July 25, 1967 D. G. MILLER 3,332,629

AUTOMATIC CLEARING MECHANISM FOR CRUSHERS

Filed Sept. 14, 1964 2 Sheets-Sheet 1

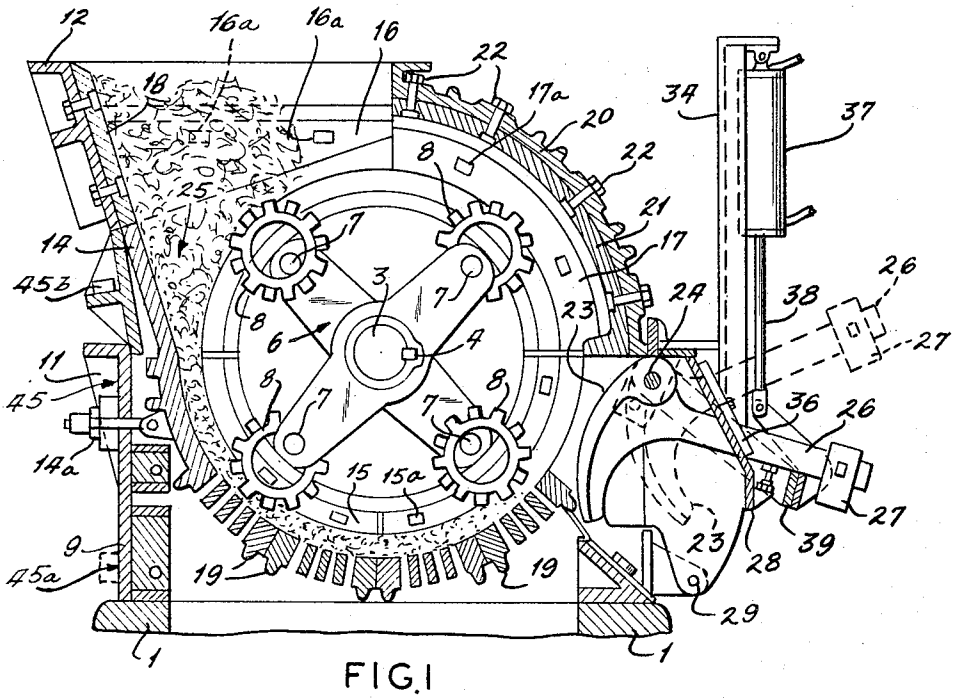


FIG.1

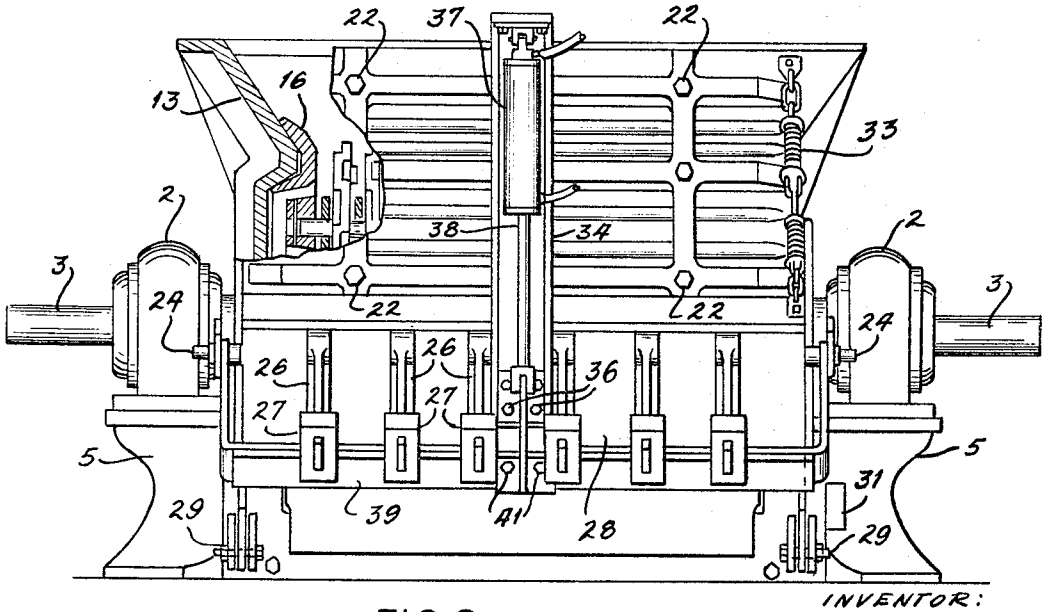


FIG.2

INVENTOR:
DONALD G. MILLER
BY
Gravely, Lieder & Woodruff
ATTORNEYS.

