July 30, 1957. W. S. BAKER ET AL 2,800,959

WINDOW CHANNELING MACHINE

Filed Nov. 5, 1952 2 Sheets-Sheet 1

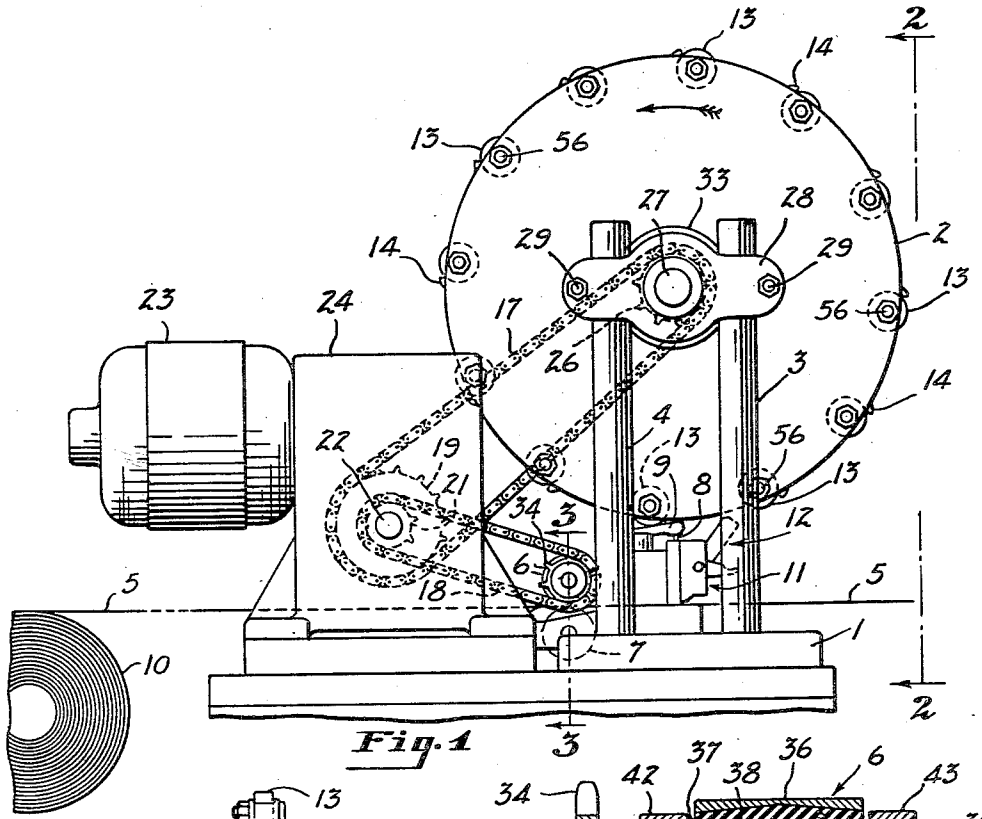

Fig. 1

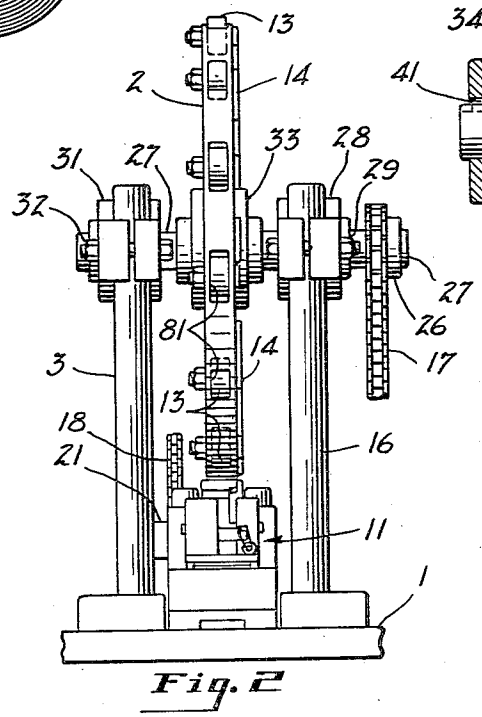

Fig. 2

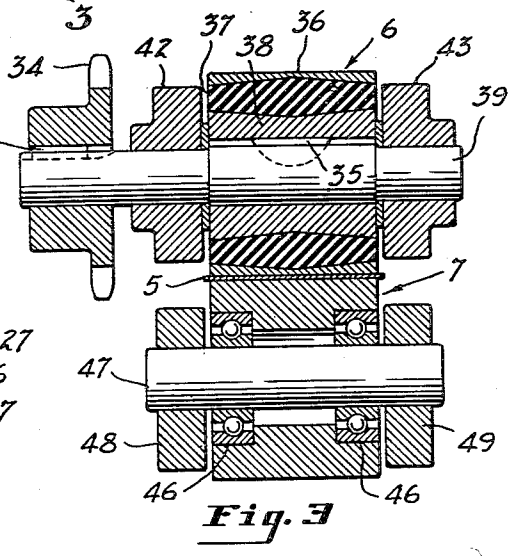

Fig. 3

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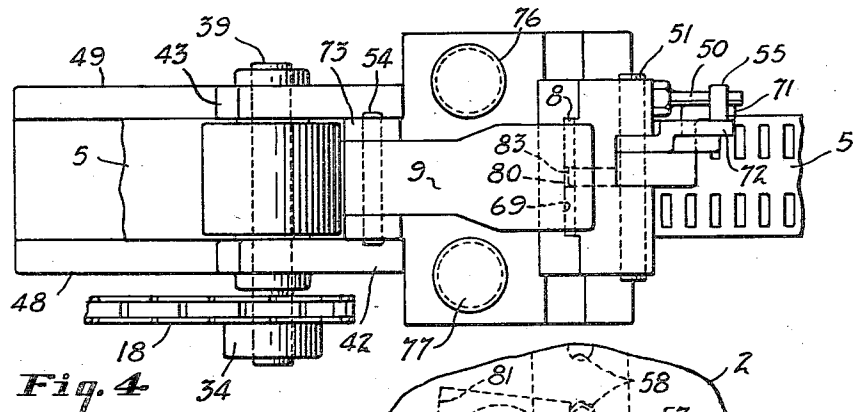

