Feb. 22, 1966 M. ROBERT 3,236,130

APPARATUS FOR CONTINUOUS PNEUMATIC PUNCHING

Filed June 24, 1963 2 Sheets-Sheet 1

FIG. 1

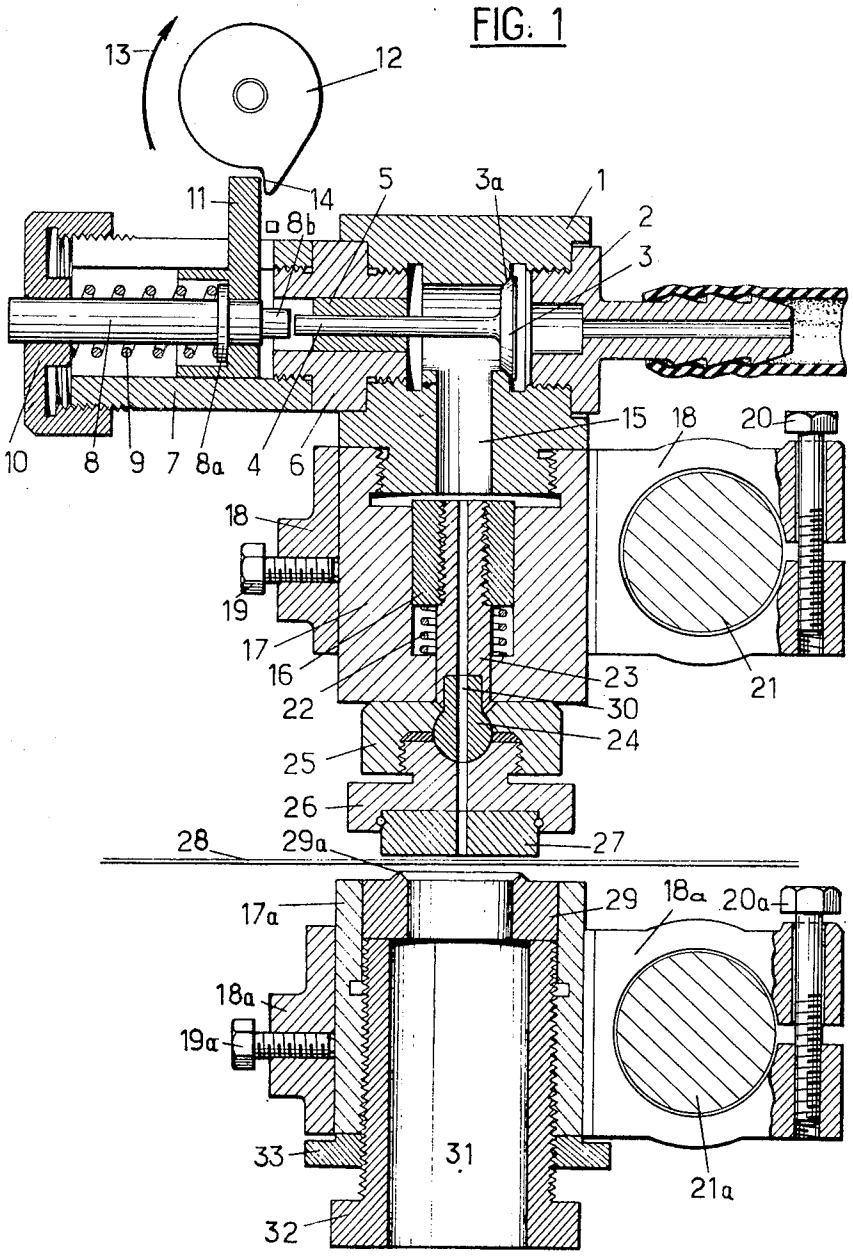

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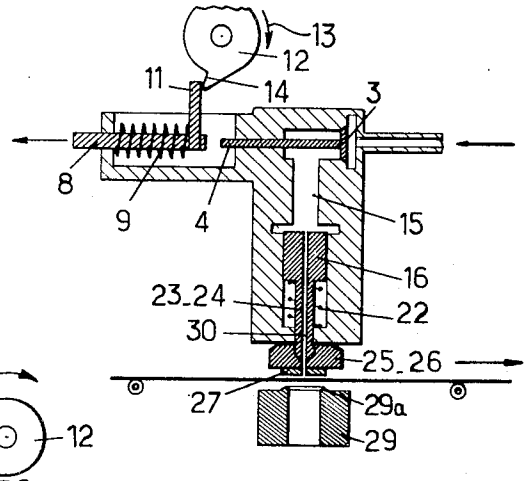
FIG. 2



