This invention relates to a roll feed auxiliary adjustment, but has reference more particularly to an adjustment of this character which is especially useful for presses in which a strip of metal is automatically and intermittently fed for operations thereon, such as blanking, piercing, drawing, etc. In presses of this kind, the metal strip, coil or sheet is usually fed past the dies by means of a roll which is rotated intermittently through a small arc to expose fresh sections of the metal strip to the action of the dies. Such rotation of the roll is usually effected by means of some suitable ratchet mechanism which, in turn, is actuated by the crankshaft of the press through the intermediary of a rod eccentrically connected to the crank-block. The rod is subjected to a combined oscillatory and reciprocatory movement to oscillate a shaft and suitable connections from said oscillating shaft to said ratchet mechanism.

Methods employed heretofore to adjust the feed stroke of a roll consisted in varying the eccentricity of said rod by means requiring the stopping of the press during the adjustment. However, the act of stopping the press renders a fine adjustment difficult to obtain since the press must be restarted to determine the efficacy of the adjustment, the end result being a trial and error or cut and try type of correction. These expedients have not proved satisfactory since the time required to adjust the feed stroke in this manner can be directly equated to loss in operation time.

The objections to this type of adjustment have been partially overcome by later developed manual adjustment means operable while the press is running. However, even these means do not meet all of the requirements for feed stroke adjustment since manual adjustments on a continuously running mechanism still must depend on the alertness and skill of the operator to detect and correct imperfect feeding.

Now that lithographed printing of coils of metal strip is increasingly being used on many diversified articles of manufacture, the tolerances required in press operations on such strip are becoming exceedingly close. It follows therefore that slight misfeeds, which were heretofore not of sufficient magnitude to justify correction, now sometimes result in a high incidence of scrap. This problem is particularly acute with long coils of lithographed stock where feed variations during the lithographing process may create irregularities in the pattern spacing. Such irregularities may occur at random and, if not compensated for as they occur, will make registration of the patterns with the press dies impossible regardless of the accuracy of the feed of the coil strip into the press. For this reason, an adjustment in the length of feed must be able to be made quickly and automatically, while the machine is in operation, since it is no longer possible to rely on manual adjustments to keep a press in operating adjustment such as will consistently produce acceptable articles of manufacture from lithographed coils of metal strip. While this problem is particularly associated with long coils, it may also arise with shorter strips of sheet material and for the sake of brevity and simplicity of exposition the word "sheet" as used hereinafter is intended to refer to material in any of the above mentioned forms.

It is a principal object of the invention, therefore, to provide an adjustment for roll feeds which will obviate the disadvantages of the aforesaid heretofore employed expedients.

Other objects of the invention include the provision of novel roll feed adjustment means which is fully automatic in operation; the provision of novel roll feed adjustment means which will automatically compensate for misaligned or misspaced patterns on lithographed coiled stock so that good registry is maintained between the patterns and the press punch and die members at all times; the provision of a novel roll feed adjustment means which automatically compensates for misfeeding of stock whereby good registry is maintained at all times between the press punch and die members; the provision of novel feed adjustment means which automatically compensates for misfed stock on lithographed stock and/or misfeeding of the stock in combination; the provision of novel roll feed adjustment means which require but a minimum of easily assembled and maintained parts; the provision of novel photoelectric feed control means employed cooperatively with other novel roll feed adjustment means to provide perfect registry in a machine at all times; and a provisional roll feed adjustment means the use of which will increase the efficiency and reliability of a press so equipped.

To the accomplishment of the foregoing and further related objects, said invention comprehends the means hereinafter fully described and particularly pointed out in the claims; the annexed drawings and the following description setting forth in detail certain structure embodying the invention, such structure however, being merely illustrative of various forms in which the principle of the invention may be used.

Figure 1 is a schematic elevational view of a preferred embodiment of the invention showing an adjusting means mounted on a press crankshaft crank block; Figure 2 is an enlarged fragmentary view of the adjusting means shown in Figure 1; Figure 3 is a sectional view of the adjusting means taken substantially along the line 3—3 of Figure 2; Figure 4 is a schematic elevational view of another preferred embodiment of the invention showing an adjusting means mounted for coaction with a press back shaft, cross shaft, or the like; Figure 5 is an enlarged fragmentary view of the embodiment of the invention shown in Figure 4, partially sectioned, to better show the interior construction; Figure 6 is a top plan view of the embodiment of the invention shown in Figure 5; and Figure 7 is a side elevational view, partially sectioned, of the embodiment of the invention shown in Figure 5.

