Sept. 9, 1969 M. E. BLAIS 3,465,634

PUNCH

Filed Feb. 20, 1967

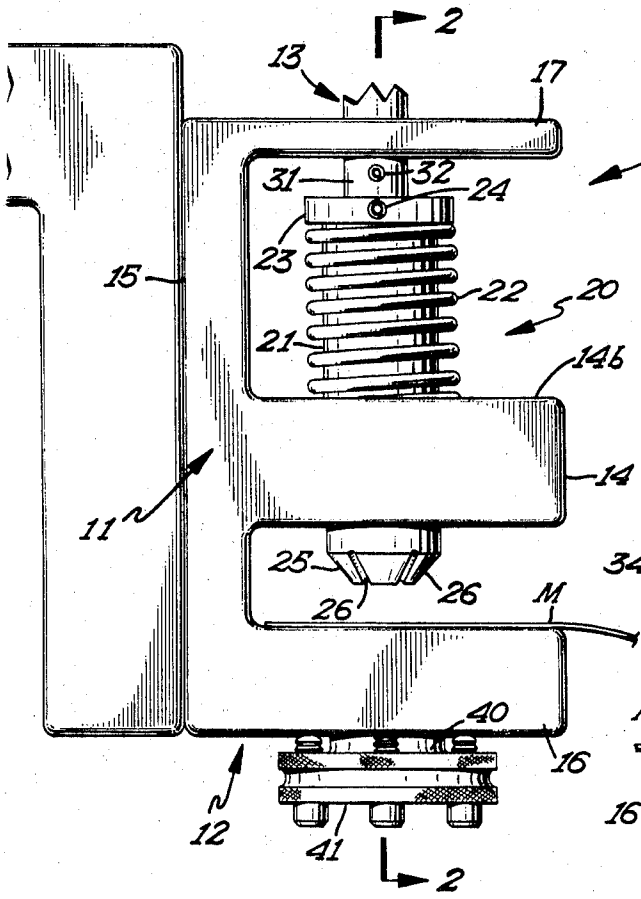


FIG 1

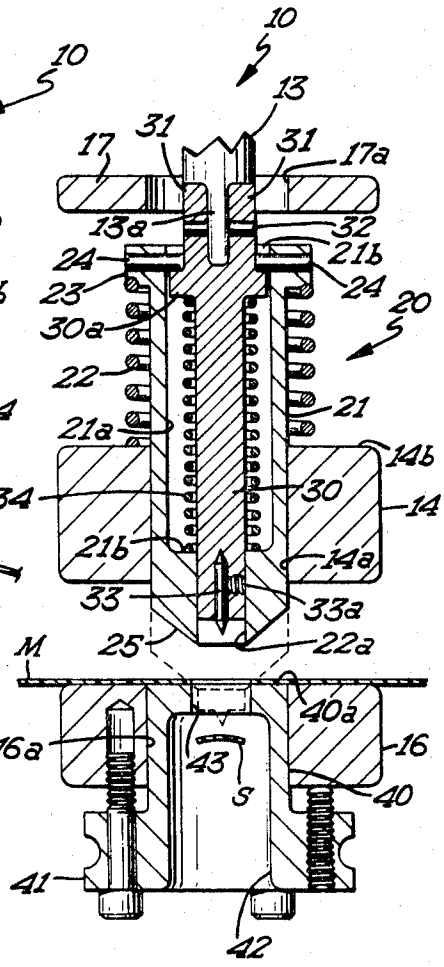


FIG 2

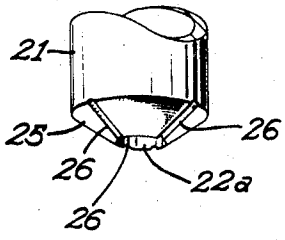


FIG 3

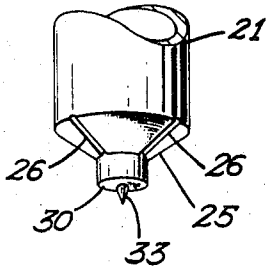


FIG 4

INVENTOR.
MAURICE E. BLAIS
BY Adams, Cwayna & Haugen
ATTORNEYS

United States Patent Office

3,465,634

Patented Sept. 9, 1969

3,465,634

PUNCH

Maurice E. Blais, Rumford, R.I., assignor to G. T. Schjeldahl Company, Northfield, Minn., a corporation of Minnesota