Fig. 4

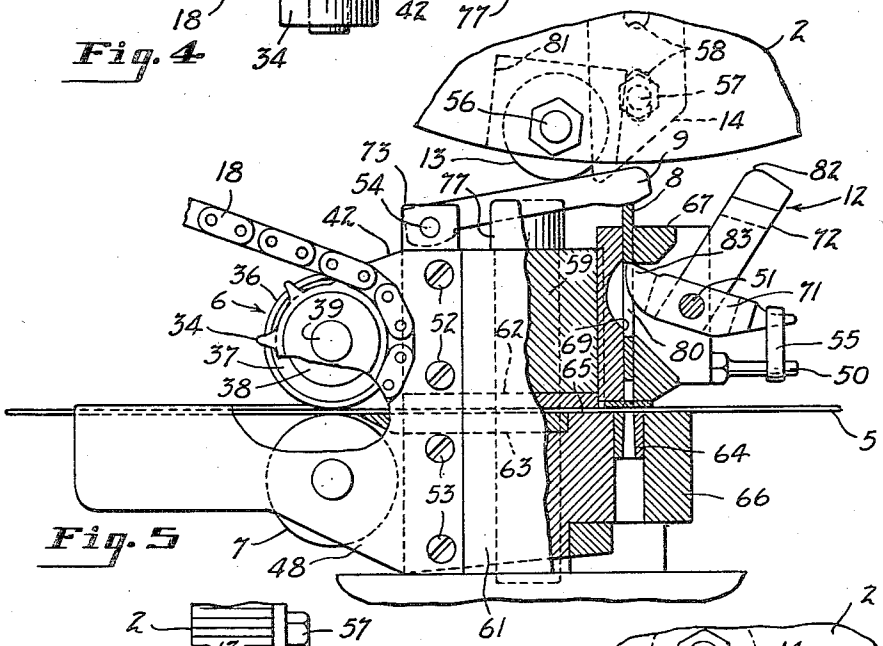

Fig. 5

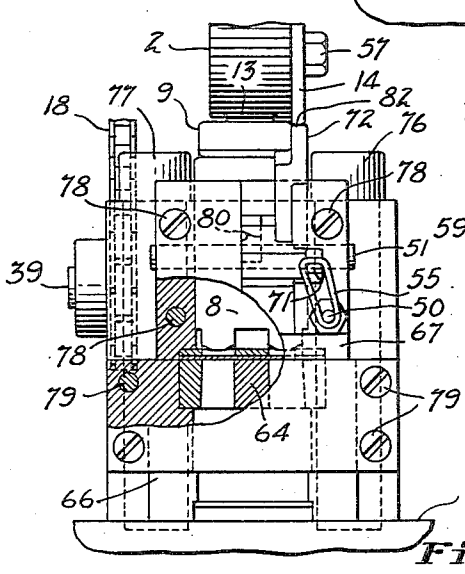

Fig. 6

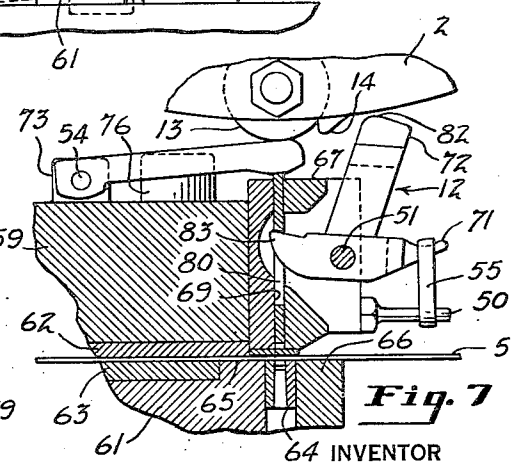

Fig. 7

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WINDOW CHANNELING MACHINE

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Application November 5, 1952, Serial No. 318,903

6 Claims. (Cl. 164—89)

This invention relates to a machine for perforating and otherwise deforming strips and bands of resilient material. In particular, it relates to a machine for perforating strip stock with a positive punch return mechanism and with resilient strip stock feed rolls, at least one of which comprises inner and outer concentric cylinders with an annulus of rubber-like material in substantial elongation and radial compression disposed between them.

Bands or strips of thin metal and plastic stock are often punched or otherwise deformed so as to provide them with various combinations of rigidity and flexibility in alternate planes. For example, strips of metal are punched for formation of the frames for window channel in automobile bodies, said channel being laterally rigid but transversely flexible to provide for fitting into the automobile window contour. Likewise, strips and bands of material are fed into machines for making large numbers of stampings or punchings in conventional punch and die mechanisms.

In the above type of operations the strip is always momentarily arrested and deformed and then fed on through the machine. One of the most difficult problems is that of feeding the strip into the machine and coordinating the rate of feed with the intermittent and momentary arrest of the strip.

Accordingly, it is one object of the subject invention to provide means for feeding strip into punching or perforating machines which is relatively simple and inexpensive and automatically provides for the intermittent and momentary arrest of the strip.

