June 18, 1957 J. R. DANEK 2,796,128

METHOD OF DETECTING A PLUGGED CONDITION OF A DIE

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Fig 2

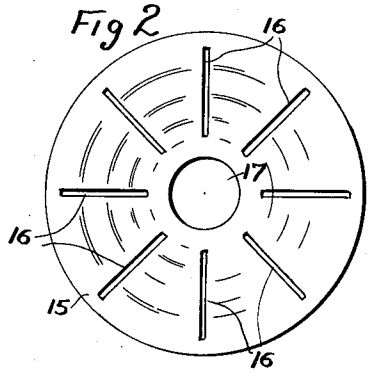
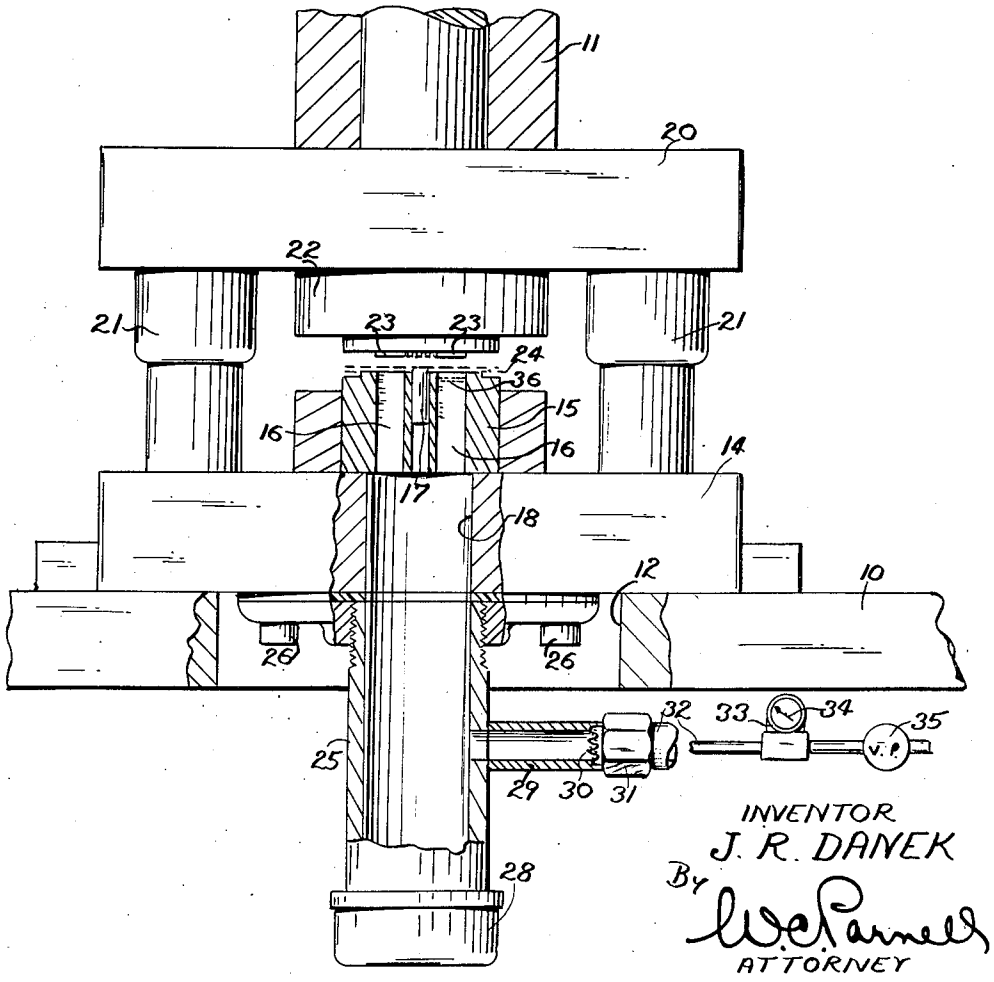


Fig 1



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METHOD OF DETECTING A PLUGGED CONDITION OF A DIE

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This invention relates to methods of detecting the plugged condition of dies, particularly those used in perforating methods and apparatus.

In perforating machines, the scrap parts, commonly known as slugs punched from materials through the aid of punches and dies, usually travel downwardly through the die openings and out through openings in the die holder and in the bed of the press. When the perforations are reasonably large, the punches can withstand the necessary force required to push the slugs through the die openings, to points where they may fall freely through the other openings in the press.

In the present embodiment of the invention, the parts to be perforated are formed of thin metal and the perforations are to form a plurality of radially extending slots which are only five thousandths (.005) of an inch in width. The die openings and the punch elements are, therefore, of similar dimensions to produce these extremely narrow perforations or slots. These very narrow punches must be kept as short as possible and cannot have sufficient travel to forcibly clear the die of each slug as it is formed. Due to the thinness of the material as well as other contours of the diaphragm type of article produced, the slugs tend to stick in the die and it has been very difficult to keep them from piling up in the die openings and causing the punches or perforators to break. Past practice has called for the punch press operator to stop after approximately twenty-five parts have been perforated and to clean out each die opening with a suitable clean out tool. However, even with this precaution, it has not been possible to produce a large number of parts between perforator breakages. Furthermore, the numerous clean out operations, particularly the severe use of the clean out tool required when numerous slugs or parts become stacked in the die openings result in breakage of the perforators, has greatly increased the wear on the die and shortens the life of the die. If it were possible for the operator to know immediately when one or more of the die openings became clogged with one of the slugs or scrap parts, the single part could be removed easily with little loss of time and with substantially no damage to the die. This also would prevent any possible breakage of the perforators.