July 25, 1967 D. G. MILLER 3,332,629

AUTOMATIC CLEARING MECHANISM FOR CRUSHERS

Filed Sept. 14, 1964 2 Sheets-Sheet 2

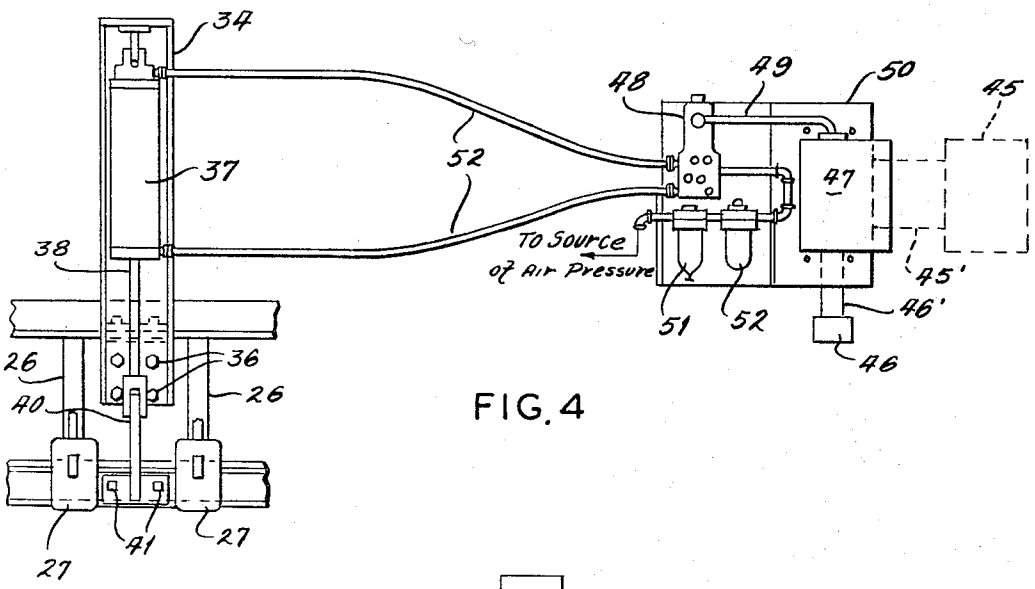


FIG. 4

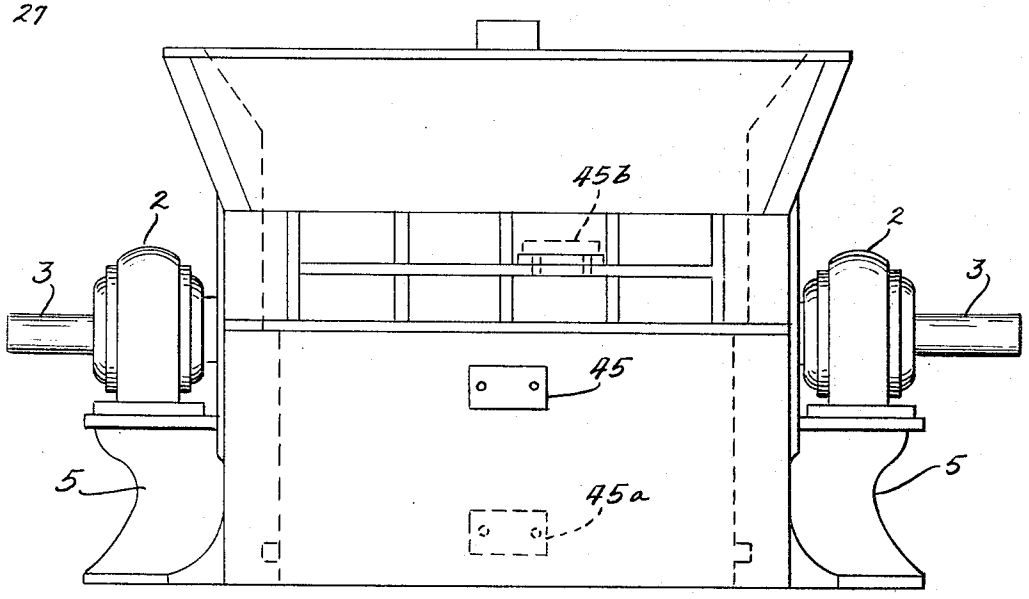


FIG. 3

INVENTOR:
DONALD G. MILLER
BY
Gravely, Lieder & Woodruff
ATTORNEYS.

United States Patent Office 3,332,629 Patented July 25, 1967

3,332,629

AUTOMATIC CLEARING MECHANISM FOR CRUSHERS

Donald G. Miller, Glendale, Mo., assignor to American Pulverizer Company, St. Louis, Mo., a corporation of Missouri

Filed Sept. 14, 1964, Ser. No. 396,058
5 Claims. (Cl. 241—33)

The present invention relates to automatic clearing crushers, and more particularly to a shock-initiated pneumatically actuated opening mechanism for discharging uncrushable material such as tramp metal and the like from crushers.

The present invention is an improvement over various rotary motion crushers and grinders which utilize tramp metal traps and impact operated discharge gates. Typically, the present invention is an improvement over U.S. Patent No. 1,520,228 granted Dec. 23, 1924, to Paul Knittel. One of the most difficult problems presented in crushing and grinding operations of metal turnings, coal and other materials is the inherent inclusion of uncrushable materials in the feed stock. For example, metal turnings often include nuts, bolts, etc. swept up in the process of obtaining metal turnings. Likewise, small chunks of stock material cut off during turning or cutting operations are often mixed with metal turnings. Previous machines had independently suspended gates which operated under impact and some also included a lever and lift bar for operating a multiplicity of the gates or fingers, as often referred to, whenever large quantities of tramp metal or other tramp material were present.

The present invention affords impact actuated fingers which under extreme conditions could independently operate and also be operated by an automatic control system. Preferably, the discharge or clearing gates or fingers, as they have become known, are preferably 8–10 inches wide to reduce leakage between adjacent fingers without impeding the efficiency of the grinding operation