Filed Feb. 20, 1967, Ser. No. 617,377

Int. Cl. B26d 7/18; B26f 1/02

U.S. Cl. 83—695 3 Claims

ABSTRACT OF THE DISCLOSURE

A punch adapted for punching thin flexible materials, including a punch member and a die arranged in axially aligned relationship, means are provided for shifting the punch into engagement with the die for cutting therebetween, the punch surface including a punching face with a plurality of non-die engaging portions whereby areas of attachment are provided between the punched area and the work. As a further feature, the punch is provided with a stripper arranged to be shifted into the area defined by the punch face to break away the attachment areas and remove the punched slug from the work, the stripper member having a pin means which is arranged to pierce the surface of the work prior to the time of engagement between the stripper and the slug.

A punch mechanism for forming openings in substantially thin sheet materials which punch includes a first punching and forming mechanism brought into registration with the material to be punched and forming in cooperation with a mating die an opening therethrough except for select places about the opening wherein the punching is not accomplished and the material within the punched area and the remainder of the material remains joined at a plurality of positions. This punch mechanism is then followed by a knock-out mechanism which is received into the punch area and drives the punched area outwardly therefrom tearing the areas which have been previously joined to the main portion of the material. This punching and knockout sequence is controlled by providing biasing means of different strengths such that the punch will be actuated and the punching operation completed before the knock-out process is initiated.

In punching substantially thin materials, a problem exists due to the ability of the material to deform about the punch member. As a result, the openings to be punched often are not clearly defined and the material often leaves the punch area carrying along the supposedly punched slug.

The device provided by applicant incorporates a unique punching face having a plurality of non-punch areas spaced thereon, which areas will hold the punched slug onto the carrying material and includes a slug stripper member sequentially driven into the slug to tear the minimal joined sections of the carrier material from the punched slug and carry the punch well away from the carrier material. In other words, the device actually provides a unit which will hold a punched slug in proper stripper position such that the stripper may exert its knock-out force entirely thereagainst, and as such, will complete the punching operation by tearing the partial attachment segments.

The operation of applicant's punch is sequential in that the primary punching member is initially engaged with the material to be cut to perforate at least a major portion thereof leaving minimal attaching sections between the punched slug and the carrier material and thereafter, on a continuing stroke of the main punch carrier, to move the stripper into contact with the now defined slug and strip the same from the carrier material.

This operation is entirely sequential due to an arrangement of the biasing means between the longitudinal or axial drive member and the punch itself.

It is therefore an object of applicant's invention to provide an improved punch member which will substantially define a punch area and will hold the punched slug therein for a subsequent stripping and knock-out action delivered to the defined slug.

It is a further object of applicant's invention to provide a unique sequential punching operation wherein a first major punch member substantially perforates and defines the slugs to be punched and thereafter a stripper member is engaged with the slugs to be punched for stripping from the carrier material. The operations occurring in a sequential arrangement on a single stroke of the drive or tool member.

It is still a further object of applicant's invention to provide a punch and stripper member which will substantially remove a punched slug away from a carrier film once it has been cut from the film so that it will not be carried along thereby.

These and other objects and advantages of the invention will more fully appear from the following description, made in connection with the accompanying drawing, wherein like reference characters refer to the same or similar parts throughout the several views and in which:

FIGURE 1 is a side elevation illustrating a punch embodying the concept of applicant's invention in proper punching position on a supporting frame.

FIGURE 2 is a vertical section taken substantially along line 2—2 of FIGURE 1.

FIGURE 3 is a perspective view of the punch element particularly illustrating the non-punching areas thereof.

FIGURE 4 is a view similar to FIGURE 3 illustrating the stripper mechanism in knock-out position with respect to the punch face.

In accordance with the accompanying drawings, the punch embodying the concept of applicant's invention, is generally designated **10** and includes a frame assembly **11**, a lower die assembly **12**, and means for driving the punch **13**, which means may be a simple reciprocating shaft member having means for connecting the shaft member to the punch proper. The support frame **11**, in the form shown, consists of a punch guide portion **14** extending outwardly from a vertical support member **15** and spaced above a lower die retaining section **16**. An additional shaft guide member **17** may be provided in upwardly spaced relationship from the punch guide member **14**, as illustrated in FIGURE 1. A plurality of aligned apertures **14***a*, **16***a*, **17***a* are provided respectively in each of the supporting and guiding elements **14**, **16**, **17** to provide an axial arrangement for positioning the respective portions of the punch system therein.