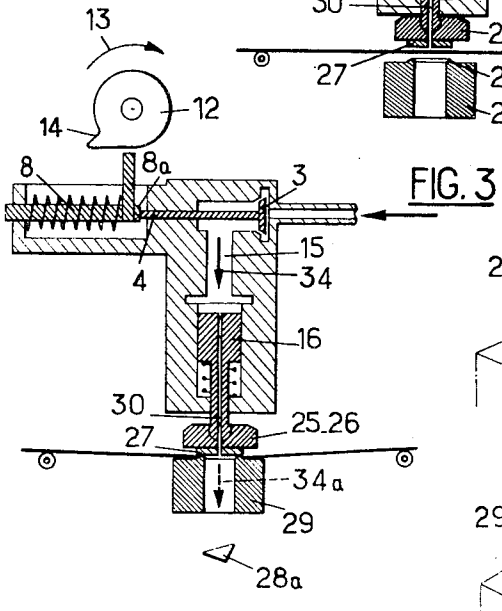


FIG. 3

FIG. 4

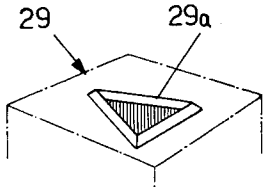


FIG. 5

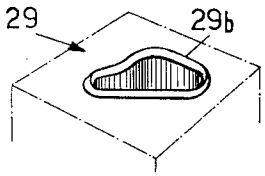


FIG. 6

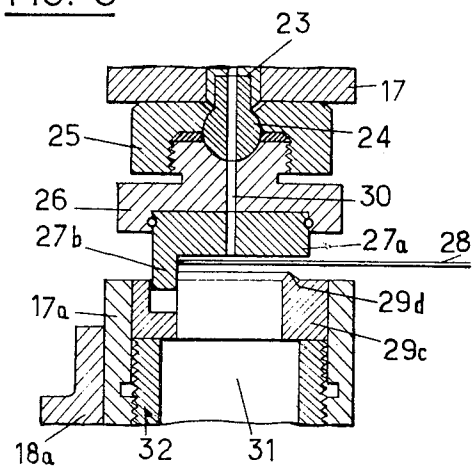
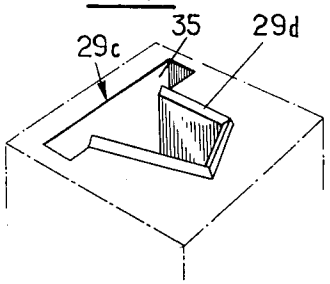


FIG. 7



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3,236,130

APPARATUS FOR CONTINUOUS PNEUMATIC PUNCHING

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Claims priority, application France, June 25, 1962, 498, Patent 1,326,202
5 Claims. (Cl. 83—98)

The present invention relates to a method of pneumatic punching intended to execute perforation at high speed at the center or at the edges of a thin ribbon or tape made of any continuously driven material.

The invention has also for its object a novel apparatus comprising the combination of a valve normally retained on a seat by the action of compressed air supplied to said apparatus through an inlet nozzle, said valve being intermittently opened by the effect of the fast action of a spring-biased striker periodically actuated by suitable means acting on the stem of said valve and allowing temporary entry of said compressed air into the apparatus and of a piston normally maintained in an elevated position by a spring. Said piston comprises a central bore which permits simultaneous said compressed air to act simultaneously for a very short time on said piston and upon that part of the ribbon which is to be eliminated by punching.

The aforesaid results are obtained by combining the action of the punching tool and of a piston operated at high speed by compressed air with the action of said compressed air itself on the part of the ribbon to be eliminated.

At the time that the edge of said part of the ribbon is gripped between the piston and the punching tool, the compressed air delivered through a bore in the center of the piston applies a pressure over said ribbon part, which facilitates the punching or shearing of the material along the knife edge of the punching tool and considerably reduces the duration of the punching operation.

The combined actions of the compressed air and of the punching tool reduce the effective duration of each individual punching operation to about one ten-thousandth of a second for 2 mm. thick cardboard moving at a speed in the order of 100 meters per minute.

The number of strikings of the piston may vary within a wide range, for instance between 1000 and 2000 strikings per minute, according to the number of punchings which have to be effected on said tape, the type of actuating means used being dependent on the number of strikings required.

Other objects and features of the present invention will be better understood by reading the following description of two embodiments of the apparatus for carrying out the present invention, with reference to the accompanying drawings upon which:

FIG. 1 is an elevation of the apparatus including a cam actuated percussion device;

FIG. 2 is a schematic view of the apparatus as shown on FIG. 1, the piston being in its upward position;

FIG. 3 is a view similar to FIG. 2, the piston being in its lowered or punching position;

FIG. 4 is a detailed perspective view showing the shape of the cutting tool for a triangular punching;

FIG. 5 is a detailed perspective view similar to FIG. 4, but showing a different punching pattern;

FIG. 6 is a detailed sectional view of the base of the apparatus shown on FIG. 1 which has been modified to employ the present invention in the case of a punching to be effected on the edge of the ribbon;

FIGURE 7 is a perspective view showing the cutting tool of FIGURE 6.

Referring now to FIG. 1, it can be seen that the present apparatus comprises a valve support **1** upon which is mounted a nozzle **2** intended for admission of compressed air.

Such compressed air normally presses the valve head **3** against a conical seat **3***a* of support **1**.

The stem **4** carrying head **3** is mounted in a sleeve **5** in a sleeve support **6** upon which is mounted a striker housing **7** enclosing a striker **8** provided with a collar **8***a* and with a striker spring **9**, said striker being enclosed by an adjustable end cap **10** upon which the spring **9** bears.

