United States Patent [19]

Service

[11] **3,761,034**

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[54] **PAPER FEEDING DEVICE**

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[73] Assignee: **Armco Steel Corporation,** Middletown, Ohio

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[52] **U.S. Cl.** **242/78.1,** 242/58.1, 242/67.3

[51] **Int. Cl.** **B21c 47/04,** B65h 19/18

[58] **Field of Search** ..... 242/78.1, 58.1, 78.3, 242/67.1 R, 67.2, 67.3, 55

[56] **References Cited**

UNITED STATES PATENTS

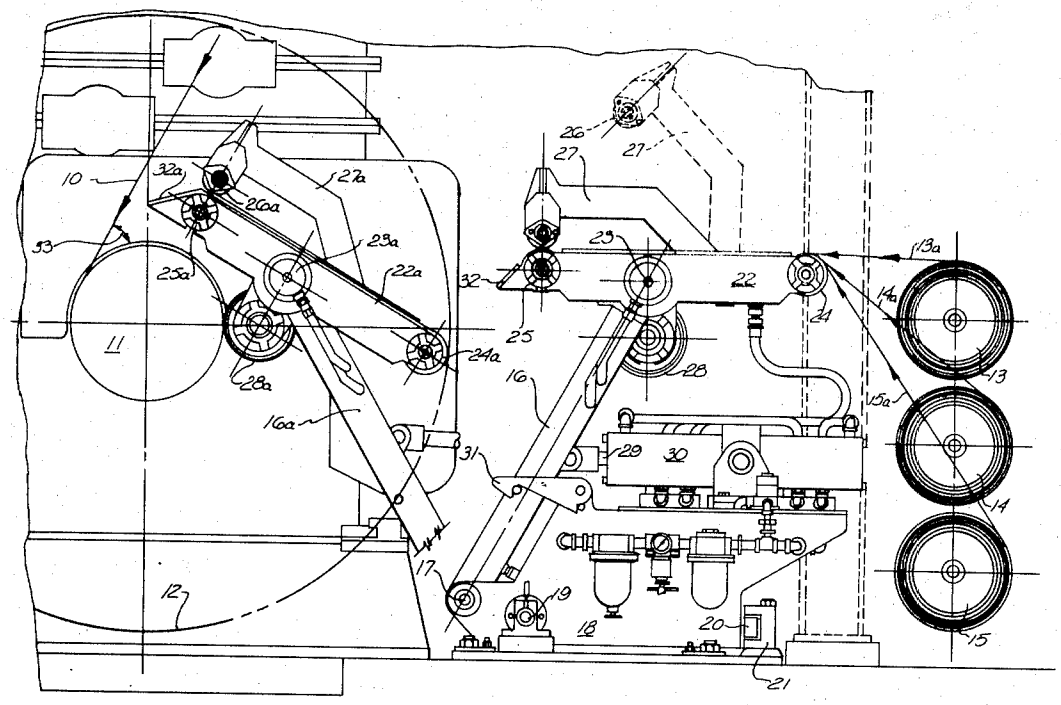
3,381,906	5/1968	Whitehouse	242/78.1
2,334,109	11/1943	McBain	242/78.1
3,489,628	1/1970	Catzen	242/58.1 X

Primary Examiner—George F. Mautz
Assistant Examiner—Edward J. McCarthy
Attorney—John W. Melville et al.

[57] **ABSTRACT**

There is disclosed an apparatus for feeding a paper strip into the convolutions of a metal strip as it is being coiled on a coiler after rolling, or annealing and pickling and the like, where the strip has a polished surface which must be protected against scratching. The apparatus includes a splicing table over which the paper is passed from the supply roll, an upper pinch roll movable into and out of engagement with the paper strip, a lower driven pinch roll cooperating with said upper pinch roll, a driver roll, and a driving connection between said driver roll and lower pinch roll. The assembly of the splicing table and pinch rolls and drive rolls is movable from an inactive position to an active position, in which said driver roll contacts the periphery of the metal strip coil, to be frictionally driven thereby and to drive said lower pinch roll. The diameters of said driver roll and lower pinch roll, and the gear train therebetween, are such that the paper strip is fed at the surface speed of the coil. The lower pinch roll is provided with a slip clutch so that the paper may be withdrawn by the metal coil at a faster speed than that provided by the pinch roll, so that tearing of the paper strip during movement of the assembly to its inactive position before the upper pinch roll is raised, is avoided.

