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FLIGHT SCORING PUNCH

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2 Sheets-Sheet 2

FIG. 3

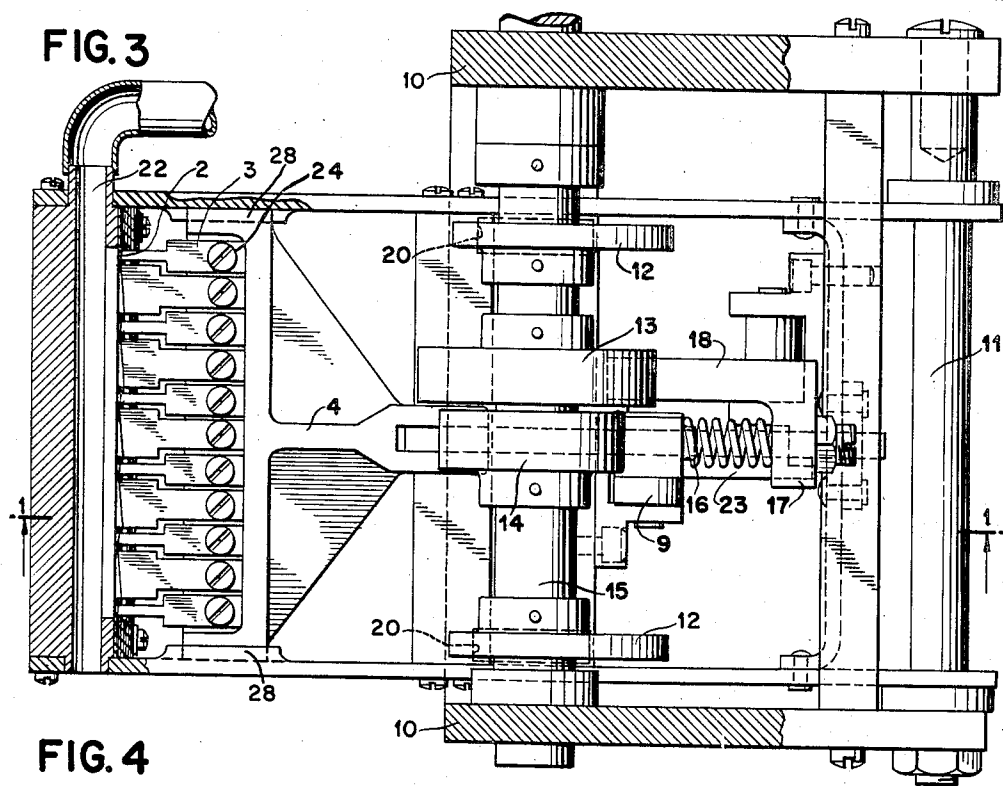
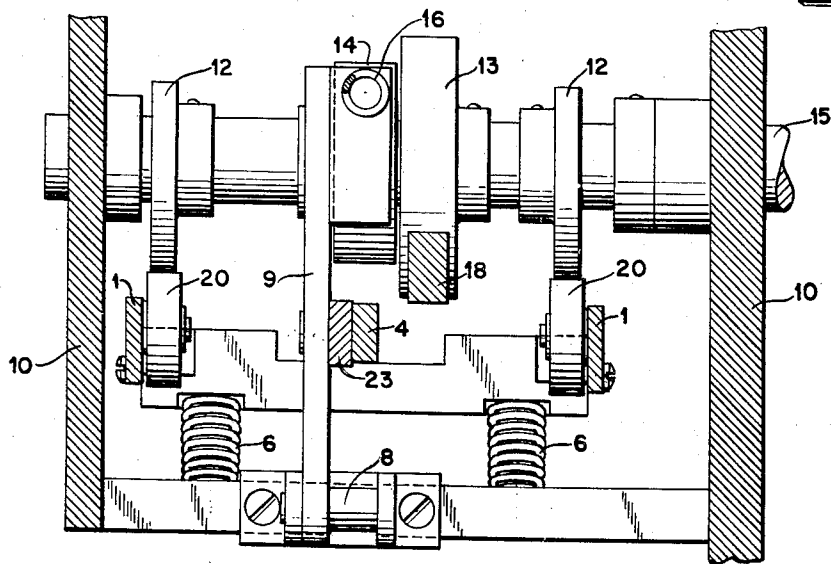


FIG. 4



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FLIGHT SCORING PUNCH

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5 Claims. (Cl. 164—89)

This invention relates to a web perforating mechanism, and more particularly to a scoring punch capable of perforating a web in motion.