and the tramp material discharge operation. The mechanical lever for operating the lift bar to open a series of discharge fingers has been replaced by a pneumatic cylinder which has a plunger attached to a linkage adapted to raise the bar and hence open the fingers to discharge tramp material whenever the air cylinder plunger is retracted. An impact actuated switch is provided at a sensitive location on the crusher housing which detects impacts of shredder rings or hammers on tramp material. Whenever the shock or impact level is of a predetermined amount, the actuator switch completes a timing circuit which controls the operation of a solenoid valve to supply appropriate air pressure to retract the pneumatic cylinder plunger thus raising the bar opening the fingers to permit discharge of the tramp material present. The control timer provides a predeterminable time interval during which the fingers remain open.

It is, therefore, an object of the invention to provide an automatic clearing mechanism for a rotary type crusher to permit discharge of undesired tramp material.

It is another object of the invention to provide a tramp material discharge mechanism including a pneumatically actuated finger trip member controlled by an impact initiated electrical controller which operates a solenoid valve to control the operation of the pneumatic cylinder.

It is another object of the invention to provide an impact actuator switch on a crusher housing which has a crushing chamber and a tramp material discharge door, the actuator impact switch providing a control signal to a controller whenever tramp material is present in the crusher chamber whereby the controller activates an

opening mechanism to open the crusher chamber tramp material discharge door.

It is another object of the invention to provide a pneumatically operated tramp material discharge door for a crusher in which shock level present in the crusher because of the presence of tramp material is detected by a control circuit to open the tramp material discharge door for a preselected period of time and continued preselected intervals until discharge of the tramp material causing the detected shock.

