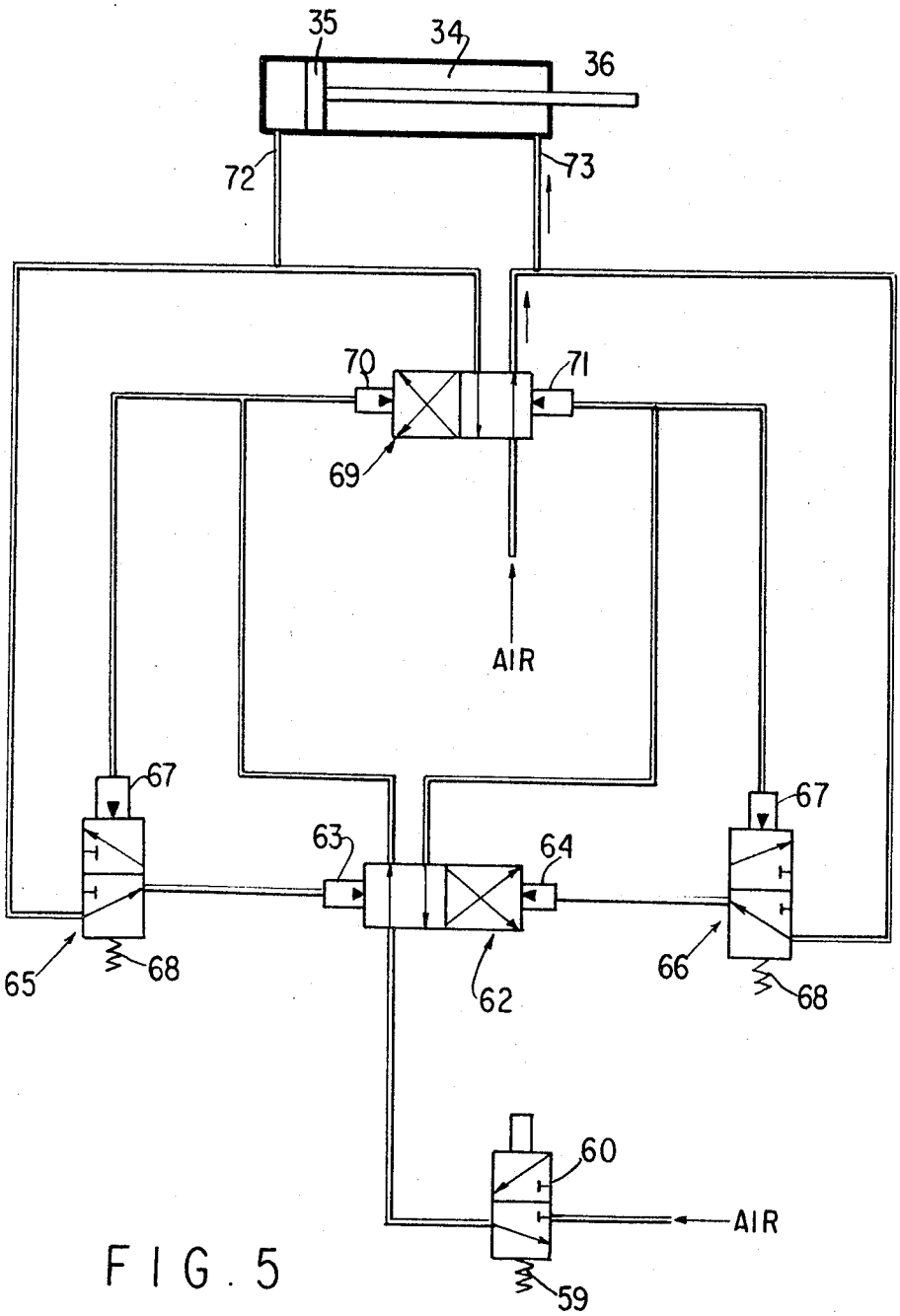

FIG. 5

INVENTOR
EDWARD J. MORIARTY
BY Ernest A. Jensen
ATTORNEY

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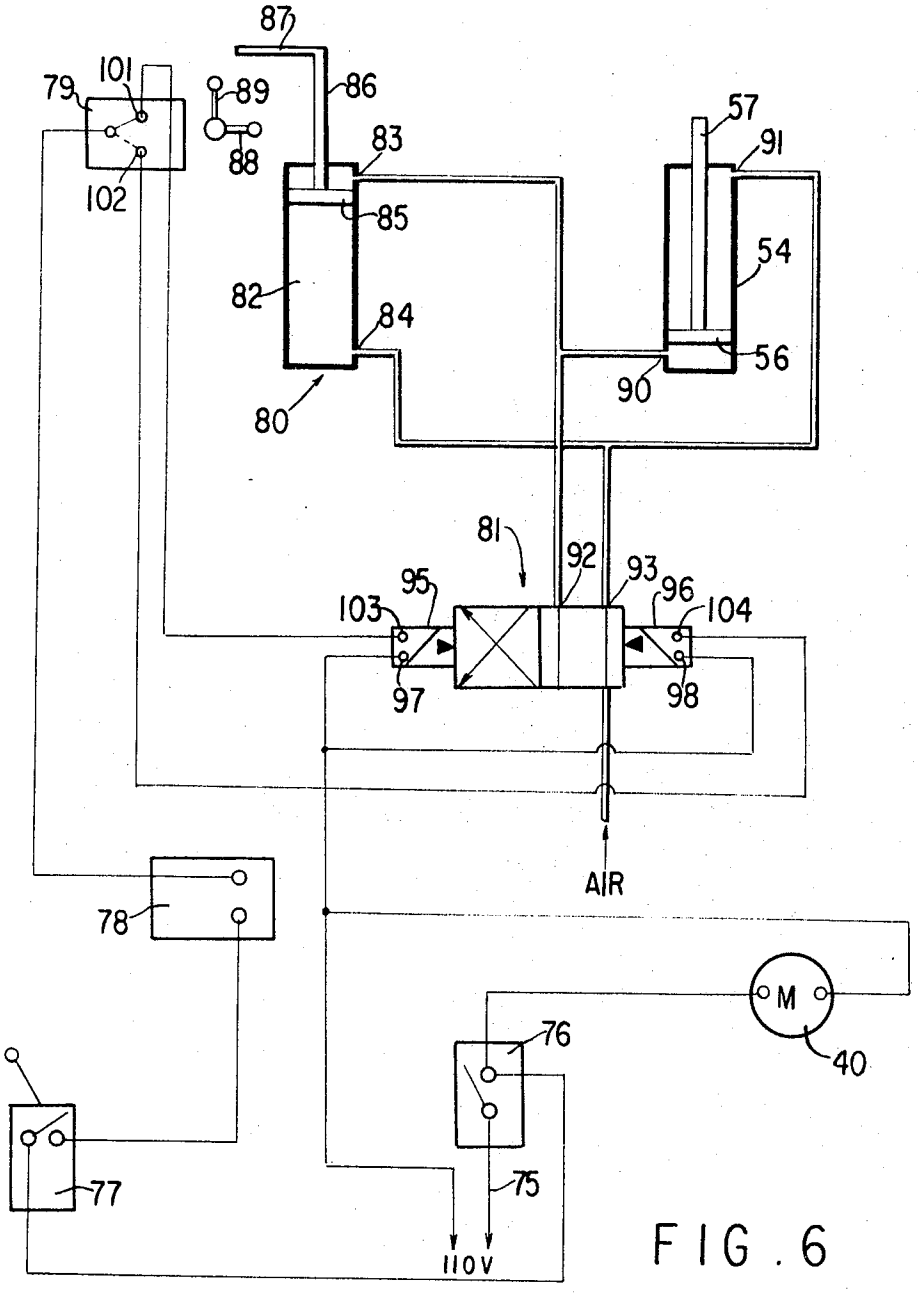

FIG. 6

INVENTOR
EDWARD J. MORIARTY
BY Ernest B. Lee
ATTORNEY

United States Patent Office

3,447,706

Patented June 3, 1969

3,447,706

BAG OPENING AND EMPTYING MACHINE

Edward J. Moriarty, 8821 Kenwood Road, Cincinnati, Ohio 45242

Filed Oct. 9, 1967, Ser. No. 673,762
Int. Cl. B65b 21/02, 69/00; B65g 65/04
U.S. Cl. 214—305
4 Claims

ABSTRACT OF THE DISCLOSURE

A machine for slitting a bag containing free flowing particles of material, vibrating the bag to empty the same, and an elongate member for ejecting the empty bag from the machine. The machine has one or more knives which alternately are moved in opposite directions by fluid pressure controlled mechanism. The operation of the bag ejecting member is controlled by a timer.

BACKGROUND OF THE INVENTION

Field of the invention

The present invention relates to material handling apparatus, and more particularly to a machine for opening bags or sacks and emptying the contents thereof into another receptacle.