Reference is now made to the drawings in greater detail and, in particular, to Figure 1. A preferred embodiment comprises a roll feed adjustment 10 secured to the end portion 12 of the crankshaft 14 of a press. A pin 16 is adjustably secured to a circular crank block or base mounting plate 18 to receive thereon the yoke portion 20 of a connecting rod 22. The lower end 24 of the connecting rod is pivotally secured to an extended arm portion 26 of a bell crank 28. The other arm 30 of the bell crank is pivotally secured to a transverse bar 32 which pivotally connects a pair of feed rolls 34 and 36 through ratchet arms 38 and 40 to intermittently rotate these rolls. Arms 38 and 40 are mounted on ratchet means (not shown) of any suitable construction so as to intermittently rotate the rolls 34 and 36 in one direction only, namely, the direction of the feed of
stock S in the press. A pair of upper rolls 42 and 44 are positioned above adjacent lower rolls 34 and 36, respectively, to grip stock therebetween and assist in advancing the stock beneath the punch 46 and die 48.

The base plate or crank block 18 (see Figures 2 and 3) is provided with a collar or sleeve 50 adapted to slip over the end 12 of the press crankshaft 14 to which it may be securely fixed. The pin 16 is rigidly secured to a non-rotatable nut 52 threaded onto a rotatable shaft 54 journaled on opposite ends in plain bearings 56 and 58 fastened to the base plate 18. A small fractional horsepower motor 60 is bolted to the crank block 18 and has a worm 62 (see Figure 3) integrally secured to the end of the rotor shaft 64 projecting normal to the threaded shaft 54. A worm wheel 66 is secured to one end of the threaded shaft 54 for meshed engagement with the worm 62, so that energization of the motor 60 will rotate the worm 62 and wheel 66 to drive the threaded shaft 54 and traverse the non-rotatable nut 52 radially with respect to the axis of the press crankshaft 14.

A light source 68 is mounted above the path of the strip S being fed into the press to cast a beam of light on the one edge of the strip. Registration or indexing marks 70 are printed at regular intervals along the margin of the strip S to receive the beam of light from the light source 68 and reflect it toward one of a pair of photoelectric scanning eyes 72 and 74 also mounted above the path of travel of the material being fed into the press. A suitable limit switch means 76 is provided to energize the motor 60 only after the material has come to rest at its forwardmost position, this period occurring when the ratchet arms 38 and 40 are passing through the return stroke prior to advancing the material one additional position. However, as an alternative embodiment it may prove expedient under certain conditions to use switch 76 for energizing light source 68 instead of the motor 60. The limit switch 76, as shown in Figures 1 and 4, is positioned to be actuated by a cam 78 secured to the periphery of the circular crankblock 18. As an alternative arrangement, the limit switch may be located adjacent to and actuated by an attachment to the feed drive oscillating shaft 80, or the mechanisms reciprocated thereby. The registration marks 70 are so positioned that when the machine is properly adjusted they should come to rest at a position 71 intermediate that which will reflect light into either the over-scanning eye 72 or the under-scanning eye 74.

Assuming that a press is properly adjusted when it begins operating, the feed rolls may over a period of time underfeed the material a slight amount which is additive during each stroke until the registration mark is no longer advanced to the intermediate normal position 71 described hereinabove. More significantly, the patterns on lithographed sheet material may be irregularly spaced, or a combination situation may develop wherein the lithographed patterns are not only irregularly spaced but the feed rolls may also under feed or over feed the stock. In any event, the registration mark will reach a position with respect to the light source that the reflection of the light source on the registration mark will reflect the beam 82 into the under scanning eye 74. This reflected beam will then energize the under-scanning eye 74 to close an appropriate circuit in control box 84, which, in turn, will energize the electric motor 60 to rotate in a predetermined direction. The electric motor 60 by rotating in said direction increases the eccentricity of the pin 16 with respect to the axis of the crankshaft 14. The stroke of the roll feed adjustment mechanism will then be increased so that progressively the registration mark 70 on the strips will be advanced forwardly to the intermediate position.