A punching mechanism according to this invention is capable of accomplishing the perforation of a moving web at predetermined intervals established by the synchronization of the control cams of the flight scoring mechanism with the web moving means. A shaft to which the cams are firmly attached makes one revolution per area of web to be scored, during which interval one cam moves the punch and die carrier vertically, another cam accomplishes the punching operation and a third cam preloads the punch and facilitates the retraction of the punches. The third mentioned cam and its follower create a heavy spring load on the punch cam follower at the time of the punching and release this spring load after the punching operation to facilitate the retraction of the punches and to reduce wear on the punch cam.

An object of this invention is to provide an improved scoring mechanism which can suitably perforate a web without interfering with its motion.

Another object is to provide a scoring mechanism in which the punches are preloaded for a more efficient operation.

Another object is to provide a scoring mechanism which can punch more quickly than before.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings which disclose, by way of example, the principle of the invention and the best mode which has been contemplated of applying that principle.

In the drawings:

Fig. 1 is a functional view of the flight scoring mechanism with the punch and die carrier shown in the starting position. The section is taken on lines 1—1 of Fig. 3.

Fig. 2 is the same view with the punch and die carrier at the mid-point of its downward travel.

Fig. 3 is a plan view of the same mechanism including a chip exhaust tube.

Fig. 4 is another structural side view taken on lines 4—4 of Fig. 2.

Fig. 5 is a section of a scored web.

In the flight scoring mechanism as illustrated by Figs. 1 and 2, carrier 1 which carries die 2 and punch 3 is pivoted on shaft 11 which is connected to the main frame 10 (Fig. 3). Rollers 20 which are attached to move freely with the punch and die carrier 1 cooperate with a pair of die vertical motion cams 12 to impart motion as viewed in Figs. 1 and 2, to punch slide 4 and die carrier 1. Die vertical motion cams 12, which turn on shaft 15, have a high and low portion which impart an angular and a circular motion to rollers 20 and thereby displace the punch and die carrier 1 and the punch slide 4 a predetermined angle during the operation of the flight scoring mechanism. Each of the punches 3 is attached to the punch slide 4 by a screw 24.

Fixedly attached to the punch and die carrier 1 is a metal piece 5 which controls tensioning of spring 6. The

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other side of spring 6 is attached to bar 7. Each time that the punch and die carrier 1 is moved down, as is shown in Figs. 1 and 2, or longitudinally in relation to the moving web, metal piece 5 presses against the upper portion of spring 6 and causes spring 6 to be pressed down towards bar 7.

Punch slide 4 is directly connected to the punch cam follower 9 by link 23. One end of the punch cam follower 9 is pivoted on the fixed center 8. The other end rides on punch cam 14, which is rotated by shaft 15. Whenever the riding part of the punch cam follower 9 enters into groove 25 during the rotation of punch cam 14, punch cam follower 9 moves counterclockwise, at the same time bringing link 23 to the left, which causes the punch slide 4 to score the moving web with punches 3. As the punch cam 14 continues its clockwise rotation, as illustrated by the arrow in Figs. 1 and 2, punch cam follower 9 is returned to the high portion of punch cam 14, thereby shifting the link 23 and the punch slide associated therewith to the right so as to retract the punches. Punch slide 4 is guided for reciprocation in suitable grooves 28 in the carrier 1.

Referring more specifically to Figs. 3 and 4, it may be seen that a cam shaft 15 carries and operates four distinct cams, two die vertical motion cams 12, a punch cam 14 and a spring loading cam 13. Spring loading cam 13 has high and low portions which engage cam follower 18 which is pivoted at pin 21. At the other end of cam follower 18 is located a spring 16 whose other end is supported by stud 29 on cam follower 9. In this way compressing and relaxing of spring 16 is accomplished by the operation of both cam followers 9 and 18. Spring 16 is biased for counterclockwise operation of cam follower 9. Pin 21 is mounted on a pair of ears 30 on bar 19.

The cams are mounted in predetermined relationship to each other and are driven in the same direction by shaft 15. In the disclosed embodiment the cams are so arranged on the shaft that when the punch cam 14 reaches the punching position during any rotation, the die vertical motion cams 12 present the mid-point of their distance relative to shaft 15 to rollers 20 and spring loading cam 13 presents its highest point to its cam follower 18. This position of the die vertical motion cams 12 during the actual punching operation means that the punch slide 4 and the associated punch and die carrier 1 will be perpendicular to the moving web 21 at the time that the punch 3 goes through the web. This may best be seen by referring to Fig. 2. In this figure the punch 3 has already gone through the web and so cam follower 18 is shown on the lowest level of spring loading cam 13. However, at the time that cam follower 9 falls into groove 25 of punch cam 14 for driving the punch through the web, cam follower 18 will be at the highest point of spring loading cam 13 and will be in position to fall quickly to the lowest point of cam 13. This arrangement permits spring 16 to be at its greatest compression just prior to and during the punching operation and at its least compression during the retracting operation when punch 3 is removed from die 2.