Description of the prior art

Heretofore, bag opening and emptying machines have been devised but these machines were not entirely satisfactory because of slitting, emptying and ejecting problems.

SUMMARY OF THE INVENTION

Accordingly, an object of the present invention is to provide an improved bag opening and emptying machine which is not subject to the difficulties heretofore encountered.

Another object is to provide such a machine which assures proper opening of the bag and rapid and complete emptying thereof.

Another object is to provide such a machine which ejects the bag after a sufficient duration of time has elapsed to assure that the bag is empty.

Another object is to provide such a machine which enables the bags to be positioned either manually or by automation for proper slitting and ejection.

Another object is to provide such a machine which goes through its cycle of operation in response to placing a bag in position for opening and emptying.

A further object is to provide such a machine which is simple in construction, economical to manufacture and reliable in use.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

In accordance with the present invention, the foregoing objects are generally accomplished by providing a machine which comprises a frame, a basket supported by the frame having a series of spaced apart rods for supporting a bag filled with free flowing particles of material, knife means between adjacent rods positioned to slit the underside of the bag, means for moving the knife means to form a slit in the underside of the bag, means for vibrating the basket to cause the material to flow through the slit in the bag whereby the bag is emptied, tine means between adjacent rods and pivotally mounted

at one side of the frame, and mechanism for raising and tilting the tine means outwardly of the frame to eject the emptied bag from the machine.

BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the invention has been chosen for purposes of illustration and description, and is shown in the accompanying drawings, forming a part of the specification, wherein:

FIG. 1 is a plan view of a bag opening and emptying machine in accordance with the present invention.

FIG. 2 is a front elevational view of the machine shown in FIG. 1.

FIG. 3 is an elevational view of a vibrating mechanism located at the back of the machine.

FIG. 4 is a sectional view taken along the line 4—4 on FIG. 3.

FIG. 5 is a diagram of the knife means cylinder control circuit.

FIG. 6 is a diagram of the ejection cylinder control circuit.

DESCRIPTION OF THE PREFERRED EMBODIMENT

General description of the machine

Referring now to FIGS. 1 to 4 of the drawings in detail, there is shown a bag opening and emptying machine which generally comprises a frame **10**, a basket **11** supported by the frame for supporting a bag (not shown) filled with particles of free flowing material, knife mechanism **12** for slitting the underside of the bag, vibrating mechanism **14** (FIGS. 3 and 4) for inducing the flow of material from the slitted bag to empty the same, and mechanism **15** for ejecting the empty bag from the machine.

Frame and basket structure

The frame **10** comprises an upper rectangular frame member **16**, a vertical leg **17** at each corner of the frame member, a triangular shelf member **18** at each corner of the frame member, a hemispherical yieldable member **19** secured on the upper side of each shelf member, and a vertical plate **20** at one side of the frame member for mounting the motor of the vibrating mechanism **14** as described hereinafter.

The basket **11** comprises an upper rectangular plate **21** having a circular opening **22**, a hemispherical yieldable member **24** secured to the underside of the plate at each corner thereof and seated on one of the members **19** to resiliently support the basket on the frame whereby vibration of the basket is facilitated, an upright tube **25** having its upper end fitted into the plate opening **22** secured thereto by vertical radially extending web members **26**, a flexible fabric tube **27** (FIG. 2) secured to the lower end of the tube **25** for conducting the material emptied out of the bag to a bin or hopper (not shown), a plurality of parallel spaced apart bowed bag supporting rods **28** secured to the tube **25** near its upper end, and a horizontal vibrator connecting bracket **29** secured to the exterior of the tube **25** and positioned beneath the plate **20**.

Knife mechanism

The knife mechanism **12** comprises a shaft **30** journalled for rotation on the frame **10** and extending beneath and perpendicularly with respect to the bag supporting rods **28**, arms **31** mounted on the shaft for rotation therewith between adjacent rods **28**, a knife **32** at the end of each arm **31** for slitting the bag, an air operated motor including a cylinder **34** pivotally mounted on the frame at **33**, a piston **35** and a piston rod **36** and being valved

for reciprocating movement, and a bell crank **37** on the shaft **30** and linked to the free end of the piston rod **36**. The shaft thus rocks the knives clockwise and counterclockwise along an arc which passes through the bottom side of the bag to not only slit the bag but to also disturb a considerable portion of the material in the bag whereby flow thereof is induced. Also, by employing more than one knife, the bag is slit in several places whereby the time to empty the bag is greatly reduced.