If the feed is over-corrected, the registration mark will then be advanced until it finally reflects beam 88 from the light source 68 into the over-scanning eye 72. The over-scanning photoelectric eye 72 then closes a circuit to energize the electric motor 60 causing it to rotate in the opposite direction, wherein the eccentricity of the pin 16 with the axis of the crankshaft 14 is reduced, thereby shortening the stroke of the roll feed mechanism until the registration mark 70 has been once again zeroed in.

The foregoing discussion has been based on the assumption that the registration marks 70 have higher reflectance properties than the surrounding background. There may be circumstances created by the particular design or coating on the material whereby a dark marking of lower reflectance than the surrounding material must be used as the registration mark. In this case, the circuit would be adapted so that the scanning eyes would work in the reverse manner, that is, in the normal situation, both eyes would be energized by the reflected light and if the registration mark shifts from position 71 sufficiently to interrupt the energization of a scanning eye, the appropriate control circuit will adjust the feed mechanism back to the normal position.

It will be seen, therefore, from the above discussion of the invention that the adjustment process is continuous so that the feed of strip S is controlled within allowable tolerances at all times. With respect to this first discussed embodiment of the invention, appurtenant parts 90 and 92 from control box 84 supply current to crankshaft slip rings 94 and 96 which are connected to motor 60 (see Figure 3) by leads 98 and 100. It will be understood that other members of slip rings may be employed depending on the particular circuit used to energize the motor 60. No discussion of the wiring circuits contained in control box 84 and adapted to energize the electric motor 60 for clockwise and counterclockwise rotation has been made since it is recognized that such circuits are well known and do not constitute a part of this invention per se.

Another preferred embodiment of the invention is shown in Figure 4 wherein the stroke adjusting mechanism is incorporated adjacent to the trammel bar 32 rather than the press crankshaft 14 (see Figure 4). In this embodiment, the crank block 102 is fitted over the end of the crankshaft in much the same manner as the base plate 18 shown in Figure 3, but it carries thereon a pin 104 which is integrally secured with the housing 121 or may be integrally secured to the base plate eccentrically with respect to the axis of the press crankshaft 14. A yoke 106 of a connecting rod 108 is received over the pin 104 for pivotally mounting. The lower end of the connecting rod 108 is fitted with a socket 109 to pivotally receive a ball 110 therein to form a conventional type ball and socket joint 112.

The ball 110 is one end of a nonrotatable threaded shaft 114 which functions as a feed adjustment tool 116 (see Figure 5). A worm wheel 118 is rotatably mounted on the threaded shaft 114 and held against lateral movement by a housing cover 120 of housing or hub member 121 which journals the threaded shaft 114. A fractional horsepower electric motor 122 (see Figure 6) is mounted on the outside of the housing 121 and has a worm 124 (see Figure 7) secured to its rotor shaft 126 journaled on the opposite side of the casing from the motor mounting. The worm 126 threaded engages the worm wheel 118 to traverse the threaded shaft 114, moving the ball and socket joint outwardly and inwardly with respect to the housing 121. The mechanism, as shown, is suitably mounted for pivotal movement on any convenient feed drive oscillating shaft 80 which, if desired, may laterally transfer oscillatory motion from the housing side of the shaft to the opposite side of the press where the roll feed mechanism may be operated. In any event, whether the motion of the housing 121 is adjacent to the opposite side of the press or to the near side, an arm 128 comparable to the arm 30 of the bell crank 28 shown in Figure 1, is provided to pivotally connect with the afore-described trammel bar 32. This arm 128 may be integrally secured with the housing 121 or may be-
tегrally secured to the backshaft 80. In either case the function and operation will be the same.

The electric motor 122 is identical to that of electric motor 60 discussed with regard to the first mentioned preferred embodiment of the invention. However, the change in stroke of the roll feed adjustment is obtained by increasing or decreasing the length of threaded shaft 114 extending outwardly from the centerline 130 (see Figure 4) of the housing 121 toward the connecting rod 108. Accordingly, the eccentricity of the pin 104 does not require the compensating adjustment during operation but the lever arm at the lower end of the connecting rod 108 is adjustable to provide the necessary correction in the feed of the press.

It will be seen, therefore, that whether the stroke adjustment of the workfeed mechanism is obtained at the crank block 18, or at the feed drive oscillating shaft 80, the necessary adjustments are being continuously made throughout the operation of the press to enable the production of a high percentage of acceptable workpieces.

