Oct. 24, 1944. A. S. HOWELL 2,361,291

INTERMITTENT STRIP FEED MECHANISM

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Fig. 1

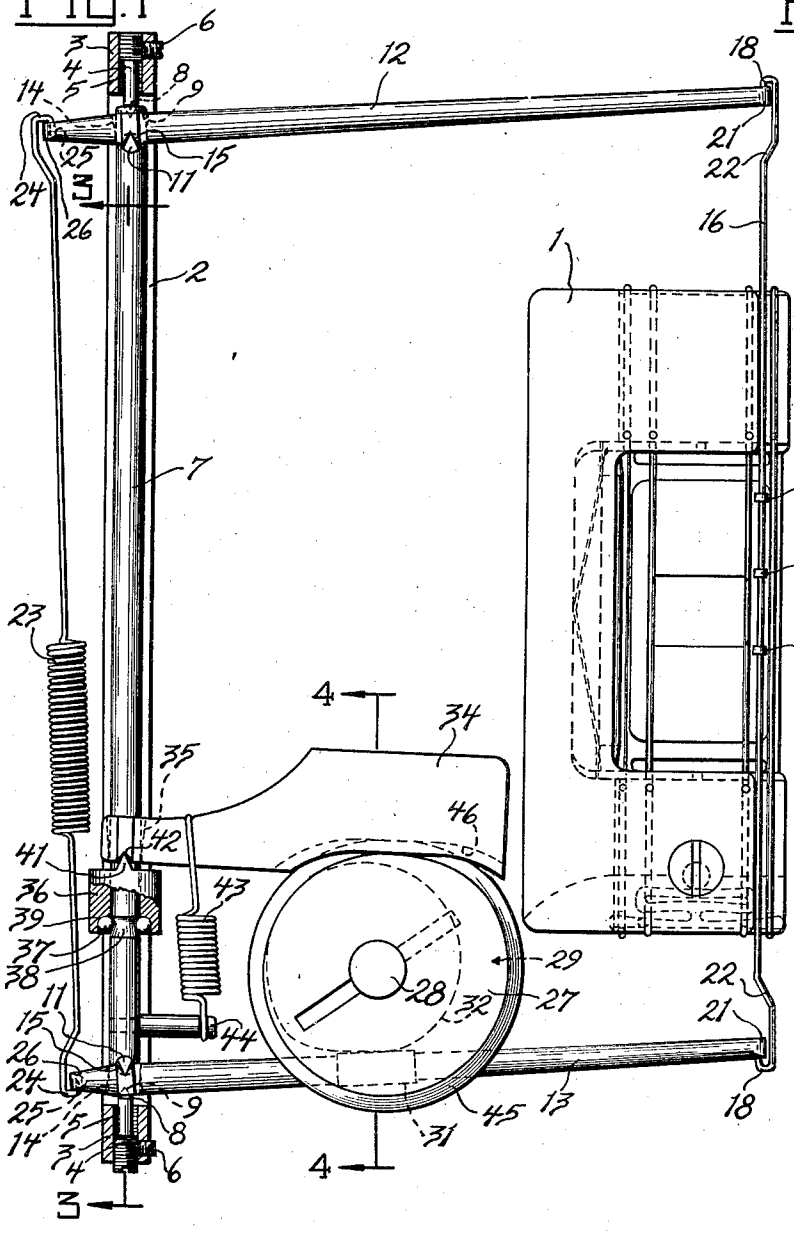
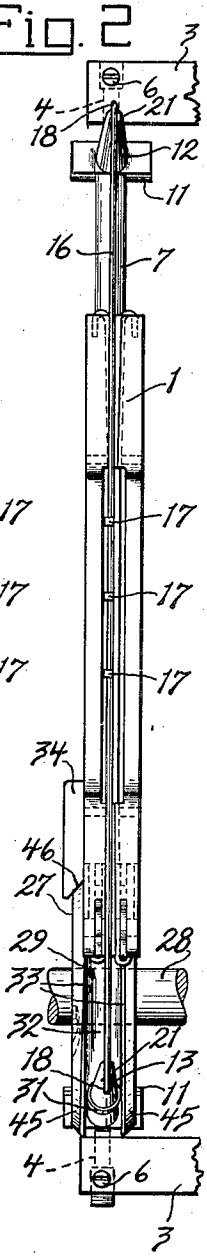


Fig. 2



INVENTOR
ALBERT S. HOWELL
BY Robert H. Miller Jr.
ATTY.