It is another object of the subject invention to provide means in the feed rolls to take up and compensate for the momentary arrest in punching and deforming operations which in no way mars or defaces the strip and which does not place undue strain on the punch.

Still other objects of the present invention are to provide a punching machine which is not subject to excessive wear and break down and which is still relatively inexpensive to build and maintain.

Other objects and advantages become apparent from the following description of several embodiments of the invention made in connection with the accompanying drawing in which like numerals refer to like parts and in which;

Figure 1 shows a front elevation of a strip perforating machine embodying the subject invention;

Fig. 2 is an end view of this machine taken along line 2—2 of Fig. 1;

Fig. 3 is an enlarged cross-section of the feed rolls taken along line 3—3 of Fig. 1;

Fig. 4 is a plan view of the feed rolls, the punch impact lever, and the punch return crank;

Fig. 5 is a side view with portions broken away of the feed rolls and the punch and die mechanism of the subject machine;

Fig. 6 is an end view of the punch and die mechanism of the subject machine; and

Fig. 7 is a detailed view of the punch impact lever, punch, punch return crank, and die of the subject machine.

Referring particularly to the drawing, Fig. 1 shows a machine embodying the subject invention. This machine comprises a frame 1 provided with a punch and die mechanism 11 operated by cams 13 and 14 on flywheel 2. Feed rolls 6 and 7, mounted on the frame, feed or supply the strip material to the punch and die mechanism. The flywheel and feed rolls are driven through a driving means comprising a motor 23, a gear reduction box 24 and a link belt and sprocket arrangement off the gear reduction box to the flywheel and top feed roll respectively. The flywheel itself is supported by brackets 28 and 31 mounted on upright posts 3, 4 and 16 which are in turn integral with the frame. The strip material 5 is supplied to the feed rolls from a reel 10 or other supply means located to the left of the motor.