It is to be understood that when these embodiments of the invention are shown herein, these embodiments are by way of example only and are not to be construed in a limiting sense. Other similar arrangements and modifications will occur to those skilled in the art and may be resorted to without departing from the spirit and scope of the invention.

1. In a device for intermittently feeding sheet material into a metal working press adapted to perform work thereon, the improvement in feed adjustment means comprising: a light source adapted to project a beam of light on sheet material being fed through said machine; photoelectric scanning means adapted to be energized by light reflected from said sheet material; a roll feed mechanism to feed a predetermined length of said sheet material at each cycle of said machine; and electric motor means adapted to vary the length of feed of said sheet material in response to a signal from said photoelectric scanning means.

2. In a device for intermittently feeding sheet material into a metal working press said sheet material having regularly spaced indexing marks thereon, the improvement in feed adjustment means comprising: a light source adapted to project a beam of light on sheet material being fed through said machine; photoelectric scanning means adapted to be energized by light reflected from said sheet material; a roll feed mechanism to feed a predetermined length of said sheet material at each cycle of said machine; and electric motor means adapted to vary said length in response to a signal from said photoelectric scanning means.

3. In a device for intermittently feeding sheet material into a metal working press said sheet material having regularly spaced indexing marks thereon, the improvement in feed adjustment means comprising: a light source adapted to project a beam of light on sheet material being fed through said machine; photoelectric scanning means adapted to be energized by light reflected from said sheet material; a roll feed mechanism to feed a predetermined length of said sheet material at each cycle of said machine; and electric motor means adapted to vary said length in response to a signal from said photoelectric scanning means.

4. In a metal working press including a feed device for intermittently feeding sheet material into said press, the improvement in feed adjustment means comprising: a light source adapted to project a beam of light on sheet material being fed through said machine; photoelectric scanning means adapted to be energized by light reflected from said sheet material; a roll feed including a pair of feed rolls; means to reciprocate at least one of said feed rolls; a reciprocable bell crank mounted on said press and having one arm thereof drivingly connected to said feed roll reciprocating means; a shaft drivingly connected to said press; a connecting rod drivingly connected at one end to the other arm of said bell crank and eccentrically connected at its other end to said shaft; connecting rod throw adjusting means; an electric motor adapted to operate said throw adjusting means; switch means synchronized with the cyclic operation of said press to energize said light source at a predetermined period in each cycle of operation; and means to energize said electric motor responsive to the energization of said photoelectric scanning means.

5. A photoelectric scanning device for controlling the intermittent feed of sheet material, said sheet material having regularly spaced indexing marks thereon adapted to vary the intensity of reflected light, comprising: a light source adapted to project a beam of light on said sheet material; a feed mechanism adapted to intermittently feed said sheet material; a pair of photoelectric cells adapted to be energized by light reflected from said sheet material; circuit means responsive to a signal from said pair of photoelectric cells adapted to vary the feed stroke of said feed mechanism; and switch means synchronized with the cyclic operation of said feed mechanism to energize said circuit means at a predetermined point in each cycle of operation.

6. A photoelectric scanning device for controlling the intermittent feed of sheet material, said sheet material having regularly spaced indexing marks thereon having a coefficient of reflection substantially different from the background, comprising: a feed mechanism adapted to intermittently feed said sheet material; a light source adapted to project a beam of light on said sheet material; a pair of photoelectric cells linearly spaced along a line parallel to the direction of feed of said feed mechanism and adapted to be energized by light reflected from said sheet material; said pair of photoelectric cells being so positioned that the reflected image of an indexing mark is normally midway between the light source and the said feed rolls; means to reciprocate at least one of said feed rolls; a reciprocable bell crank mounted on said press and having one arm thereof drivingly connected to said feed roll reciprocating means; a shaft drivingly connected to said press; a connecting rod drivingly connected at one end to the other arm of said bell crank and eccentrically connected at its other end to said shaft; connecting rod throw adjusting means; an electric motor adapted to operate said throw adjusting means; switch means synchronized with the cyclic operation of said press to energize said light source at a predetermined period in each cycle of operation; and means to energize said electric motor responsive to the energization of said photoelectric scanning means.