7 Claims, 3 Drawing Figures



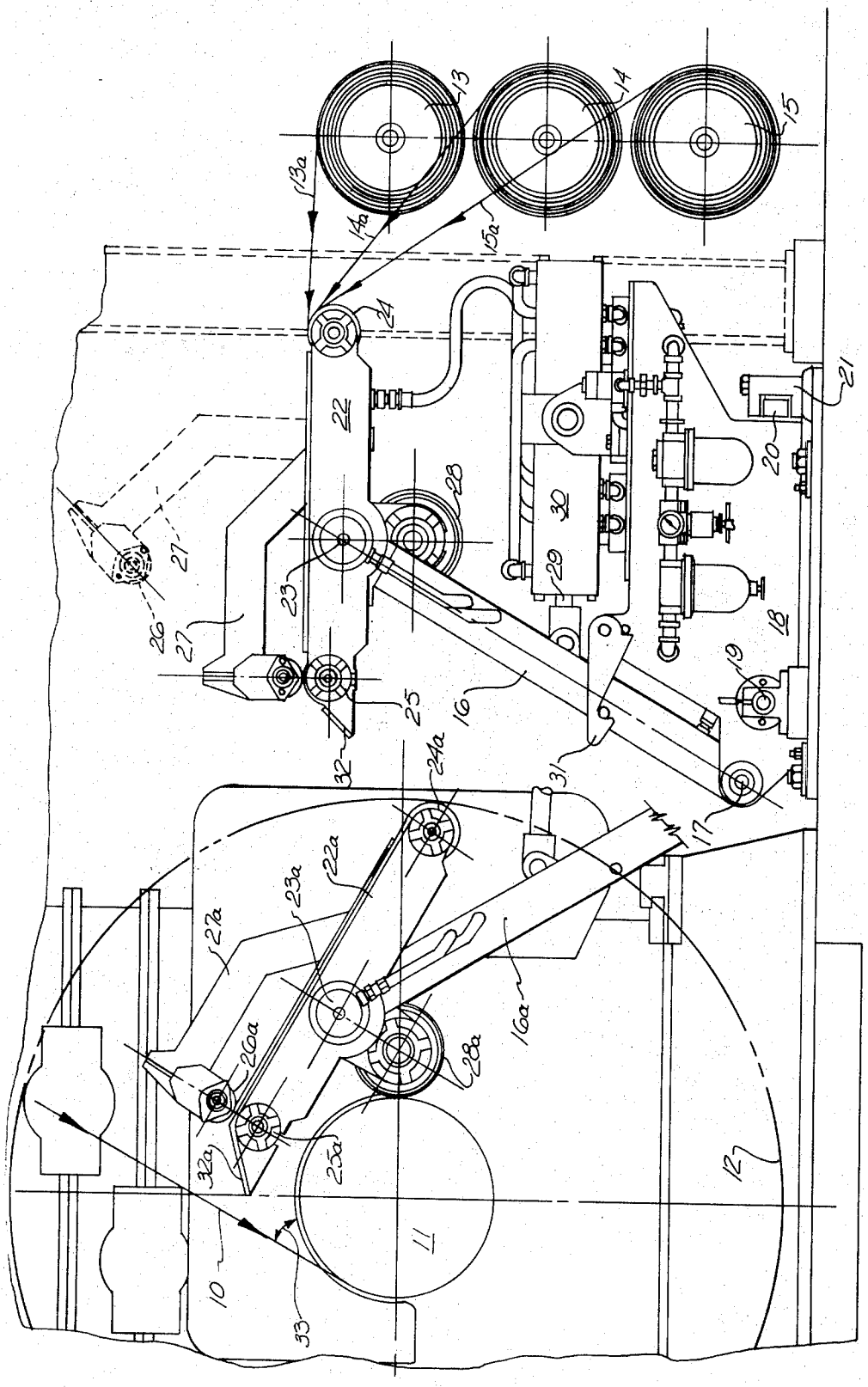