Fig. 3 shows the feed roll arrangement contemplated by the subject invention. In this arrangement, top feed roll 6 is driven by sprocket 34 keyed to its shaft or axle 39 through key 41. The shaft in turn is supported by plates 42 and 43 located at either side thereof and rotates in roller bearings, needle bearings, bushings or the like. Top feed roll 6 comprises an outer cylinder or outer member 36 and an inner cylinder or inner member 38 with an annulus of rubber-like material 37 in substantial elongation and radial compression disposed or located between them. The top roll 6 is keyed to the shaft 39 through 35. Obviously, other means can be employed to unite the sprocket and feed roll with the shaft such as press fittings or machine screws of various sorts. The outer contact face of outer roll 36 can be roughened as by a knurling or cross-hatching or other devices to increase its grip on the strip stock. Any such knurling, however, tends to mar the surface of the strip stock and as such is not particularly desirable except when necessary to provide friction and grip between the feed roll and strip stock.

The inner and outer cylinders of the top roll can be substantially parallel or can diverge at the center and converge near the edges as shown in Fig. 3. In any case, the inner member should be in a radially spaced relation to the outer member and substantially concentric with it to provide for the intermediate rubber annulus. Any of the resilient mountings in which the rubber annulus is in substantial elongation and radial compression are suitable for this purpose. United States Patent No. 2,572,215 to Swart issued October 23, 1951, United States Patent No. 2,517,791 to Hutton issued August 8, 1950 and United States Patent No. 2,598,115 to Dodge issued May 27, 1952 disclose several species of such mountings and further describe their characteristics.

The bottom feed roll 7 of the subject apparatus is mounted on single ball bearings 46 which are in turn mounted on shaft 47. The shaft is supported by plates 48 and 49. The surface of the bottom feed roll can likewise be knurled or otherwise roughened to provide a better grip between it and the feed roll. I have found, however, that it is preferable to knurl or roughen the surface of one feed roll only, preferably the driving feed roll and not the idler feed roll, so that one face of the strip is clear and unmarred and always presentable. The bottom feed roll of Fig. 3 can be replaced by a resilient feed roll similar to top feed roll 6 as desired. In most applications, I have found that only one of the two feed rolls need by a resilient roll and provide the resilient, torsional, takeup means required by the subject invention. This, of course, depends upon the thickness and rigidity of the material being perforated or otherwise deformed and the amount of take-up or wind-up required of the feed rolls during the actual punching or stamping operation. Furthermore, we preferably use only one resilient feed

roll and drive this resilient feed roll and allow the other roll to rotate as an idler. In some cases, however, both feed rolls may be driven and may be resilient rolls as already described. In accordance with this invention, we preferably drive the resilient roll and not the rigid roll.

The feed rolls should be set so that they are not as far apart as the thickness of the material being fed through them or so that they are slightly closer together than the thickness of material being fed through them. Thus a grip or initial compression on the strip material is provided. The resilient mounting and particularly the rubber annulus of the mounting gives as necessary to accommodate the strip material. In this way the resilient feed roll performs a dual function by providing a torsional spring take-up when the strip material is momentarily arrested and by providing a resilient and spring-like grip on the strip material as it passes through the rolls.

Figs. 4 to 7 illustrate the punch and die arrangement of the subject invention. In this arrangement, a punch **8** is mounted in slot **69** in punch block **67** and the punch block is in turn screwed to or otherwise made integral with top body block **59** or to the frame itself (see Figs. 5 and 7). The die **64** is mounted in die block **66** which is screwed to or otherwise made integral with bottom body block **61** or with the machine frame. As shown in Fig. 6, machine screw **78** screw the punch block **67** to the top body block **59** and machine screws **79** screw the die block **66** to bottom body block **61**. Intermediate the punch and die and the body blocks is a slot or passage **65** for the strip **5**. This passage is adapted to accommodate the various gauges of strip to be used and extends from the feed rolls to the punch and die and on through the apparatus. If desired, wear plates **62** and **63** may be provided on the body blocks to protect the body blocks against wear and to control the passage thicknesses. Pins **76** and **77** unite the body blocks with the frame and screw into the frame at the base thereof. The pins are removable to provide for adjustment of the body blocks such as by shimming or grinding. The plates **42** and **48** supporting the feed rolls are also screwed to the body blocks with machine screws **52** and **53** and are adjustable therewith.