7. In a metal working press including a feed device for intermittently feeding sheet material into said press, the improvement in feed adjustment means comprising: a light source adapted to project a beam of light on sheet material being fed through said press; photoelectric scanning means adapted to be energized by light reflected from said sheet material; a roll feed including a pair of feed rolls; means to reciprocate at least one of said feed rolls; a reciprocable bell crank mounted on said press and having one arm thereof drivingly connected to said feed roll reciprocating means; a shaft drivingly connected to said press; a connecting rod drivingly connected at one end to the other arm of said bell crank and eccentrically connected at its other end to said shaft; connecting rod throw adjusting means; an electric motor adapted to operate said throw adjusting means; switch means synchronized with the cyclic operation of said press to energize said light source at a predetermined period in each cycle of operation; and means to energize said electric motor responsive to the energization of said photoelectric scanning means.

8. In a metal working press including a feed device for intermittently feeding sheet material into said press, the improvement in feed adjustment means comprising: a light source adapted to project a beam of light on sheet material being fed through said press; photoelectric scanning means adapted to be energized by light reflected from said sheet material; a roll feed including a pair of feed rolls; means to reciprocate at least one of said feed rolls; a reciprocable bell crank mounted on said press and having one arm thereof drivingly connected to said feed roll reciprocating means; a shaft drivingly connected to said press; a connecting rod drivingly connected at one end to the other arm of said bell crank and eccentrically connected at its other end to said shaft; connecting rod throw adjusting means; an electric motor adapted to operate said throw adjusting means; switch means synchronized with the cyclic operation of said press to energize said light source at a predetermined period in each cycle of operation; and means to energize said electric motor responsive to the energization of said photoelectric scanning means.

9. In a metal working press including a feed device for intermittently feeding sheet material into said press, the improvement in feed adjustment means comprising;
a light source adapted to project a beam of light on sheet material being fed through said press; photoelectric scanning means adapted to be energized by light reflected from said sheet material; a roll feed including a pair of feed rolls; means to reciprocate at least one of said feed rolls; a reciprocable bell crank mounted on said press and having one arm thereof drivingly connected to said feed roll reciprocating means; a connecting rod drivingly fastened at one end to the other arm of said bell crank; drive shaft drivingly connected to said press; a connecting rod throw adjusting means including a housing secured to one end of said drive shaft normal to the drive shaft axis and concentric therewith; a screw journalied in said housing; a nut threaded on said screw and having a stub shaft extending therefrom to receive the other end of said connecting rod thereon; a worm wheel secured to one end of said screw; a worm drivingly connected to said worm wheel; a motor adapted to drive said worm wheel; a motor adapted to drive said worm; and means to energize said motor responsive to the energization of said photoelectric scanning means.

10. In a metal working press including a feed device for intermittently feeding sheet material into said press, the improvement in feed adjustment means comprising: a light source adapted to project a beam of light on sheet material fed through said press; photoelectric scanning means adapted to be energized by light reflected from said sheet material; a roll feed including a pair of feed rolls; means to reciprocate at least one of said feed rolls; a reciprocable bell crank mounted on said press and having one arm thereof drivingly connected to said feed roll reciprocating means; a shaft drivingly connected to said press; a connecting rod drivingly connected at one end to the other arm of said bell crank and eccentrically connected at its other end to said shaft; connecting rod throw adjusting means; an electric motor adapted to operate said throw adjusting means; circuit means adapted to energize said electric motor responsive to the energization of said photoelectric scanning means; and switch means synchronized with the cyclic operation of said press to connect said electric motor to said circuit means at a predetermined period in each cycle of operation.

11. In a metal working press including a feed device for intermittently feeding sheet material into said press, the improvement in feed adjustment means comprising: a light source adapted to project a beam of light on sheet material being fed through said press; photoelectric scanning means adapted to be energized by light reflected from said sheet material; a roll feed including a pair of feed rolls; means to reciprocate at least one of said feed rolls; a reciprocable hub member mounted on said press having an arm extending therefrom and drivingly connected to said feed roll reciprocating means; a threaded shaft extending from said hub member; a drive shaft driven by said press; a connecting rod drivingly fastened at one end to said threaded shaft and eccentrically fastened at its other end to said driveshaft; said threaded shaft being adjustable engaged in said hub; a worm wheel in said hub threaded on said shaft; an electric motor mounted on said hub; a worm driven by said motor to rotatably engage said worm wheel; circuit means adapted to energize said electric motor responsive to the energization of said photoelectric scanning means; and switch means synchronized with the cyclic operation of said press to connect said electric motor to said circuit means at a predetermined period in each cycle of operation.

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