This spring is periodically compressed by an actuator or pusher **11** slidably mounted within housing **7**, said pusher being actuated by a cam **14** rotating in the direction indicated by arrow **13**, said cam periodically engaging pusher **11** through shoulder **14**.

Each time that pusher **11** is disengaged from cam **12**, spring **9** of striker **8** expands violently and the head **8***b* of striker **8** strikes stem **4** of valve **3**.

Valve **3** is then opened during a very short time till the end of the expansion of striker **8** after which the compressed air arriving through nozzle **2** to return the valve **3** to its seat.

While valve **3** is opened, a certain amount of compressed air enters a bore **15** and actuates a piston **16** within a cylinder **17** mounted on support **1**. The height of this cylinder may be adjusted with respect to a collar **18** by means of a bolt **19**.

The collar **18** is fastened to a bar **21** by means of bolt **20**.

The downward movement of piston **16** compresses a spring **22** and moves a support **23** for a ball and socket joint upon which ball **24** is mounted.

The ball and socket sleeve **26** is seated in a cap **25** which carries the hammer **27** and ensures, upon downward movement of piston **16**, a perfect application of ribbon **28** over the knife edge of punching tool **29**.

A passage **30** is bored through the center support **23**, of ball **24**, sleeve **26** and hammer **27**, to allow the compressed air to act simultaneously on that part of ribbon **28** which is located inside knife **29***a* of punching tool **29**.

The combined action of compressed air and punching tool **29** effects the punching in a substantially instantaneous way, and the cutting **28***a* (FIG. 3) is eliminated immediately through a channel **31** within the center of the adjustable tool support **32**.

The support **32** and the tool **29** are mounted within a cylinder **17***a*, whose height may be adjusted by a nut **19***a* relatively to a collar **18***a*.

Collar **18***a* is rigidly mounted on a bar **21***a* of the machine frame by means of a bolt **20***a*.

A lock nut **33** fastens support **32** on cylinder **17***a*.

Referring now to FIG. 2, the same reference numbers as on FIG. 1 will be found. As shown the striker spring is just at the beginning of its compression step, the valve **3** being still closed by the action of compressed air, piston **16** being at its elevated position.

On FIG. 3, it can be seen that pusher **11** of the striker is just disengaged from cam **12** and that striker **8** has driven its head **8***b* with great force against stem **4** of valve **3**, which then opens for a very short time.

The compressed air passing through bore **15** and channel **30** in the direction indicated by arrows **34** and **34***a* actuates piston **16** while applying at the same time a pressure on the center of the part of the ribbon **28** which is then cut against the knife of the punching tool by the action of hammer **27**.

An instant punching is thus obtained and cutting **28***a* is immediately expelled through opening **31**.

FIGS. 4 and 5 show two different shapes of cutting knives, referenced respectively **29***a* and **29***b*.

On FIGS. 6 and 7, the punching has to be effected on one of the edges of ribbon **28**. The punching tool, referenced **29***c* on said figures, is provided, in such case—independently of knife **29***d*, very clearly represented on FIG. 7—with a recess **35** within which a protruding boss **27***b* provided on hammer **27***a* is slidably mounted.

The protruding boss **27***b* prevents compressed air admitted through bore **30** from escaping on the side where punching tool **29***a* has no knife edge **29***d*, and allows an increase in cutting speed in the same manner as in the case of punchings which may be effected by knives **29***a* and **29***b*.

It is well understood that those skilled in the art may modify or change the illustrated embodiments as shown or described, or replace certain elements of these embodiments by equivalents without departing from the basic concept of the invention, as defined by the appended claims.

What is claimed is:

1. Punching apparatus comprising in combination two axially aligned members for perforating sheet material positioned therebetween, a piston connected to move one of said members toward and away from the other, a pressure chamber in which said piston is slidably mounted, first resilient means biasing said piston and one member away from the other member, valve means controlling the admission of pressure fluid to said chamber to drive said piston and one member toward the other member, said valve means comprising a valve member urged toward its closed position by the pressure of fluid travelling toward said chamber, a striker, second resilient means for biassing said striker against said valve member in a direction urging said valve member into its open position, and mechanically driven means which alternately compresses said second resilient means to eliminate valve opening pressure on said striker and valve member and suddenly releases said compressed resilient means to drive said striker against said valve member to open said valve, said piston being formed with a central bore through which a portion of the compressed fluid admitted to said chamber is directed against said material as said one member is driven toward the other member.

2. Apparatus as claimed in claim **1** in which said chamber is defined by relatively movable means which permit adjustment of the chamber volume.

3. Apparatus as claimed in claim **1** in which said one member is connected to said piston by a ball and socket joint.

4. Apparatus as claimed in claim **1** comprising adjustable abutment means for adjusting the throw of said valve member.

5. Apparatus as claimed in claim **1** in which said one member is provided with a boss projecting toward the other member, and said other member is recessed to admit both said boss and the piece to be cut from said material by said members, said boss being positioned to enter one side of said recess, and the remaining sides of said recess being bordered by cutting edges.

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