These and other objects and advantages of the invention will become apparent from the appended claims and the detailed description forthcoming in conjunction with the drawings wherein:

FIG. 1 depicts in cross section the rotary crusher apertaining to the invention,

FIG. 2 is a rear view of the crusher in FIG. 1 illustrating the pneumatic finger trip mechanism,

FIG. 3 is a front view of the crusher illustrated in FIG. 1 which depicts an impact actuator switch in the normal location and alternate more sensitive and less sensitive possible locations, and

FIG. 4 schematically represents the control circuit connected to the pneumatic finger trip mechanism for opening the crusher chamber tramp material discharge fingers.

Referring now to FIGS. 1, 2 and 3 the preferred crusher will be described. Crusher **10** is supported from foundation **1**. Lower housing **5** mounts pillow blocks **2**. Rotor shaft **3** extends between pillow blocks **2** and has key **4**. Rotor shaft **3** carries cross arms **6** keyed to key **4** in shaft **3**. Cross arms **6** have ring shafts **7** which loosely support shredder rings **8**. The crusher **10** has removable lower plate **9**, grinding plate cover **11** and upper cover **12**. Upper housing **13** (see FIG. 2) partly supports breaker and grinder plate **14** that rests in lower housing **5**. Plate **14** is attached to plate cover **11** by bolts **14***a*. Liner **16** is bolted to upper housing **13** by bolts **16***a*, and liner **17** is attached to housing **13** by bolts **17***a*. Liner **18** is fixed to upper cover **12** by bolts. Liner **15** is attached to bottom housing **5** by bolts **15***a*. Grate bar panels **19** are supported by lower housing **5**. Round top **20** with liner **21** bolted thereto by bolts **22** completes the fully lined crusher chamber **25** with the exception of apron fingers **23** pivoted about finger shafts **24**. Finger shanks **26** mount counterweights **27**. Automatic apron **28** pivotally supported at hinge **29** mounts finger shaft **24**. Apron **28** carries counterweight **31**. Additionally, spring assemblies **33** at each side hold apron **28** in position. Support brace **34** attached by bolts **36** to apron **28** supports pneumatic cylinder **37** which has a plunger rod **38**. Lift bar **39** is pivoted from finger shaft **24**, and seats under shanks **26** in back of counterweights **27**. Linkage **41** couples plunger rod **38** to lift bar **39**. Thus whenever plunger rod **38** retracts into pneumatic cylinder **37**, lift bar **39** rotates about finger shaft **24** rotating fingers **23** thereabout.

In accordance with the invention, impact actuator switch **45** is positioned at the front of crusher **10** (see FIG. 3). Alternatively actuator switch **45** may be placed at position **45***a* for minimum sensitivity or at position **45***b* for maximum sensitivity. Referring to FIG. 4, impact actuator switch **45** is connected by electrical leads **45'** to control timer **47**. Also, manual control **46** is connected by leads **46'** to timer **47**. Timer **47** is electrically connected to solenoid control valve **48** by electrical conduit **49**. The timer **47** and valve **48** are conveniently mounted on remote control panel **50**. The pneumatic valve **48** has the conventional air filter **51** and oiler **52** interposed between the air pressure source and pneumatic valve **48**. Air control flexible lines **52** supply air pressure.

In operation, a motor (not shown) rotates shaft **3** and cross arms **6** in a counterclockwise direction to crush

metal shaving, etc. between shredder rings **8** and breaker and grinder plate **14** discharging the desired material through grate bars **19**. However, whenever a piece of uncrushable material or tramp metal entered into the crusher chamber **15**, the impact of shredder rings **8** thereon would produce sufficient shock to activate impact actuator switch **45** completing a circuit to the control timer **47** which in turn would activate pneumatic valve **48** to supply air pressure in pneumatic cylinder **37** raising plunger rod **38** moving lift bar **39** opening apron fingers **23** for a controlled period of time to discharge the uncrushable material.

For a more detailed description of the crusher operation, the heretofore noted U.S. Patent No. 1,520,228 should provide complete information. The present invention improves fingers **23** and increases their efficiency by widening them to avoid loss of material between adjacent fingers.