As shown herein, the knives **32** are double edged and are formed with arcuate cutting surfaces **38**. This enables the knives to slit one bag while moving clockwise and to slit the next bag while moving counter-clockwise whereby a return stroke of the knives during each operating cycle is eliminated but the return stroke in the next operating cycle becomes the cutting stroke. Such an arrangement is highly advantageous because wear on the knife mechanism is reduced by one-half. Also, the knives by being double edged need only be removed for sharpening only half as often.

Vibrating mechanism

The vibrating mechanism **14** (FIGS. 3 and 4) comprises a motor **40** mounted on the plate **20** with its drive shaft **41** extending downwardly, a shaft **42** journalled for rotation in bearing means **44** on the bracket **29**, a pair of thick plates **45** eccentrically secured to the shaft **42** for rotation therewith, and a flexible shaft **46** connecting the motor shaft **41** and the eccentric shaft **42**.

By positioning one plate **45** above the bearing means and the other plate below the bearing means, the forces exerted on bearing means are balanced.

By being eccentrically mounted, the plates **45** upon being rotated impart vibration to the bracket **29** which vibration is transmitted to the tube **25** and the bag supporting rods **28** on the tube to shake the bag and cause material to flow therefrom and into the tubes **25** and **26**.

Ejecting mechanism

The bag ejecting mechanism **15** comprises a horizontal shaft **50** journalled for rotation at one side of the frame and being parallel with respect to the shaft **30**, elongate means such as structure having bent tines **51** positioned between and below adjacent bag supporting rods **28** and having a U-shaped extension **52** for mounting the fork structure for pivotal movement on the shaft **50**, and a reciprocating air operated motor including a cylinder **54** pivotally mounted on the frame **10** at **55**, a piston **56** and a piston rod **57** linked to the extension **52** at **58**.

The ejecting mechanism is arranged so that when the piston **57** is moved to its lowermost position, the free ends of the tines **51** are swung upwardly and outwardly beyond the frame **10**. As this occurs, the empty bag is lifted from the bag supporting rods **28** and is dropped to the side of the frame.

Knife mechanism control circuit

In FIG. 5, a control circuit for the knife mechanism motor is shown diagrammatically and includes conventional air operated valve and valve actuator elements. These elements have not been illustrated in detail in FIGS. 1 to 4 because their construction and operation will be better understood by their schematic disclosure.

These elements include a three-way Automatic Valve Co. valve **60** which is operated by a return spring **59** and by a lever **61** (FIGS. 1 and 2) extending between and above a pair of rods **28** and being moved downwardly by the weight of the bag when placed on the rods. A four-way Clippard valve **62** has actuators **63** and **64** which respectively are controlled by identical Clippard four-way valves **65** and **66** each having an actuator **67** and a return spring **68**. A four-way Allenair valve **69** has actuators **70** and **71** and is in fluid flow connection with port **72** and **73** at opposite ends of the motor cylinder **34**.

When the valve **60** is operated, the actuator of the valve **65** is pressurized causing this valve to close, and the actuator **63** of the valve **62** is exhausted. Simultaneously, the actuator **70** of the valve **69** is pressurized to shift this valve to a position so that air enters the cylinder at **72** whereupon the piston rod **36** is extended and the knife shaft **30** is turned counterclockwise causing the knives to slit the bag. When the bag is almost empty or its weight has decreased substantially, the return spring **59** of the valve **60** causes this valve to exhaust. This also causes the actuator of the valve **65** to be exhausted and causes the actuator **63** of the valve **62** to be pressurized whereupon the valve **62** is shifted.

When the valve **60** is again operated by the next bag, the actuator of the valve **66** is pressurized causing this valve to close, and the actuator **64** of the valve **62** is exhausted. Simultaneously, the actuator **71** of the valve **69** is pressurized to shift this valve to a position so that air enters the cylinder at **73** whereupon the piston rod **36** is retracted and the knife shift **30** is turned clockwise causing the knives to slit the bag. When the bag is almost empty or its weight has decreased substantially, the return spring **59** of the valve **60** causes this valve to exhaust. This also causes the actuator of the valve **66** to be exhausted and causes the actuator **64** of the valve **62** to be pressurized whereupon the valve **62** is shifted.

The knife mechanism control circuit has now been restored to its original position and is ready to repeat its cycle of operation upon actuation of the lever **61**.

Bag ejecting mechanism control circuit

In FIG. 6, a control circuit for the bag ejecting mechanism motor is shown diagrammatically which generally includes a source of electricity **75**, a main switch **76**, a control switch **77**, a timer **78**, a reversing switch **79**, a mechanism **80** for operating the reversing switch, and a control valve **81** for the bag ejecting mechanism motor and the mechanism **80**.