The punching section of this device **10** is generally designated **20**, and includes in the form shown, a substantially cylindrical punch member **21** arranged for vertical reciprocation in guide passage **14***a* and includes, at the lower end thereof, a punch face **22** and at the upper end thereof, a stop shoulder **23**. This cylindrical punch member **21** is substantially hollow over a major portion thereof to provide a cavity **21***a* therein for housing a stripper member generally designated **30**, and likewise is provided with a passage **21***b* on the upper end thereof adjacent the shoulder portion **23** to permit attachment thereof to the driving means **13**.

One method which may be utilized to attach the punch **10** to the driving means **13** is to provide a pair of bifurcations **31–31** at the uppermost end of the stripper member **30** and provide the driving means **13** with a downwardly extending leg **13***a* to be received between the bifurcations **31–31** with a pin member **32** providing the connection therebetween.

In the form shown, a first spring member **22** is provided between the aforementioned upper shoulder **23** and the uppermost surface **14***b* of the punch guide support **14**. This spring **22** is compressive in nature and tends to return the punch cylinder **21** into an uppermost position, as illustrated in FIGURES 1 and 2.

In order to provide connection between the punch member **21** and the stripper **30**, a pair of inwardly extending pins **24–24** are provided radially through the aforementioned shoulder portion **23** to extend into the cavity **21***a* of the cylinder **21** such that an uppermost shoulder **30***a* of the stripper will normally abut thereagainst on its upward stroke, which abutment will serve to not only aid the spring **22** in returning the punch cylinder **21** to its upward position, but will likewise capture the stripper **30** within the cavity **21***a*.

The punch face **22** of the punch **21** is, in the form shown, angularly arranged with respect to the longitudinal axis of the cylinder **21** to provide an upwardly beveled face **25** thereon. This is the actual punching face of the punch and will, when in operation, mate with the lower die section **12** to cut the material M therebetween. The particular shape of this die face **25** is not highly critical although the applicant has found that an angular arrangement with respect to the axis of the cylinder of approximately 40 degrees is highly efficient and provides proper cutting. It should be obvious that this particular plunger face **25** could be of many different shapes depending upon the particular opening being cut into the material M and applicant does not wish to limit himself to a particular design for the plunger face except as hereinafter follows.

The important aspect of the plunger face **25** is the provision of a plurality of grooves **26** arranged thereon and extending therein. These grooves **26** are cut into the face **25** of the punch such that when the punch face **25** mates with the corresponding die, no material will be cut in these areas and rather, the slug being punched will be retained by certain uncut sections spaced therearound to hold the same in substantially the same planar relationship with the material as before punching of the material. These sections of attachment are substantially small but do afford the strength to retain the punched area in position below the punch to afford striking thereby by the knock-out and stripper member **30**. It should be obvious that to properly hold such a knock-out section for stripping that at least three such sections of non-perforation **26** should be provided about the punch face **25**.

In order to afford the striker or stripper member **30** the action to strip the low selectively held slug S from the material M an aperture **22***a* is provided substantially centrally and axially of the punch face **25** such that the stripper **30** is free to reciprocate therein. As illustrated in FIGURE 2, a needle point **33** is provided axially of the stripper **30** and is held herein by a set-screw or the like **33***a* with the piercing point of the needle **33** extending outwardly from the end of the stripper **30**. It should also be observed that, as illustrated in FIGURE 2, in the retracted position, the pin member **33** is well behind the foremost end of the punch face **25**. A second spring member **34** is contained within cavity **21***a* and abuts at one end with the outwardly extending shoulder **30***a* of stripper **30** and at the other end with the cavity surface **21***b* surrounding the aperture **22***a* of the punch **21**. This spring member **34** is of substantially higher compressive force than the aforementioned spring member **22** such that in operation, when a longitudinal axial force is provided by the driving means **13**, the punch member **21** will compress spring **22** to be driven into mating relationship with the lower die **12** affording the first cut into the material without shifting the stripper **30** relative to the punch cylinder **21**. After the punch member **21** has been driven down to mate with the die and cut the material M, the continued axial force of the driving means **13** will force the stripper member **30** downwardly into the new selectively held slug S and included in this motion the pin member **33** will pierce the film substantially centrally thereof and the continued downward force will break the selective attachment areas. The pin member **33** serves the function of locating the slug S properly with respect to the stripper **30** and it should be obvious that when cutting particularly thin materials, this location is necessary as otherwise it could be possible that one of the selectively held areas would break before the other of such areas therefore permitting the slug to bend about the other still connected areas and prevent the tearing thereof from the material M.