The object of the invention is a method and apparatus by the aid of which the method may be practiced of detecting any plugged condition of a punch and die combination.

With this and other objects in view, the invention employed in combination with the punch and die combination includes an apparatus by the aid of which the method may be practiced for creating a subatmospheric air pressure on underside of a die which may vary from a normal value as the result of a clogged condition of the die opening.

In the present embodiment of the invention, a closed chamber communicating with the die opening is connected through a pressure gauge to a vacuum pump to create a pressure differential on the opposite ends of the die opening whereby the gauge will register any clogged condition of the die opening.

Other objects and advantages will be apparent from the following detailed description when considered in conjunction with the accompanying drawing, wherein:

Fig. 1 is a front elevational view of a press embodying the invention, portions thereof being shown in section, and

Fig. 2 is an enlarged top plan view of the die.

The apparatus selected to illustrate the invention is a press having a bed **10** and a reciprocable ram **11**. The bed **10** has a cavity **12** over which the die holder **14** is mounted in the conventional manner. A die **15** mounted on the holder **14** is provided with a plurality of radially positioned die openings **16** positioned about a central core **17** and communicating with an opening **18** in the die holder. The die, as shown in Fig. 1, is closer to the actual size than the plan view shown in Fig. 2, and the part produced by this method and apparatus is a flexible diaphragm type of structure with annular corrugations through which slots .005 of an inch in diameter are to be cut or perforated while a central aperture of each part fits over the core **17**.

A tool or punch holder **20** fixed to the ram **11** may be provided with the conventional guiding means **21**. A punch or perforating unit **22** mounted on the underside of the tool holder **20** carries a set of perforators **23** corresponding in number, position and size to the die openings **16** to cooperate therewith in perforating the slots in the material indicated at **24**.

The apparatus by the aid of which the method may be practiced includes a chamber **25** secured firmly and sealed to the underside of the die holder **14** as at **26** in alignment with the aperture **18** to provide direct communication through the aperture **18** between the chamber **25** and the die openings **16**. The lower end of the chamber **25** is shown closed by the aid of an element **28** but it is apparent that any suitable means such as a self-sealing trapdoor type of structure may be employed, normally closing and sealing the lower end of the chamber, yet permitting convenient opening of the chamber for the escapement of the slugs or punched parts therefrom. An outlet **29** for the chamber **25** is provided with a filter unit **30** and is connected at **31** with an air line **32** a portion of which is shown schematically to include a pressure gauge **33** with a pointer **34** and a conventional dial (not shown). A vacuum pump **35** is connected in the line **32** beyond the gage **33**.

Considering now the method, it will be apparent that the vacuum pump will create a subatmospheric pressure below the die openings **16**. Furthermore, it is possible with the conventional pumps of this type to create a known subatmospheric pressure which will be registered by the pointer of the pressure gauge **33**. During each operating cycle of the press **8**, perforations will be formed pushing a slug into each die opening which should drop through the opening or pulled through the opening by the subatmospheric pressure but, as is found in certain instances, the slug as indicated at **36** may remain in a die opening thus plugging the opening. Each slug, when plugging a die opening, creates a certain amount of friction, otherwise it would drop free. Therefore, other slugs piling up on top of the initial slug and adding thereto the required force to move the piling up group of slugs downwardly into the die cavity will eventually cause breakage of the perforator **23**.

The creation of the subatmospheric pressure of a known value will eliminate a percentage of the parts **36** from plugging their respective die openings, but during instances when the suction or subatmospheric pressure

should not be sufficient, there will be a noticeable change or increase in the pressure which will be recorded by the gauge 33. It is recognized that momentarily, when the punch and die are closed, the perforators will close all of the die openings 16 and cause a momentary action of the pointer of the pressure gauge from its normal position, but as soon as the punch is moved upwardly to its open position, the pointer should return to its normal position. If the pointer fails to do this, it is obvious that one or more of the die openings has become plugged. Furthermore, the pointer will indicate how many of the die openings have been plugged, this being apparent due to the fact that the normal value of the subatmospheric pressure will cause the pointer to be located at one position and each clogged opening will cause it to move a known distance from the normal position. In this manner, the operator after each operating cycle may know whether or not any of the die openings have been clogged so that safe operation may continue until such notice is registered on the gauge. At this time, the press may be stopped and with little effort the single slug may be caused to continue its movement through the die opening through the aid of a suitable tool and thereby eliminate stacking up of additional slugs or parts therefrom.

It is to be understood that the above described arrangements are simply illustrative of the application of the principles of the invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. The method of detecting a plugged condition of the die of a punch and die combination which comprises the punching of material with the punch and die to thereby insert successive slugs downwardly into the die, establishing a subatmospheric pressure at a normal value below the die to draw the slugs from the die, and periodically during operation of the punch and die measuring the pressure below the die and comparing it with the normal value.

2. The method of detecting a plugged condition of a multiple punch and die combination having a plurality of die openings comprising the punching of material with the multiple punch and die to thereby insert successive slugs downwardly into the die openings, establishing a subatmospheric pressure at a normal value below the multiple die to draw the slugs from the openings of the die, and periodically during operation of the punch and die measuring the pressure below the die and comparing it with the normal value.

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