The mechanism **80** comprises a cylinder **82** having ports **83** and **84** at opposite ends, a piston **85** in the cylinder **81**, and a piston rod **86** having a lateral arm **87** for operating the reversing switch **79**.

The reversing switch has two operating arms **88** and **89** ninety degrees apart. When the piston rod **86** is retracted, the arm **87** engages the horizontally positioned arm **88** and moves it into a vertical position while moving the arm **89** into a horizontal position. When the piston rod **86** is extended, the arm **87** engages the horizontally positioned arm **89** and moves it back into its vertical position while returning the arm **88** to its horizontal position.

The bag ejecting mechanism motor includes the cylinder **54** which has ports **90** and **91** at opposite ends, the piston **56** and the piston rod **57**.

The switch **77** puts the timer **78** in operation when a bag of material contacts the lever **61**. The timer is constructed and arranged to close its contacts twice momentarily in cycle of operation, namely, when a sufficient duration of times has elapsed for the bag to be emptied and the bag is to be ejected and when the bag has been emptied.

The control valve **81** is a four-way Allenair valve which has ports **92** and **93** respectively connected to cylinder ports **83** and **90** and cylinder ports **84** and **91**, and has solenoids **95** and **96** for shifting its valve member.

One side of the source of electricity **75** is connected to a terminal **97** of the solenoid **95** and a terminal **98** of the solenoid **96**. The main switch **76**, the control switch **77** and the timer **78** are connected in series in the other side of the source. A terminal **99** of the timer is connected to a terminal **100** of the reversing switch **79**, and terminals **101** and **102** of the switch **79** are respectively connected to a terminal **103** of the solenoid **95** and a terminal **104** of the solenoid **96**.

The vibrator motor **40** is directly connected to one side and is connected to the other side through the main switch **76** so that the motor keeps running while the main switch is closed.

In operation with the main switch closed, momentary closing of the contacts of the timer **78** energizes the solenoid **95** of the valve **81** to position the valve so that air is supplied to the cylinder ports **83** and **90** whereupon the piston rod **57** is extended to raise the bag ejecting tines **51**, and the piston rod **86** is retracted to reverse the switch **79**. The next momentary closing of the timer contacts energizes the solenoid **96** of the valve **81** to position the valve so that air is supplied to the cylinder ports **84** and **91** whereupon the piston rod **57** is retracted, to return the bag ejecting tines **51**, and the piston rod **86** is extended to reverse the switch **79**.

The bag ejecting mechanism control circuit has now been restored to its original position and is ready to repeat its cycle of operation with each operation of the timer **78** by the control switch **77**.

SUMMATION

From the foregoing description it will be seen that the present invention provides an improved bag opening and emptying machine which responds to the weight of a filled bag to initiate an automatic cycle of operation. The machine is sturdy in construction and can withstand such rough usage to which it may normally be subjected.

As various changes may be made in the form, construction and arrangement of the parts herein, without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in any limiting sense.

I claim:

1. A bag opening and emptying machine comprising a frame, an open bottom basket, yieldable elements between said frame and said basket for supporting said basket on said frame to facilitate vibration of said basket, a pair of parallel members for supporting a bag filled with free flowing particles of material and having a space therebetween, a rotatable shaft on said frame at right angles to said members, an arm on said shaft, a knife on said arm positioned to move within said space and to slit the underside of the bag, means for rotating said shaft to cause said knife to move in an arcuate path and slit the underside of the bag, means for vibrating said basket to cause the material to flow through the slit in the bag whereby the bag is emptied, tine means positioned in said space and below the bag, means for pivotally mounting one end of said tine means on said frame, and mechanism for operating said last mentioned means to swing said tine means upwardly and outwardly of said frame and thereby lift the emptied bag and eject it from the machine.

2. A machine according to claim **1**, wherein said knife has two edges, and said shaft rotating means are constructed and arranged to alternately move said knife in opposite directions.

3. A machine according to claim **1**, wherein said members are rigid rods secured to said basket at the upper end thereof.

4. A machine according to claim **1**, wherein additional parallel members are provided with each adjacent pair having a space therebetween, and a sufficient number of arms and knives are operated by said shaft to provide a knife in each space to thereby form a plurality of slits in the bag whereby the bag emptying tine is shortened.

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HUGO O. SCHULZ, *Primary Examiner.*