The pneumatic cylinder alternatively may be designed to operate from a manual switch control **46** rather than merely by the impact actuator switch **45**. The manual control switch can be used to override the automatic controls if occasion should arise and it is deemed necessary to keep the fingers open continuously for an extended period of time.

One such occasion for using the manual switch to override the automatic controls might be when a piece of tramp material is of such size, shape and density that it may require several or even a number of cyclings of the automatic control before it is ejected from the crushing chamber.

Another such occasion might be when it is known that extra large size tramp material or an extra large quantity of tramp material is about to or has entered the crusher and it is desired to get them out as soon as possible to avoid possible heavy damage and not wait for the time required to do this automatically through one or two opening cycles even though this time may be relatively short.

Another such occasion might arise if some malfunction should occur in the automatic controls. If this should happen the malfunctioning controls could be overridden by the manual switch until such time as they could be repaired.

Although the invention has been described with particular reference to a crusher quite similar to the crusher of U.S. Patent No. 1,520,228 it may be used equally well with various other types of crushers and grinders such as the drop grate or screen cage type crushers which are now prevalent. An air actuated pneumatic cylinder suitable for use as cylinder **37** may be obtained under the trade name Nopack Model E double acting nonrotating type, manufactured by Galland-Henning Nopack Division, Milwaukee 46, Wisconsin. A suitable pneumatic air valve **48** is one of the solenoid air valves Model 3JLSA4 manufactured by Numatics Inc., Highland, Michigan. A suitable impact actuator switch and control circuit is the vibra switch sold under the trade designation Robertshaw 66–C–WT–115 or 65–C–EP–115, manufactured by the Robertshaw Fulton Controls Company.

Various changes and modifications in the details of the automatically actuated finger trip mechanism of the present invention will become readily apparent to those skilled in the art and such minor changes and modifications are deemed to be within the spirit and scope of the present invention which is limited as solely necessitated by the scope of the appended claims.

What is claimed is:

1. An automatic clearing mechanism for crushers comprising in combination with a crusher including a housing, a concaved bottom grating supported within said housing, and a rotary shredder mechanism within said housing cooperating with said grating to define a crusher chamber, an opening defined by said housing for discharging uncrushable material from said crusher chamber, a series of pivoted fingers supported from said housing for independently and yieldably closing said opening, a bar operator for pivoting said series of pivoted fingers, pneumatic means for moving said bar operator, a time interval controller for activating said pneumatic means during a preset period, and an impact switch for activating said internal controller whenever the shock level within said crusher chamber indicates the presence of uncrushable material.

2. An automatic clearing mechanism for crushers comprising

(A) in combination with a crusher including a housing, a concaved bottom grating supported within said housing, and a rotary shredder mechanism within said housing cooperating with said grating to define a crusher chamber,

(B) an opening defined by said housing for discharging uncrushable material from said crusher chamber,

(C) a series of pivoted fingers supported from said housing for independently and yieldably closing said opening,

(D) a bar operator for pivoting said series of fingers in concert, and

(E) means for moving said bar operator to pivot said fingers into open position.

3. The mechanism of claim **2** wherein the housing includes a fixed portion and movable apron, the said housing opening being defined by an edge of the apron and an edge of the fixed portion of the housing whereby the said opening is enlarged when the apron is moved to an open position, the pivoted fingers being mounted on the apron, and the bar operator moving means is a pneumatic cylinder and piston mounted on a support fixed to the apron and movable therewith, and including link means connecting the bar operator to the piston for movement therewith.

4. The device of claim **2** wherein means for moving the bar operator is pneumatic and the pneumatic means is operated by a solenoid valve and including an impact sensor mounted on the crusher for operating said solenoid valve when uncrushable material is present in the chamber.

5. The device of claim **4** including a manual override means for operating said solenoid valve independently of the impact sensor.

References Cited

UNITED STATES PATENTS

1,520,228	12/1924	Elzemeyer et al.	241—86
2,405,059	7/1946	Sahmel	241—33

FOREIGN PATENTS

222,934	8/1962	Austria.

ANDREW R. JUHASZ, *Primary Examiner.*