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Fig. 3

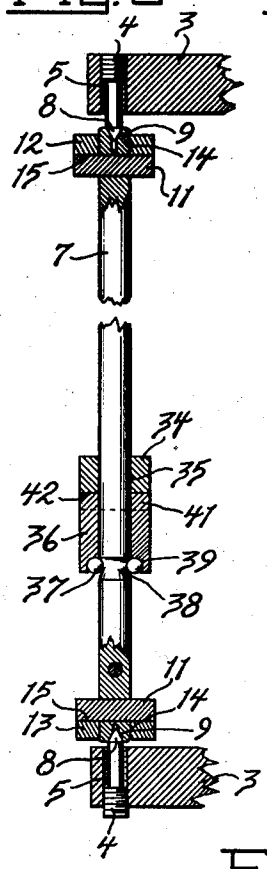


Fig. 4

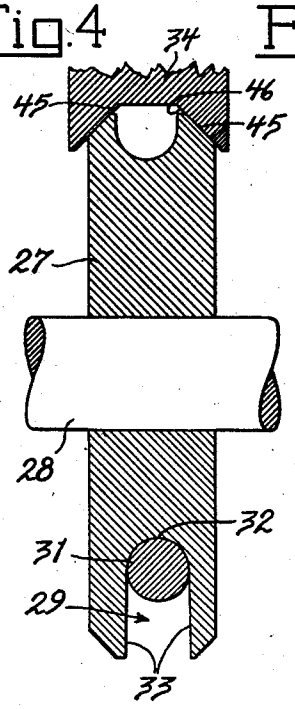


Fig. 5

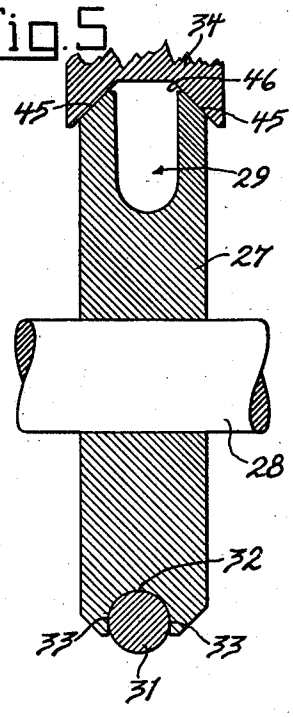


Fig. 6

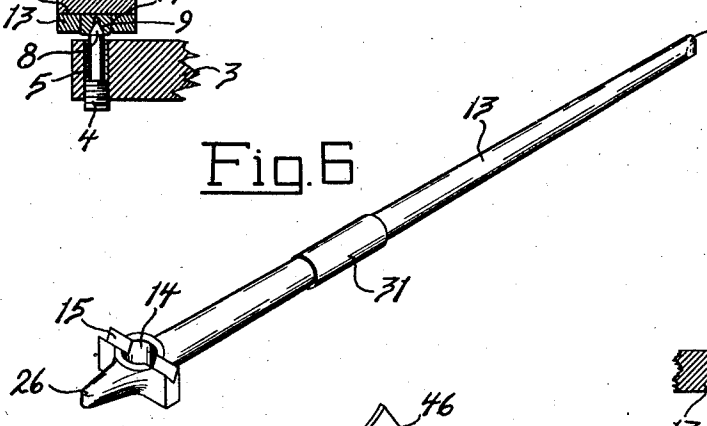


Fig. 8

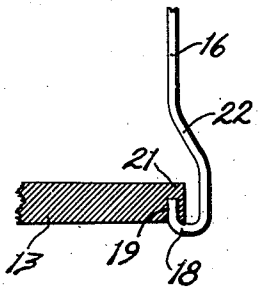
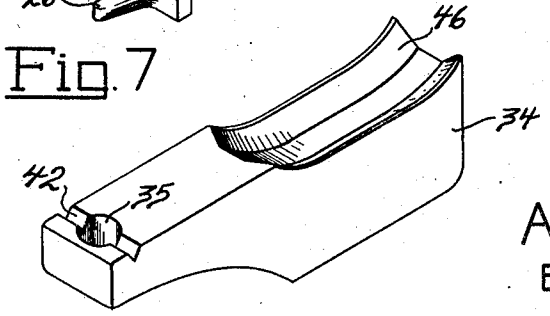


Fig. 7



INVENTOR
ALBERT S. HOWELL
BY Robert F. Michle, Jr.
ATTY.

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UNITED STATES PATENT OFFICE

2,361,291

INTERMITTENT STRIP FEED MECHANISM

Albert S. Howell, Culver, Ind., assignor to The Bell & Howell Company, Chicago, Ill., a corporation of Illinois

Application January 6, 1943, Serial No. 471,442

16 Claims. (Cl. 88—18.4)

My invention relates particularly to an intermittent strip feed mechanism for feeding motion picture film strips provided with usual feed perforations spaced longitudinally thereof.

Objects of the invention reside in the provision of a novel, desirable and effective intermittent strip feed mechanism which is precise in its operation, which is capable of operation at high speeds, which is so constructed that the reciprocatory structure thereof has a comparatively small amount of momentum, and which is economical as to manufacture, all with a view toward the provision of a precision intermittent feed mechanism for motion picture film strips.

Another object of the invention resides in the provision of a novel, desirable and effective counterbalancing device for intermittent strip feed mechanisms and particularly for the feed mechanism of my invention, with a view toward minimizing vibration incident to reciprocation of the reciprocatory structure of the feed mechanism.

Referring to the drawings—

Figure 1 is an enlarged elevational view of an intermittent motion picture strip feed mechanism embodying my invention with parts broken away and shown in section;

Figure 2 is another elevational view of the same taken at a right angle to Figure 1;

Figure 3 is a vertically condensed sectional view substantially on the line 3—3 of Figure 1;

Figures 4 and 5 are partial sectional views substantially on the line 4—4 of Figure 1 and showing the parts in different positions of their operation;

Figure 6 is a perspective view of one of the feed element carrier arms of the mechanism, hereinafter described;

Figure 7 is a perspective view of the counter balance weight of the mechanism, hereinafter described; and

Figure 8 is a partial sectional view showing the engagement structure between a carrier arm and the wire-like feed element of the mechanism, hereinafter described.

Referring to the drawings, 1 designates generally a motion picture strip feed guide which is the subject matter of my co-pending application for United States Letters Patent, Serial No. 471,443, filed January 6, 1943, for improvement in Strip feed guide.

A frame part 2 is provided with extensions 3 spaced longitudinally of and transversely from the guide. Bearing studs 4 are adjustably screw-threaded respectively into coaxial bores 5 through the extensions 3 on an axis extending longitudinally and spaced transversely from the guide, the studs being secured in adjusted positions by means of set screws 6. See Figures 1, 2 and 3.

A shaft 7 is pivotally mounted axially thereof by means of opposing tapered ends 8 of the studs 4 engaging in tapered recesses 9 in the ends of the shaft, the shaft being thus positioned for angular movement on its axis and disposed longitudinally and spaced transversely from the guide 1. Pivot pins 11 are spaced longitudinally of the shaft 7 and extend diametrically therethrough and are secured therewith, the pins projecting from both sides of the shaft and having their projecting portions of V-shape to form male knife bearing elements facing oppositely away from each other and disposed respectively on axes spaced longitudinally of and extending correspondingly transversely of the shaft.

Two carrier arms 12 and 13 are provided adjacent corresponding ends thereof with transverse bores 14 through which the shaft 7 projects and which are so shaped as to permit pivotal movement of these arms on axes normal to the axis of the shaft. See Figures 1, 3 and 6. These arms are provided at the bores thereof with V-shaped grooves 15 forming female knife bearing elements extending transversely of the arms and their bores 14. The arms 12 and 13 have their grooves 15 respectively engaged on the V-shape portions of the pins 11 with the shaft extending through the bores 14 and, when oppositely tensioned against the pins 11 as hereinafter described, are fixed with the shaft angularly thereof for pivotal movement with the shaft on the shaft axis and are independently pivotally mounted thereon on axes spaced longitudinally of and extending correspondingly transversely of the shaft, the arms being thus universally pivotally mounted at the axis of the shaft.

A laterally flexible wire feed element 16 has three collars 17 secured in equally spaced relation on the intermediate portion thereof and forming laterally projecting feed teeth engageable with usual feed perforations of a motion picture film strip, not shown, in the guide 1 for feeding the strip therethrough. See Figures 1 and 2. The ends of the wire 16 are doubled back to provide opposing hooks 18, see also Figure 8, which are engaged in oppositely facing transverse bores 19 in corresponding ends 21 of the carrier arms 12 and 13 for securing the wire 16 at points therealong oppositely spaced from the collars or teeth 17 with and extending between the arms when the arms are tensioned as hereinafter described, the wire being offset adjacent

its ends, as designated at 22, to aline the intermediate portion thereof with the extremities of the hooks so that the intermediate portion of the wire is not laterally displaced with angular movement of the wire.

A tension spring 23 has its ends doubled back to provide opposing hooks 24, see Figure 1, which are engaged in oppositely facing transverse bores 25 in the other corresponding ends 26 of the carrier arms 12 and 13 for securing the spring with and extending between the arms in similar but opposite relation with respect to the wire 16, so that the spring reacting on the pivotal bearings 11–15 of the arms on the shaft 7, maintains engagement of these bearings and acting through the arms is operative on the wire 16 longitudinally thereof to longitudinally tension the wire and thereby to rigidly maintain the same.

As so carried in tensioned condition, the wire 16, with its laterally projecting collars or feed teeth 17, is, with respect to the guide 1 and a perforated strip therein, longitudinally reciprocable by reason of the arm pivot bearings 11–15 of the arms 12 and 13 for strip feed and return movement and is laterally reciprocable for strip perforation engaging and disengaging movement by reason of the pivotal movement of the shaft 7 with which the arms are fixed angularly of the shaft, and the wire 16 is reciprocated longitudinally and laterally in timed relation for intermittently feeding a perforated strip in the guide in the following manner.

The arms 12 and 13 are connected at equal radii thereof with the wire 16 and are connected at unequal radii thereof with the spring 23, as will be seen in Figure 1, or conversely, the sum of the feed element (wire 16) and tensioning element (spring 23) radii of one of the arms (lower arm 13) is less than that of the feed and tensioning element radii of the other of the arms (upper arm 12), so that the spring 23 yieldably urges the arms and feed element in one direction of the feed and return movement of the feed element, i. e., upwardly of the wire 16 in Figures 1 and 2.

A cam member 27 is revolubly mounted by means of a drive shaft 28, on which the cam member 27 is fixed, journaled in axially fixed position in suitable bearings not shown. See Figures 1 and 2. This cam member is spaced from the shaft 7 in the direction of the wire 16 and is disposed with its axis above the lower arm 13 and normal to the plane of the guide.

The cam member 27 is provided with a peripheral cam groove 29 downwardly engaging an enlarged cam follower portion 31 on the arm 13 intermediate the wire 16 and the pivotal mounting of this arm. The bottom of this cam groove is formed to provide a radial cam 32 which bears downwardly on the cam follower portion 31 in opposition to the spring 23 for reciprocating the wire 16 and the arms 12 and 13 for longitudinal feed and return movement of the wire. See Figures 1, 4 and 5. The opposing axially facing sides 33 of this cam groove embrace the cam follower 31 therebetween and are formed to provide an axial cam which acts on the cam follower 31 for reciprocation of the wire 16 and the arms 12 and 13 laterally of the wire for strip perforation engaging and disengaging movement of the wire, the cams 32 and 33 being so timed as to effect intermittent feed of a perforated strip in the guide with rotation of the cam member.

A counterweight arm 34 is provided at one end thereof with a transverse bore 35 through which the shaft 7 projects and which is so shaped as to permit pivotal movement of this arm normal to the axis of the shaft. See Figures 1, 3 and 7. A collar 36 surrounds the shaft 7 and is pivotally mounted on the shaft for movement angularly of the shaft axis by means of its bore being journaled on the shaft and of ball bearings 37 oppositely engaging a peripheral groove 38 on the shaft and a downwardly facing counterbore 39 of the bore of the collar to form a thrust bearing opposing downward movement of the collar. The collar 36 is provided with an upwardly facing V-shaped ridge 41 forming a male knife bearing element facing upwardly of and disposed normal to the pivotal axis of this collar. The weight arm 34 is provided with a V-shaped groove 42 forming a female knife bearing element disposed normal to the bore 35 and engageable downwardly on the ridge 41 whereby the weight arm, when tensioned downwardly on the ridge 41 as hereinafter described, is universally pivotally mounted correspondingly with the carrier arms 12 and 13 at the axis of the shaft 7.

The weight arm 34, at a point spaced from its pivot point, bears downwardly on the periphery of the cam member 27, and a tension spring 43 engages downwardly on the weight member, intermediate the pivot point of the weight member and the region of contact of the weight member with the cam member, and, reacting on a stud 44 secured on the shaft 7 and extending radially therefrom, yieldably urges the weight member downwardly to maintain the groove 42 in downward engagement with the ridge 41, the collar 36 in downward engagement with its pivotal thrust bearing, and the weight member in downward engagement with the cam member 27.

The cam member 27 is provided with an additional peripheral cam formation comprising axially spaced complemental bevel cam surfaces 45 disposed on opposite sides of the cam groove 29 and converging radially outward of the cam member and downwardly on which a downwardly facing radially extending correspondingly beveled cam follower groove 46 on the weight arm 34 engages. The complemental cam surfaces 45 are so formed as to provide a radial and axial cam formation operative on the weight member to reciprocate it in paths corresponding with the feed and return movement and the strip perforation engaging and disengaging movement of the toothed wire 16 and arms 12 and 13.

The axial and radial cam components of the cam surfaces 45 are so timed with respect to the axial and radial cam components of the cam groove 29 that the feed shuttle, exemplified by the toothed wire 16 and arms 12 and 13 as tensioned by the spring 23, and the weight arm 34 are reciprocated in timed opposite movement phase relation with respect to both of the feed and return movement and the strip perforation engaging and disengaging movement of the feed shuttle for counterbalancing the shuttle. Accordingly, as shown, both the feed and return and the strip perforation engaging and disengaging movements of the shuttle are counterbalanced.

By way of illustration, Figure 4, which shows the same position of the cam member 27 as does Figure 1, shows the cam follower portion 31 of the arm 13 at the uppermost position of the feed and return movement and to the right at the strip perforation engaging position of the feed

shuttle and shows the weight arm 34, positioned, oppositely with respect to the feed shuttle, in its lowermost position and to the left. Figure 5 shows the cam member 27 in another position in which the cam follower portion of the arm 13 is at the lowermost position of the feed and return movement and to the left at the strip perforation disengaged position of the feed shuttle and in which the weight arm 34, positioned oppositely with respect to the feed shuttle, is at its uppermost position and to the right.

While I have thus described my invention, I do not wish to be limited to the precise details described, as changes may be readily made without departing from the spirit of my invention, but having thus described my invention, I claim as new and desire to secure by Letters Patent the following:

1. In an intermittent strip feed mechanism, the combination of a laterally flexible wire-like feed element provided with at least one laterally projecting strip perforation engaging feed tooth, tensioning means carrying said feed element for longitudinal reciprocatory strip feed and return movement and operative on said feed element longitudinally thereof at points therealong oppositely spaced from said tooth to longitudinally tension said feed element, and means for longitudinally reciprocating said feed element.

2. In an intermittent strip feed mechanism, the combination of a laterally flexible wire-like feed element provided with at least one laterally projecting strip perforation engaging feed tooth, tensioning means carrying said feed element for longitudinal reciprocatory strip feed and return movement comprising a carrier member mounted for reciprocatory movement and connected with said feed element at a point spaced in one direction from said tooth and a resilient tensioning element connected with said feed element at a point spaced in the opposite direction from said tooth and operative longitudinally of said movement of said carrier member to longitudinally tension said feed element, and means operative on said carrier member for reciprocating the same and said feed element.

3. In an intermittent strip feed mechanism, the combination of a laterally flexible wire-like feed element provided with at least one laterally projecting strip perforation engaging feed tooth, tensioning means carrying said feed element for longitudinal reciprocatory strip feed and return movement comprising two carrier arms pivotally mounted for independent corresponding movement and connected at radii thereof with said feed element respectively at points on said feed element spaced oppositely from said tooth and a resilient tensioning element connected with one of said arms and operative thereon to longitudinally tension said feed element between said arms, and revoluble means operative on the other of said arms for reciprocating said arms and feed element.

4. In an intermittent strip feed mechanism, the combination of a laterally flexible wire-like feed element provided with at least one laterally projecting strip perforation engaging feed tooth, tensioning means carrying said feed element for longitudinal reciprocatory strip feed and return movement comprising two carrier arms pivotally mounted for independent corresponding movement and connected at radii thereof with said feed element respectively at points on said feed element spaced oppositely from said tooth and a resilient tensioning element connected with said arms at radii thereof and operative therebetween to longitudinally tension said feed element and the sum of the feed and tensioning element radii of a first of said arms being less than that of the feed and tensioning element radii of the second of said arms to yieldably urge said arms and feed element in one direction, and revoluble means operative on one of said arms in the opposite direction for reciprocating said arms and feed element.

5. In an intermittent strip feed mechanism, the combination of a laterally flexible wire-like feed element provided with at least one laterally projecting strip perforation engaging feed tooth, tensioning means carrying said feed element for longitudinal reciprocatory strip feed and return movement and for lateral reciprocatory strip perforation engaging and disengaging movement and operative on said feed element longitudinally thereof at points therealong oppositely spaced from said tooth to longitudinally tension said feed element, and revoluble means for longitudinally and laterally reciprocating said feed element in timed relation for effecting intermittent feed of a feed perforated strip.

6. In an intermittent strip feed mechanism, the combination of a laterally flexible wire-like feed element provided with at least one laterally projecting strip perforation engaging feed tooth, tensioning means carrying said feed element for longitudinal reciprocatory strip feed and return movement and for lateral reciprocatory strip perforation engaging and disengaging movement comprising a carrier arm universally pivotally mounted and connected at a radius thereof with said feed element at a point spaced from said tooth and a resilient tensioning element connected with said feed element at a point spaced in the opposite direction from said tooth and operative to longitudinally tension said feed element, and revoluble means operative on said arm for reciprocating the same and said feed element longitudinally and laterally of said feed element in timed relation for effecting intermittent feed of a perforated strip.

7. In an intermittent strip feed mechanism, the combination of a laterally flexible wire-like feed element provided with at least one laterally projecting strip perforation engaging feed tooth, tensioning means carrying said feed element for longitudinal reciprocatory strip feed and return movement and for lateral reciprocatory strip perforation engaging and disengaging movement comprising a shaft member pivotally mounted axially thereof, two carrier arms fixed with said shaft member angularly of said shaft member and independently pivotally mounted thereon respectively on axes spaced longitudinally of and extending correspondingly transversely of said shaft member, said arms being connected at radii thereof with said feed element respectively at points on said feed element spaced oppositely from said tooth, and a resilient tensioning element connected with one of said arms and operative thereon to longitudinally tension said feed element between said arms, and revoluble means for reciprocating said arms and feed element longitudinally and laterally of said feed element for effecting intermittent feed of a perforated strip and operative on the other of said arms.

8. In an intermittent strip feed mechanism, the combination of a laterally flexible wire-like feed element provided with at least one laterally projecting strip perforation engaging feed tooth,

tensioning means carrying said feed element for longitudinal reciprocatory strip feed and return movement and for lateral reciprocatory strip perforation engaging and disengaging movement comprising a shaft member pivotally mounted axially thereof, two carrier arms fixed with said shaft member angularly of said shaft member and independently pivotally mounted thereon respectively on axes spaced longitudinally of and extending correspondingly transversely of said shaft member, said arms being connected at equal radii thereof with said feed element respectively at points on said feed element spaced oppositely from said tooth, and a resilient tensioning element connected with said arms at unequal radii thereof and operative therebetween to longitudinally tension said feed element and to yieldably urge said arms in one direction, and a revoluble cam member provided with a peripheral cam groove formed to provide a radial and an axial cam, both of which are operative on the carrier arm having the lesser tensioning element radius and the radial cam of which is operative on this arm in the direction opposite said one direction.

9. In an intermittent strip feed mechanism, the combination of a toothed strip feed shuttle mounted for reciprocation, a counterbalance weight mounted for reciprocation in a path corresponding with that of said shuttle, and means for reciprocating said shuttle and weight in timed opposite movement phase relation for counterbalancing said shuttle.

10. In an intermittent strip feed mechanism, the combination of a toothed strip feed shuttle mounted for reciprocation, a counterbalance weight mounted for reciprocation in a path corresponding with that of said shuttle, and a revoluble cam member operative on said shuttle and weight for reciprocating the same in timed opposite movement phase relation for counterbalancing said shuttle.

11. In an intermittent strip feed mechanism, the combination of a toothed strip feed shuttle mounted for reciprocatory strip feed and return movement and for reciprocatory strip perforation engaging and disengaging movement transversely of said feed and return movement, counterbalance weight means mounted for reciprocation in paths corresponding with said feed and return and said perforation engaging and disengaging movements of said shuttle, and means for reciprocating said shuttle and weight means in timed opposite movement phase relation with respect to both of said feed and return and said perforation engaging and disengaging movements of said shuttle for counterbalancing said shuttle.

12. In an intermittent strip feed mechanism, the combination of a toothed strip feed shuttle mounted for reciprocatory strip feed and return movement and for reciprocatory strip perforation engaging and disengaging movement transversely of said feed and return movement, counterbalance weight means mounted for reciprocation in paths corresponding with said feed and return and said perforation engaging and disengaging movements of said shuttle, and a revoluble cam member for reciprocating said shuttle and weight means in timed opposite movement phase relation with respect to both of said feed and return and said perforation engaging and disengaging movements of said shuttle for counterbalancing said shuttle and comprising an axial and radial cam formation operative on said shuttle and a second axial and radial cam formation operative on said weight means.

13. In an intermittent strip feed mechanism, the combination defined in claim 12 and further characterized in that one of said cam formations comprises a peripheral cam groove and in that the other of said cam formations comprises an exterior peripheral cam formation.

14. In an intermittent strip feed mechanism, the combination of a laterally flexible wire-like feed element provided with at least one laterally projecting strip perforation engaging feed tooth, tensioning means carrying said feed element for longitudinal reciprocatory strip feed and return movement comprising a carrier member mounted for reciprocatory movement and connected with said feed element at a point spaced in one direction from said tooth and a resilient tensioning element connected with said feed element at a point spaced in the opposite direction from said tooth and operative longitudinally of said movement of said carrier member to longitudinally tension said feed element, a counterbalance weight mounted for reciprocation corresponding with that of said carrier member, and means for reciprocating said carrier member and weight in timed opposite movement phase relation for counterbalancing said carrier member and feed element.

15. In an intermittent strip feed mechanism, the combination of a laterally flexible wire-like feed element provided with at least one laterally projecting strip perforation engaging feed tooth, tensioning means carrying said feed element for longitudinal reciprocatory strip feed and return movement and for lateral reciprocatory strip perforation engaging and disengaging movement comprising a carrier arm universally pivotally mounted and connected at a radius thereof with said feed element at a point spaced from said tooth and a resilient tensioning element connected with said feed element at a point spaced in the opposite direction from said tooth and operative to longitudinally tension said feed element, a counterbalance weight universally pivotally mounted, and revoluble means operative on said arm and weight for reciprocating the same in timed opposite movement phase relation with respect to both said feed and return and said perforation engaging and disengaging movements for counterbalancing said arm and feed elements.

16. In an intermittent strip feed mechanism, the combination of a laterally flexible wire-like feed element provided with at least one laterally projecting strip perforation engaging feed tooth, tensioning means carrying said feed element for longitudinal reciprocatory strip feed and return movement and for lateral reciprocatory strip perforation engaging and disengaging movement comprising a shaft member pivotally mounted axially thereof, two carrier arms fixed with said shaft member angularly of said shaft member and independently pivotally mounted thereon respectively on axes spaced longitudinally of and extending correspondingly transversely of said shaft member, said arms being connected at radii thereof with said feed element respectively at points on said feed element spaced oppositely from said tooth, and a resilient tensioning element connected with said arms at radii thereof and operative therebetween to longitudinally tension said feed element and the sum of the feed member and tensioning element

radii of a first of said arms being less than that of the feed member and tensioning element radii of the second of said arms to yieldably urge said arms and feed element in one direction of said feed and return movement, a counterbalance weight universally pivotally mounted in the region of the axis of said shaft, a second resilient element yieldably urging said weight in the direction opposite said first mentioned direction, and a revoluble cam member operative between one of said arms and said weight in opposition to said tensioning elements for reciprocating the same in timed opposite movement phase relation with respect to both said feed and return and said perforation engaging and disengaging movements for counterbalancing said arms and feed element.

ALBERT S. HOWELL.