Figs. 3 and 4 illustrate more clearly the relative structural inter-relationship and appearance of the various components of the flight scoring mechanism. It must be understood that any pattern of punches 3 appropriate for scoring might be used. The cavity labeled 22 in Fig. 3 is merely an exhaust tube to drop off the chips which fall during a punching operation. Fig. 4 shows more clearly the inter-relationship between the die vertical motion cams 12, rollers 20 and springs 6 for accomplishing the lateral motion of the punch and die carrier 1. As shown in Fig. 4, two springs 6 are actually employed to make rollers 20 follow cams 12 in the preferred embodiment.

Fig. 5 illustrates the character of the scoring which is accomplished by the punching mechanism although it must be understood that any scoring pattern may be developed by changing the character of the punches shown in Fig. 3. The scoring may be done on a standard business machine card, as shown in Fig. 5, or on any other appropriate record material.

Functionally and referring specifically to Figs. 1 and 2 the flight scoring mechanism will be examined through one complete cycle of its operation. Initially it must be understood that in order to score a particular web at a predetermined distance thereon it is necessary that the rotation of cam shaft 15 be synchronized with the web feeding mechanism. Rollers 26 constitute a part of such a feeding mechanism.

Assuming that the start of a typical scoring cycle occurs when rollers 20 touch die vertical motion cams 12 at a point where the least distance occurs between their perimeter and cam shaft 15, the punch and die carrier 1 will be in one of the two extreme positions of its travel, as shown in Fig. 1. At this time springs 6 will be in their state of least compression. Since cam follower 9 is on the high portion of punch cam 14 and cam follower 18 is on the higher going portion of the spring loading cam 13, spring 16 will be in a high state of compression.

As cam shaft 15 continues its clockwise rotation, an ever higher going portion of the die vertical motion cams 12 will be presented against the surface of rollers 20, thereby turning the rollers and displacing them laterally with relation to cam shaft 15.

Since rollers 20 ride on pins attached to the punch and die carrier 1, the punch and die carrier continues to be displaced longitudinally in relation to the moving web at a rate determined by the configuration of cams 12 which is such that the free end of the punch travels at the speed of the web. As the cam 15 continues its rotation, the spring loading cam 13 continues to present an ever higher portion of its surface to its cam follower 18, thereby increasing the compression of spring 16. The compression in springs 6 is increased as a result of the downward motion of the punch and die carrier. When the clockwise rotation of the die vertical motion cams 12 approaches the point where it causes rollers 20 to move the punch and die carrier 1 and punch slide 4 to almost a perpendicular relationship with the moving web, the highest surface of spring loading cam 13 is presented to its cam follower 18 and spring 16 is at its highest state of compression. Punch cam 14 is approaching the punching position.

When the punch and die carrier 1 and punch slide 4 are exactly perpendicular to the moving web, cam follower 9 will drop into notch 25 of punch cam 14 at a greater speed than would otherwise occur because of the great compression developed in spring 16 by cam follower 18 acting in conjunction with the spring loading cam 13. As cam follower 9 enters notch 25 of punch cam 14, it brings link 23 down and thus causes the punch slide 4 to which the link is pinned to go down also, driving the punches attached to the slide through the moving web. Since the punch slide 4 and the punch and die carrier 1 are also moving during the punching operation, no time is lost in perforating the web.

Spring 16 which was at its highest state of compression just prior to the actual punching operation is at its lowest state of compression after punches 3 perforate the moving web. This results from the fact that followers 9 and 18 which determine the degree of compression of spring 16 are resting on the lowest points of punch cam 14 and spring loading cam 13, respectively, at this time, therefore, there is least compression in spring 16 during the retraction of the punches. The increased compression of spring 16 during punching and its decreased compression during retraction permit an efficiency of operation which would not otherwise be possible.

As cam shaft 15 continues its clockwise rotation, cam

follower 9 will be returned to the high portion of punch cam 14 and cam follower 18 will ride an even higher portion of the spring loading cam 13 until the next punching operation. In this way spring 16 will again be returned to its highest state of compression. The die vertical motion cams 12 will continue to move rollers 20 a greater distance from cam shaft 15, in this way causing the punch and die carrier 1 and punch slide 4 to move longitudinally with the moving web even after the punching operation. The punches 3 are retracted as a result of the action of cam follower 9, leaving notch 25 of punch cam 14 during the clockwise rotation of the punch cam 14.