The punch **8** is engaged by an impact bar or lever **9** intermediate the punch and flywheel that is pivoted on pin **54** mounted on ears **73** on the top body block. One or more impact cams **13** on the flywheel strike hammer blows on the bar **9** as the wheel rotates and force and advance the punch **8** through the strip material. Punch **8** can also be provided with a knob or head of other conventional design integral with or resting upon it so as to absorb the blow from cam **13**. Generally, however, it is preferable to provide an impact bar or punch lever resting on the head of the punch and separate from the punch so as to minimize lateral forces against the punch and minimize punch breakage.

Bell crank **12** pivoted on pin **51** provides a positive acting punch return means to withdraw the punch from the strip material and complete the punching cycle. Bell crank **12** has two arms, arm **71** which is approximately or roughly perpendicular to the punch and arm **72** which is roughly parallel to the punch. The end **83** of arm **71** fits in central longitudinal slot or opening **80** formed in the punch. This slot extends along the line or axis of movement of the punch as shown. The other arm **72** extends out from the pivot pin to a point adjacent the circumference of the flywheel and coextensive with the head of the punch. Impact cams **14** on the flywheel are set so as to strike the end **82** of arm **72** when it is in the raised position and the punch is in the down position (Fig. 7). Thus as the flywheel rotates, one of the cams **13** strikes bar **9** or the head of the punch and forces the punch through the strip material and immediately thereafter one of the cams **14** strikes arm **72** and returns the punch to its initial position. The flywheel shown rotates counterclockwise so that cams **13** first strike the punch

impact lever and then cams **14** strike the punch return arm **72**. It should be noted that arm **72** extends to the side of the wheel so as not to interfere with the other cams **13**. If desired, a spring or rubber band **55** can be attached to the end of arm **71** from extension rod **50** on one of the machine screws **78** to minimize chatter and provide smoother operation.

Pairs of cams **13** and **14** should be spaced and adjusted about the circumference of the flywheel to coordinate with the radius of the flywheel, number of cams on the flywheel, speed of rotation of the flywheel and punching cycle. Under some circumstances, usually with slow speeds of rotation and large radius flywheels, a plurality of single cams or actuating means may be employed on the flywheel so that each cam strikes both the punch impact lever and punch return bell crank arm. When regular and evenly spaced perforations are desired, the cams should be evenly spaced about the circumference of the flywheel. Otherwise, the cams should be spaced in accordance with the spacing of the perforations.

The flywheel should be relatively heavy to provide adequate momentum and to securely mount the cams. As shown in Fig. 5, cams **13** are evenly spaced about the circumference of the wheel and bolted to it with bolts **56**. Said cams are shown herein as cylindrical cam rollers or ball bearings which are found to be quite satisfactory and to minimize wear on both the impact lever and cam. A recess **81** (Fig. 2) is provided in the wheel for each impact roller **13**. Cam **14** is bolted to the wheel with bolts **57** and can be adjusted in slots **58** as necessary. Generally only one of the cams need be adjustable and this should preferably be the bell crank arm cam **14**. The wheel itself is mounted on hub **33** on axle **27** which is in turn supported by bearings in brackets **28** and **31**.

The driving means for the machine shown comprises an electric motor **23** and gear box or gear reduction unit **24** mounted on the frame. Sprocket **19** on the axle **22** of the gear reduction unit drives chain belt or link belt **17** which drives sprocket **26** keyed to shaft **27** of the flywheel. Likewise, sprocket **21** on axle **22** drives belt **18** which in turn drives the sprocket **34** of the top feed roll **6**. Obviously other driving means such as a pulley and V-belt arrangement are equally satisfactory provided that they do not slip. The rotation of the flywheel **2** and the feed rolls **6** and **7** is preferably synchronized or coordinated for best results as shown in the drawings.

It is understood that the feed roll of the subject invention can be adapted to any punching, stamping, coining, drawing, or other machine into which a strip of material is continuously fed and in which the movement of the material is momentarily halted or arrested while it is deformed. The above machines are further characterized by having relatively short and rapid punching or deforming cycles so that the strip material is fed to it in a substantially continuous fashion. In any such cases, feed rolls according to the subject invention can be utilized to take-up and automatically compensate for the stoppage and then release the energy so stored and feed the material forward. It is also understood that the strip material can be bands or strips of ferrous metal, brass, copper and the like or even plastics such as nylon and polyvinyl chloride.

It will be understood that, in accordance with the provisions of the patent statutes, variations and modifications of the specific devices disclosed herein may be made without departing from the spirit of the invention.