The lower die section **12** includes a substantially cylindrical unit **40** received into the die guide aperture **16***a* and the die support **16**, and includes a lower flange **41** extending outwardly from the cylindrical portion **40** such that the die may be properly held into the guide **16** and properly positioned with respect to the surface of the support **16***b* over which the material M will travel. The die **40** is provided with a longitudinal passage **42** therethrough, which passage terminates in the actual die passage **43** formed upwardly therein, which die passage **43** terminates at its upper surface **40***a* which surface corresponds to the top-most surface of the die support **16** and which is the mating surface for punch **10**.

As illustrated in FIGURE 2, the stripper member **30** is designed to be received into passage **43** such that it will push the defined slug S entirely therethrough and into the substantially larger cavity **42** therebelow. This pushing of the slug S is important in that it is necessary to completely remove the slug S from the material being cut to prevent the slug S from being carried therealong.

The operation of the punch should be substantially self-explanatory, but a short description is given hereinafter. As the drive member **13** is driven downwardly, the fact that spring member **22** is of less compressive strength than the internal spring of stripper **34**, will permit the spring **34** to actually drive against the lower internal portion **21***b* of cavity **21***a* and drive the punch **21** downwardly into mating cutting position with the die **40**, and more particularly with the die passage **43** in the die **40**. This downward function will, as previously stated, cut a slug in the material, which slug is retained onto the material through a plurality of substantially small connective links, being the links in the areas of non-cutting **26** of the punch face **25**. After the punch face **25** has been driven into cutting relation with the die **40**, the continued downward motion of the drive means **13** will force the stripper member **30** downwardly through passage **22***a* where the needle point **33** will be driven into the partially held slug S and continued downward motion will rend the still attached portions of the slug S from the material M and will subsequently force the slug S to be delivered through passage **43** into the larger area **42** completely away from the carried material M. Retraction of the drive means **13** and removal of the downward force from the drive means **13** will, of course, permit the compressive springs **22** and **34** to force the stripper **30** and punch element **21** upwardly into proper position well above the material M to allow the material to be moved therepast to the next punch location.

Although illustrated in circular form, it should be obvious that this same concept could be utilized in any particular shape, and of course, in more complicated shapes, it may be necessary to properly locate the non-cutting areas of the punch face about the slug.

It should be obvious that applicant has provided a new and unique punch mechanism for partially retaining slugs from punch areas until a stripper member moved in sequential relationship to the punch is available to rend the slug from the material, thereby preventing the slug from folding under or being carried along with the material after supposed cutting.

It will, of course, be understood that various changes may be made in the form, details, arrangements and pro-

portions of the parts without departing from the scope of the invention as set forth in the appended claims.

What is claimed is:

1. A punch adapted for punching thin materials, including:

(a) a punch member;

(b) a die arranged in aligned relation to said punch member;

(c) means for shifting said punch into engagement with said die for cutting therebetween;

(d) said punch including a punching face having a plurality of non-die engaging portions thereon whereby areas of attachment are provided between the punched area and the material; and

(e) a stripper member arranged and constructed to be shifted into the area defined by said punch face to break the attachment areas and remove the punched area from the material, said stripper being arranged and constructed to be shifted by said punching shifting means; and

(f) differential biasing means connecting said punch member and said stripper member to said punch shifting means permitting said punch member to perform the punching operation before actuating the stripper member.

2. The structure as set forth in claim 1 being particularly characterized in that said stripper member is provided with a forward face having pin means disposed therealong, said pin means being arranged to pierce the surface of said thin material prior to the time of engagement between said forward surface and said pin material.

3. The structure as set forth in claim 1 and said biasing means including a pair of spring members having different compressive strength respectively operatively associated with said punch and stripper members.

References Cited

UNITED STATES PATENTS

2,501,682	3/1950	Kuchman	83—128
2,789,640	4/1957	Belden	225—96 XR

LEONIDAS VLACHOS, Primary Examiner

U.S. Cl. X.R.

83—128, 678, 686; 225—96