Springs 6 will continue to be depressed further between metal piece 5 and bar 7 after the punching operation until rollers 20 arrive at the highest point of the die vertical motion cams 12, at which time springs 6 will be at their highest state of compression. As the die vertical motion cams 12 present an ever lower portion to rollers 20, the punch and die carrier 1 will travel from its bottom-most position to its top-most position, as illustrated in Figs. 1 and 2. From a time shortly after the actual punching operation, compression has been gradually building up in spring 16 and it will continue to increase until the next punching. However, in the case of springs 6, compression has built up only during the forward motion of the punch and die carrier in relation to the moving web and relaxation of springs 6 occurs when the punch and die carrier 1 travels backward in relation to the moving web or upward as illustrated in Figs. 1 and 2. Springs 6 thereby serve to provide a steady movement of the punch and die carrier 1 in relation to the moving web.

Spring loading cam 13 continues to present an ever higher portion of its perimeter to its cam follower 18 as the punch and die carrier 1 returns to its forward or upper position in preparation for another scoring operation. The compression of spring 16 continues to be increased as punch and die carrier 1 moves forward towards the center position for punching until it is at its maximum state of compression just prior to the punching operation. It reaches this condition immediately prior to the dropping of cam follower 9 into notch 25 of cam 14. The punches are thus able to perforate the web with a force and speed not previously achieved in the art.

Since cam follower 18 drops to the lower portion of spring loading cam 13 as the punches penetrate the web, spring 16 is now in its most distended form, in this way permitting the much speedier retraction of the punches than heretofore.

In order to accomplish the preloading of the punches for obtaining a more efficient scoring operation, as described above, the spring loading cam 13 and the punch cam 14 must be mounted on shaft 15 in proper relationship so that during each scoring cycle maximum compression will be developed in spring 16 immediately prior to the entry of cam follower 9 into notch 25 of punch cam 14 and so that cam follower 18 will be on the lower portion of spring loading cam 13 during the retraction of the punches. By modifying the structure of the cam followers 9 and 18 it might be possible to alter the angular distance between notch 25 of punch cam 14 and the sharp down portion of the spring loading cam 13 without affecting the proper operation of spring 16 in preloading the punch and serving to make a more efficient retraction.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art, without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. In a punching machine, means for feeding record

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material in a predetermined path and at a predetermined speed, a carrier mounted for oscillation about a pivot, a punch mounted on said carrier for movement toward and away from the pivot, a spring connected to said punch to resiliently urge it away from the pivot, a plurality of control devices, comprising a first control device mounted to oscillate said carrier and punch about the pivot, a second control device mounted to load said spring and hold it in a loaded position, and a third control device mounted to release said spring and impel said punch in its punching direction and thereafter to retract said punch, said second device being arranged to effect unloading of said spring prior to retraction.

2. The invention according to claim 1 in which said spring is loaded through the application of force at one end by said second control device and is released through the operation of said third control device which enables the opposite end of said spring to act on said punch, and the further unloading is affected by removing said force by said second control device.

3. The invention according to claim 2 in which the plurality of control devices comprises a set of cams configured to effect the operations in timed relation to the movement of the record material.

4. In a punching machine, the combination comprising a carrier mounted for oscillation about a pivot, a punch mounted on said carrier for movement toward and away from the pivot, a spring connected to the punch to resiliently urge it away from the pivot, first, second and third cams mounted on a common shaft, a first cam follower cooperating with said first cam and attached to said carrier for oscillating said carrier and punch into and from a punching position, a second cam follower cooperating

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with said second cam for loading said spring and holding it in a loaded position, a third cam follower cooperating with said third cam and attached to said carrier to release said spring and to impel said punch in the direction of punching and thereafter to retract said punch, said second and third cam followers serving to load said spring during retraction.

5. In a punching machine, means for feeding record material in a predetermined path and at a predetermined speed, a punch and an activating spring therefor, a carrier, said punch being mounted on said carrier for travel in a direction of record material movement to effect punching, said carrier being pivoted to oscillate in a path adjusted to the record material, first, second and third control devices, said first device to oscillate the carrier and punch, said second device for loading said spring and holding it in a loaded position, and said third device to release said spring and to impel said punch the direction of punching and thereafter retract said punch, said second device being arranged to effect unloading of said spring prior to said retraction, said second and third devices participating in the initial loading of said spring during said retraction operation after which said second device gradually brings said spring into its fully loaded condition.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,854,077

September 30, 1958

Donald A. Novak et al.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 47, for "web 21" read -- web 27 --; column 6, line 18, after "punch" insert -- in --.

Signed and sealed this 2nd day of June 1959.

(SEAL)

Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents