United States Patent

Gallistel et al.

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[54] INCREMENTAL WEB FEEDING MEANS

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[52] **U.S. Cl.** **226/141,** 226/157, 226/145
[51] **Int. Cl.** **B65h 17/22**
[58] **Field of Search** 226/157, 137, 139, 140, 141, 226/142, 145; 74/222, 117

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[57] **ABSTRACT**

Readily adjustable web-feeding means which, in the specific form disclosed, embodies a chain and sprocket drive with a takeup crank arm engaging an intermediate portion of the chain to produce an intermittent driving action which is readily adjustable from a location remote from the crank arm by varying the relationship between the engaged chain segment and the crank arm axis such as by moving by means of a remote-controlled mechanism one end of the engaged chain segment such as the anchored end of the chain whereby the effective takeup stroke on the chain can be varied.

14 Claims, 5 Drawing Figures

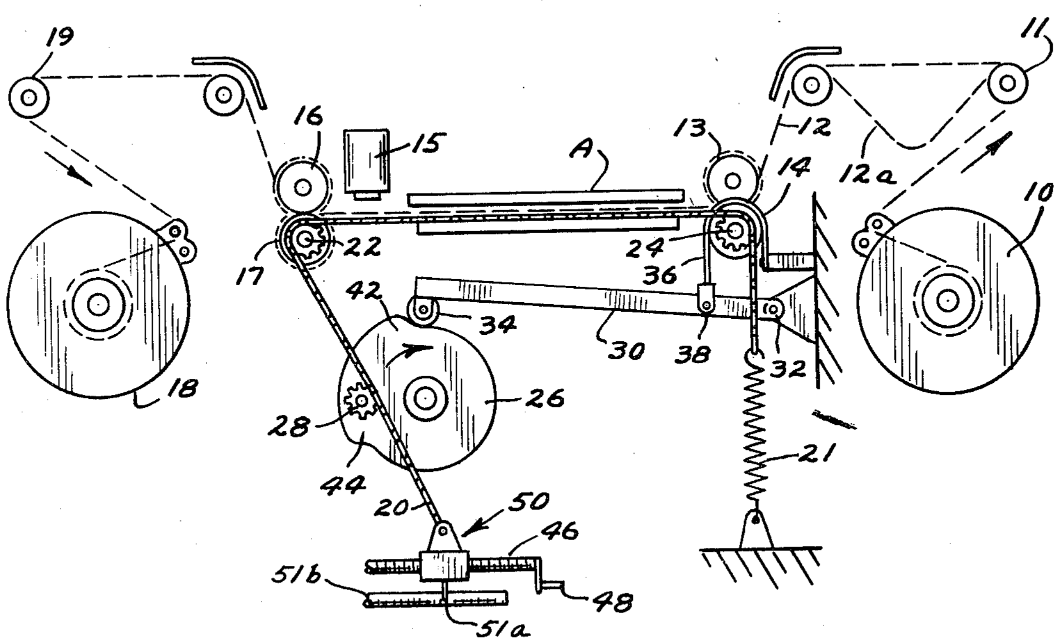
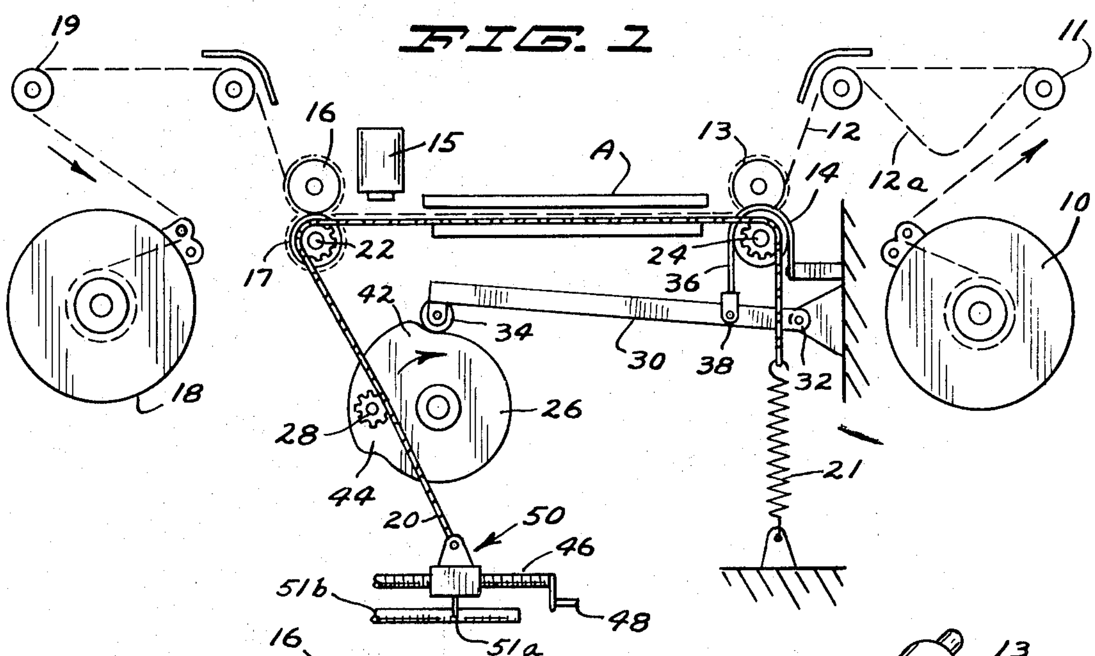


FIG. 1



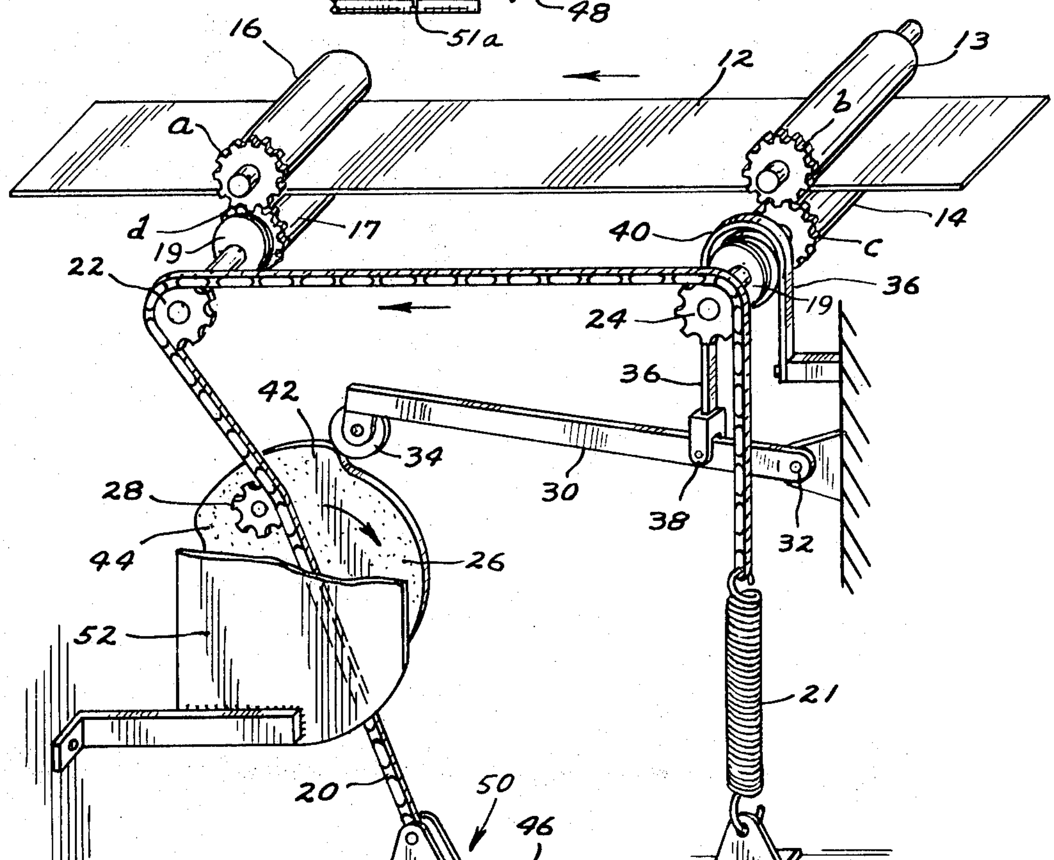


FIG. 2

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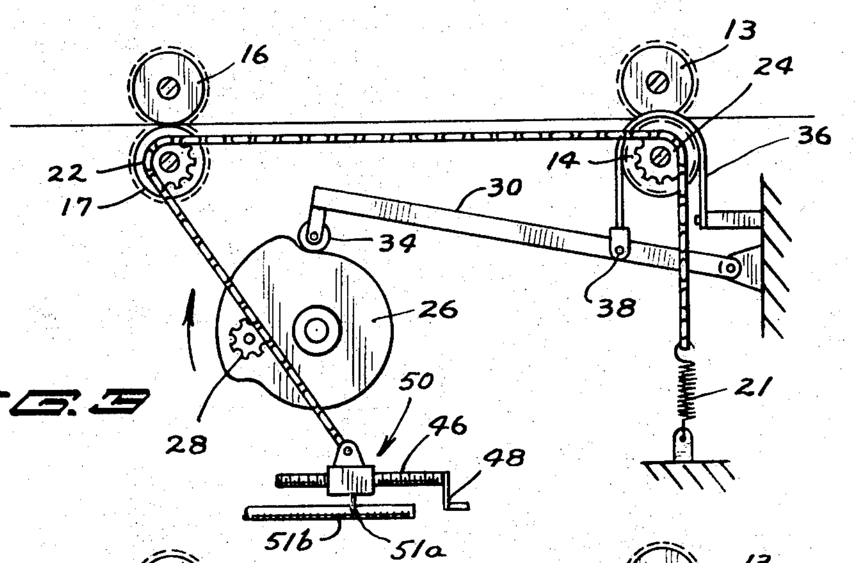

FIG. 3

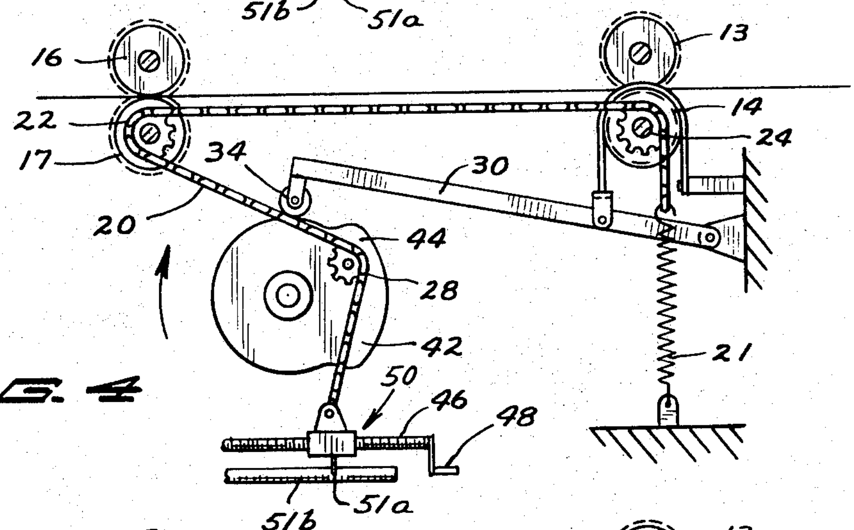

FIG. 4

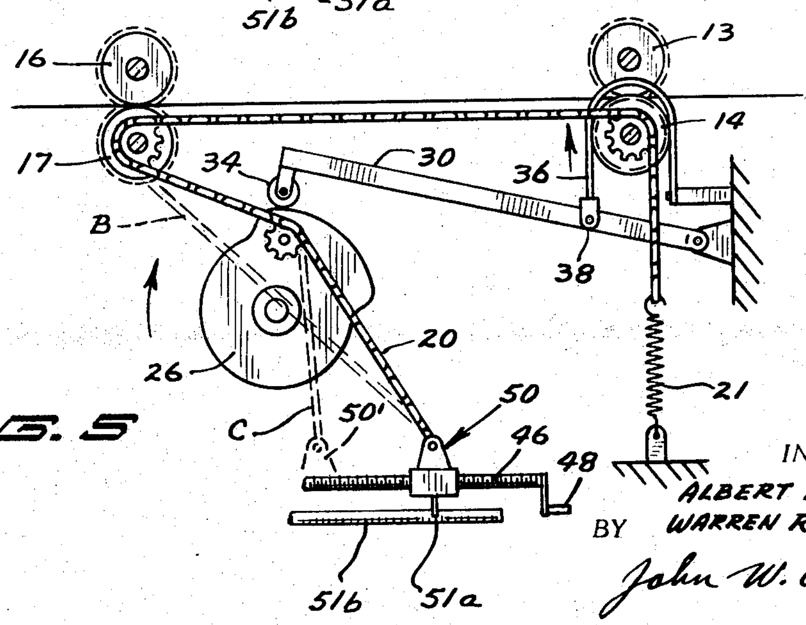

FIG. 5

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INCREMENTAL WEB FEEDING MEANS

A related invention is disclosed in copending application Ser. No. 831,049, filed June 6, 1969, invented by one of the two present inventors and assigned to the same assignee. That invention constitutes a variable feed mechanism for a web of sheet material in which the length of the feed actuating arm is adjustable to vary the length of the increments intermittently fed through the machine. Since this actuating arm must be positioned inside the machine and since the adjusting means is mounted on the arm itself, it is not readily accessible for adjustment by the operator although the mechanism has otherwise proved to function efficiently and satisfactorily. It is, of course, highly desirable to have a readily accessible adjustment means remote from the feed-actuating mechanism and the present invention is specifically designed to provide this accessibility. This is particularly important where the feed mechanism is located within a lightproof housing of a photographic printer which causes damage to the photographic paper whenever the housing is opened.

Accordingly, it is a principal object of the present invention to provide a variable feed mechanism which has a readily accessible control member located remotely of the actuating mechanism.

A further and more specific object of the present invention is to provide a readily adjustable intermittent drive for a feed mechanism which accelerates the paper feed gradually and may also provide gradual deceleration.

Another object of the present invention is to provide a variable feed mechanism for operation at a high speed which has a brake mechanism actuated during deceleration to prevent overrun of the feed rollers.

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

FIG. 1 is a diagrammatic elevational view of a supply and takeup mechanism for a photographic printer including my new adjustable feed mechanism;

FIG. 2 is a perspective diagrammatic view of my variable feed mechanism;

FIG. 3 is a side elevational view of one step in the operational cycle of my variable feed mechanism;

FIG. 4 is a diagrammatic elevational view of another step in the operational cycle of my variable feed mechanism;

FIG. 5 is a side elevational view showing adjustment of my variable feed mechanism.

In the form of the invention shown, a portion of the photographic printer is illustrated. Referring now to FIG. 1, a driving roller 11 is provided to draw a web of sheet material 12 from supply reel 10. In the form shown the web constitutes photographic printing paper although other material may be used. A loop 12*a* is provided to isolate the reel 10 from surges resulting from periodic operation of the feeding mechanism. Rollers 13 and 14 feed the web into the printing area A while rollers 16 and 17 provide tension and draw the material 12 through the printing area A. Rollers 16 and 17 are slightly larger than rollers 13 and 14 so as to maintain tension on the web in the printing area. A takeup reel 18 is provided for the material 12 which passes over an idler roller 19. An ordinary numbering mechanism 15 provides an identifying mark for each individual section of material passing through the printing area. A chain 20 is provided to drive sprockets 22 and 24 thereby driving rollers 17 and 14 respectively. Rollers 13 and 16 are driven by gears *a* and *b* which engage gears *c* and *d* associated with rollers 14 and 17 respectively. Not shown in the diagrammatic view but present in the working machine are clutches 19 respectively associated with the drive shafts of the sprockets 22 and 24 which allow the chain to drive the material 12 in a forward direction only, slippage of the clutches occurring as the spring 21 causes return movement of the chain at the end of the forward takeup movement during each cycle.

A drive wheel 26 is provided and is connected to a mechanism (not shown) which drives the drive wheel 26 through one complete revolution for each cycle of machine operation. Such a mechanism is disclosed in the copending application previously identified herein.

The takeup movement for each cycle of operation is produced by an idler wheel such as the sprocket 28 which engages an intermediate portion of the chain 20. Suitable means for producing lateral takeup movement of the chain and takeup wheel 28 is provided such as the rotary disk member 26 on which the takeup wheel 28 is mounted. The wheel 26 in effect provides a crank arm for producing the desired lateral movement of said takeup wheel 28 and also confines the portion of the chain engaged with said wheel 28 to maintain driving engagement therebetween. The crank arm or disk prevents the chain from bypassing the engaging member or takeup wheel 28 and becoming entangled in the mechanism. The surface of the wheel 26 may be coated with vibration damping and absorbing materials known as nylon and teflon which are readily available on the market.

In FIG. 1, the mechanism is shown in its initial starting position. A brake arm 30 is mounted on a suitable support, shown diagrammatically, at a fixed pivot point 32. A brake bank 36 is attached to the brake arm at 38 and extends over a brake drum 40 to a suitable stationary mounting. In FIG. 1, the brake is shown in the engaged position causing friction between the brake drum 40 and the brake band 36. The drive wheel 26 acts as a cam and is engaged by the follower wheel 34 on the brake arm 30. A cam lobe is provided which commences with the inclined rise portion 42 and terminates with the decline portion 44.

The mechanism for varying the amount of takeup produced by the lateral movement of the takeup wheel 28 during its eccentric revolution about the axis of the drive wheel 26 can be readily adjusted by varying the position of the portion of the chain 20 engaged by the takeup wheel 28 and the axis of rotation of the wheel 26. In the specific form of the invention illustrated, this adjustment is accomplished by providing an anchor 50 at the end of the chain 20 opposite the end attached to the spring 21. Suitable means for moving the anchor 50 are provided such as the adjusting screw 46 which is operable by the crank 48. A position indicating scale 51*b* is provided which can be calibrated to read the length of photographic material driven by the chain when the anchor 50 is in the indicated position. An indicating arrow 51*a* is mounted on the anchor 50 to indicate the position of the anchor at any particular setting of the adjusting mechanism.

As shown in FIG. 2, a shield 52 may be provided to prevent lateral vibration of the chain 20 by enclosing the chain between the drive wheel 26 and the shield. The shield may be spring loaded against the chain so that a substantial vibration damping is achieved without increased friction drag on the mechanism. The shield may be coated with a low friction resilient vibration damping material just as is wheel 26 as shown in FIG. 2.

In FIG. 3, drive wheel 26 is shown at the initiation of a cycle of operation. The wheel is shown slightly advanced in its revolution, the idler wheel 28 slightly engaging chain 20 and the wheel 34 on the inclination 42. As the idler wheel 28 engages the chain 20, the chain is drawn in such a fashion that the sprockets 22 and 24 turn counter clockwise thereby driving the photographic material through the viewing area by turning rollers 13, 14, 16 and 17. At the same time the brake band 36 is released from brake drum 40. It will be seen that as the chain 20 is driven the spring 21 is extended.

Further illustration is provided in FIGS. 4 and 5 showing that as the drive wheel 26 advances in its revolution it causes a greater and greater deflection of the chain 20 until it reaches the point of maximum advancement shown in FIG. 4. It will be understood that as the wheel 28 initially engages the chain, the deflection will commence at a relatively slow rate and the rate of deflection will increase as the result of the harmonic motion of the takeup wheel.

From the point of maximum advancement depicted in FIG. 4, the chain deflection will decrease and the spring 21 will provide the required force to return the chain 20 to its starting position. As previously explained, the sprockets 22 and 24 drive through clutches 19 so that no drive is imparted to the rollers 13, 14, 16 and 17 on the return portion of the cycle. It can be seen, however, in FIG. 4 that the wheel 34 on the brake arm 30 rides down the declination 44 before the maximum acceleration is provided to the photographic material. Thus the brake is applied well before the return portion of the cycle commences so as to prevent overrun of the photographic material.

FIG. 5 illustrates the adjustment of the drive length of the variable feed mechanism. In FIG. 5 the screw 46 has been adjusted by the operator using handle or crank 48 to a position in which the maximum deflection of the chain 20 by idler wheel 28 produces a minimum deflection as compared to other possible adjustments. This is completely illustrated by the dotted line portion B showing the chain undeflected in its new position and C showing the deflection of the chain with the anchoring point 50′ in the position shown in the other figures. It will be appreciated that as the operator would move the anchoring point 50 from the old position 50′ shown in FIG. 5 to the new position that some advancement of the chain and sprocket would occur causing wastage of a small portion of photographic material. However, once the advancement has occurred and the machine set in operation, the slight advancement of the chain and increased tension on the spring 21 in the initial position will have no effect on the operation of the mechanism. It is possible to adjust the mechanism while in operation to obtain the desired length.

The operation of the mechanism according to my invention will now be explained. In operation, the advancing mechanism operates at a high rate of speed, sometimes in fact operating well in excess of 100 times a minute. For each cycle of operation, the drive wheel 26 starts from an initial position such as is shown in FIG. 1 or FIG. 3, and advances clockwise through one complete revolution. As the cycle of operation is initiated, the brake band 36 is released from the brake drum 40 as a result of the follower wheel 34 on the brake arm 30 riding up the incline 42 of the cam lobe. The size of the cam lobe may be suitably adjusted so as to reengage the brake at a predetermined optimal portion of the operating cycle.

In FIG. 2, the cycle of operation is shown in its beginning stages with the acceleration of the photographic material just commencing as the brake mechanism is being released. In FIG. 4, the mechanism is shown at maximum displacement as one full frame of photographic material has been advanced. The brake is applied at or slightly before the point of maximum velocity so that when the advancement portion of the cycle ceases, no overrun of the photographic material in the feed rollers occurs. This provides for proper framing and positioning of the photographic material. The amount of braking applied can, of course, be adjusted in many ways to produce the desired deceleration and drag characteristics on rollers 13 and 14.

The variable adjustment feature of the invention is shown in FIG. 5 in which an external crank or handle 48 may be readily adjusted by the operator to reposition the anchoring point 50 the chain and thus adjust the feed length of the individual frames of photographic web 12. It will be appreciated that the track along which the anchoring point 50 travels as a result of operation of the screw and handle may be at an inclination to more closely approximate a tangent with the drive wheel 26 so that relatively little advancement of the chain 20 will occur as the mechanism is adjusted for a different feed length. Anchor 50 may also travel in an arc, thereby causing no unwanted advancement. Also, if the drive wheel 26 is moved back and forth for adjustment, no unwanted advancement will occur.

This invention has numerous advantages. As a result of the circular motion of the idler wheel 28 on the drive wheel 26, the chain and consequently the photographic material is driven in a harmonic motion as a function of time thus providing a gradual acceleration of the photographic material. This gradual acceleration of the photographic material insures that no sudden stresses are placed on the material and, as a result of this, the material is not likely to jam in the mechanism or to be torn.

As will be noted, the idler wheel 28 becomes totally disengaged from the chain at the end of a cycle of operation thus allowing the accuracy of the stroke length to become independent of a requirement that the drive wheel 26 stop in exactly the same position at the completion of each cycle. Since the machine is intended for cyclic or intermittent operation, it is highly advantageous that the machine is independent of slight variations of the drive motor in determining feed length.

Each stroke length of the photographic material will be determined only by the position of the anchoring point 50 of the chain 20 as shown on the scale 51*b*, and the drive wheel will provide only the motive power for each cycle. Thus feed length adjustments can be made by the mechanical means such as that shown or something comparable without having to make a complicated gear or mechanical change in the rotation and driving equipment. Since the drive length adjustment does not involve adjustment of the crank arm length but involves displacing the anchoring point of the chain, the adjusting handle or crank can be placed in a position convenient to the operator of the machine. The adjustment control can be placed in any desired location by the use of mechanical means well known so that the connection to screw 46 can be made through angles or changes in height of the control handle. Adjustments can be made while the unit is in operation. Of course, it will be observed that it will be possible to adjust the feed length of web material such as photographic print paper to any desired size in extremely small increments.

As a result of the smooth acceleration and deceleration provided by the harmonic motion of the drive wheel, a relatively light pressure is permitted on the driving rollers which is advantageous as the light pressure will prevent injury to the paper surface. Another feature is that as the drive element is engaged at the beginning of a stroke there is no load on the drive mechanism until the takeup wheel contacts the chain, thus reducing the starting load on the drive mechanism. It has been found that when the takeup wheel contacts the chain there is a relatively low impact or shock produced. For these reasons it has been found that a mechanism according to our invention will be very durable and have an extremely long life compared to previous drive mechanisms.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportion of the parts without departing from the scope of the invention, which generally stated consists in the matter set forth in the accompanying claims.

What is claimed is:

1. An adjustable intermittent feeding mechanism for elongated strips of sheet material comprising
   - strip engaging elements to drive said strip intermittently through a working area,
   - an elongated flexible actuating member operably connected with said strip engaging elements and having an intermediately disposed takeup portion,
   - yieldable tensioning and return means connected to one end of said flexible actuating member,
   - means for anchoring the other end of said flexible member,
   - a rotary driving member mounted from rotation on an axis disposed transversely of said flexible member,
   - a takeup member mounted on said driving member and positioned for takeup engagement with said intermediate takeup portion of said flexible member and located in radially spaced relation to said axis,
   - a power source for said rotary member to drive said means through one complete revolution to drive each advancement of said strip of material, and
   - means for varying the relationship between said takeup member and said flexible member to adjust the effective length of the takeup stroke of said takeup member and thus adjust the increment of takeup of said flexible member.

2. The structure set forth in claim 1 and said last mentioned means constituting mechanism for varying the space between the axis of the rotary driving member and the portion of the flexible member engaged by said takeup member at the beginning of the takeup stroke.

3. The mechanism of claim 1 in which said rotary driving member constitutes a rotary drive wheel and having said takeup member mounted at a distance from the axis of rotation of said wheel.

4. The mechanism of claim 1 in which said feeding mechanism employs a one-way driving means operably associated with said strip-engaging elements so that said flexible actuating member is driven through an actuating stroke, thereby advancing said strip of material, but preventing backward movement of said strip when said tensioning means returns said flexible actuating element to its initial position.

5. The mechanism of claim 1 in which friction means is operably connected to said feeding mechanism to resist the movement of said strip of material during at least a portion of each cycle.

6. The mechanism of claim 5 in which said friction means comprises

- a rotary brake element associated with at least one of said strip-engaging elements, and
- a brake means associated with said rotary brake element for engagement therewith.

7. The apparatus of claim 6 including means for tightening said brake means on said rotary brake element during a portion of the takeup cycle.

8. The apparatus of claim 7 in which said rotary driving member has a cam portion thereof operably associated with said tightening means to control the forcing of said brake means into contact with said rotary brake element.

9. The apparatus of claim 1 in which said rotary driving member has a surface associated with said flexible actuating member to restrict the lateral movement of said flexible member.

10. The apparatus of claim 9 in which said surface is coated with a material to dampen lateral vibration of said flexible actuating member.

11. The apparatus of claim 1 in which a shield is mounted with a surface parallel with said rotary driving member so that said flexible actuating member is confined in a space formed between said shield and said rotary driving member.

12. The apparatus of claim 11 in which said shield is coated with a material to dampen lateral vibration of said flexible actuating member.

13. The apparatus of claim 2 in which said rotary driving member is mounted at a permanently fixed position in said mechanism and in which said mechanism for varying the space between the axis of the rotary driving member and the portion of the flexible member engaged by said takeup member is a movable mounting means for said anchoring means, said movable mounting means being operable to move said flexible actuating member back and forth transversely of the axis of said rotary driving member.

14. The apparatus of claim 2 in which said anchoring means for said flexible member is mounted at a permanently fixed position in said mechanism and in which said mechanism for varying the space between the axis of the rotary driving member and the portion of the flexible member engaged by said takeup member is a movable mounting means for said rotary driving member, said movable mounting means being operable to move said rotary driving member back and forth transversely with respect to said flexible actuating member.

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