What we claim is:

1. In a punching machine for perforating strip stock having a frame, a punch mounted for reciprocation on said frame in a direction to perforate strip stock, means restraining movement of the punch in a transverse direction, an impact wheel rotatably mounted on said frame, and one or more impact members spaced about the periphery of said impact wheel for imparting hammer

blows to said punch, the improvement which comprises: means including a pair of feed rolls for continuously feeding strip material to said punch in said transverse direction to be perforated by said punch, one of said feed rolls comprising inner and outer rigid annular members and an annulus of elastic rubber-like material in substantial elongation and radial compression disposed between said rigid members, said annulus providing a resilient torsional spring which permits limited rotation of the outer rigid member relative to the inner member due to variation in the movement of the strip material when movement of the strip material is retarded by engagement with the punch, said outer member engaging said strip material and holding said material against the other feed roll, and means for continuously driving said one of said feed rolls and said impact wheel in synchronism.

2. Strip feeding means for a high speed punching machine having a frame, a punch mounted for reciprocation on said frame in one direction and held against movement in a transverse direction, an impact wheel mounted for rotation on said frame and having at least one impact member thereon for striking hammer blows on said punch, and means for rotating the wheel at high velocity, said feeding means comprising: a pair of feed rollers for engaging the opposite faces of a sheet of strip material to feed said material past said punch in said transverse direction and means for driving one of said feed rollers continuously, said one feed roller comprising an outer rigid strip-engaging sleeve, an inner core spaced from and concentric to said sleeve, and torsional take-up means comprising an annulus of rubber-like material in substantial elongation and radial compression between said core and said sleeve, said sleeve being driven from said core solely through said annulus and being rotatable relative to said core to compensate for temporary stoppage of the strip by the punch during the punching operations.

3. A feeding mechanism for a punching machine having a stationary die, a punch mounted for reciprocation toward and away from the die, and means for reciprocating the punch at high velocity, said feeding mechanism comprising: a pair of feed members, one feed member comprising an inner driving member, an outer rigid strip-engaging sleeve, and a resilient rubber torsion spring between said driving member and said sleeve, and means for continuously rotating said driving member at a predetermined speed in timed relation to the operation of said punch, said sleeve being free to rotate slower than said member during the time movement of the strip is interrupted by the punch so that torsional energy is stored in said rubber spring and being free to rotate faster than said core when the strip is released by the punch to expend the energy stored in said spring.

4. Strip feeding means for a high speed punching machine having a frame, a punch mounted for reciprocation on said frame in one direction, means restraining movement of the punch in a transverse direction, an impact wheel mounted for rotation on said frame and having at least one impact member thereon for striking hammer

blows on said punch, and means for rotating the wheel at high velocity, said feeding means comprising: a pair of feed rollers for engaging the opposite faces of a sheet of strip material to feed the material past said punch in said transverse direction, one feed roller comprising an outer rigid strip-engaging member, an inner driving member, and a torsional spring operably connected between said strip-engaging member and said driving member, said members being rotatable relative to each other to compensate for changes in the rate of movement of said strip material due to engagement of the strip material with the punch, and motor means for rotating said driving member to cause feeding of the strip material by said feed rollers.

5. In a machine for punching strip stock having a frame, a punch mounted for reciprocation on said frame, an impact wheel rotatably mounted on said frame, and one or more impact members spaced about the periphery of said wheel for imparting hammer blows to said punch, the improvement which comprises: means including a pair of feed rolls for feeding strip material to said punch to be perforated by said punch, one of said feed rolls comprising driving and driven members and a torsional spring interposed between said members for transmitting rotational energy from the driving to the driven member, and means for continuously rotating said driving member in synchronism with said impact wheel, said driven member engaging the strip stock to feed the stock at varying speeds, the driven member rotating slower than the driving member during the time movement of the strip is interrupted by the punch so that torsional energy is stored in said spring and rotating faster than the driving member when the strip is released by the punch due to the energy stored in said spring.

6. A machine for perforating strip stock comprising a frame, a punch and a die mounted on said frame, said punch and die being mounted so as to provide a passage for the strip stock between them, means to advance said punch through the strip stock, means to retract said punch, feed rolls for feeding said strip stock through the punch and die, means for restraining movement of said punch and said die in the direction of feed of said strip stock at least one of said feed rolls comprising inner and outer concentric cylinders with an annulus of rubberlike material in substantial elongation and radial compression disposed between them, and means for continuously driving one of said feed rolls in synchronism with said punch.

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