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FIG. 1

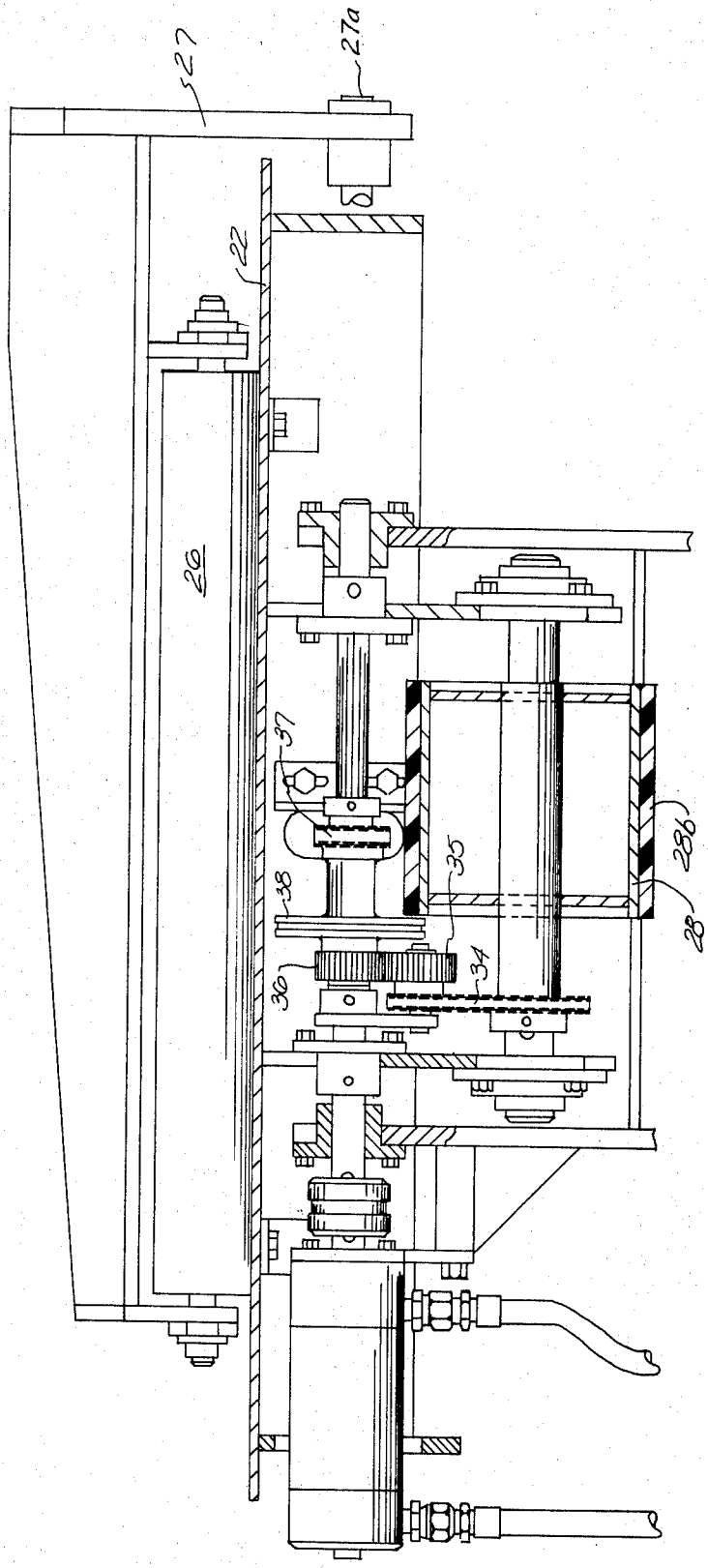

FIG. 2

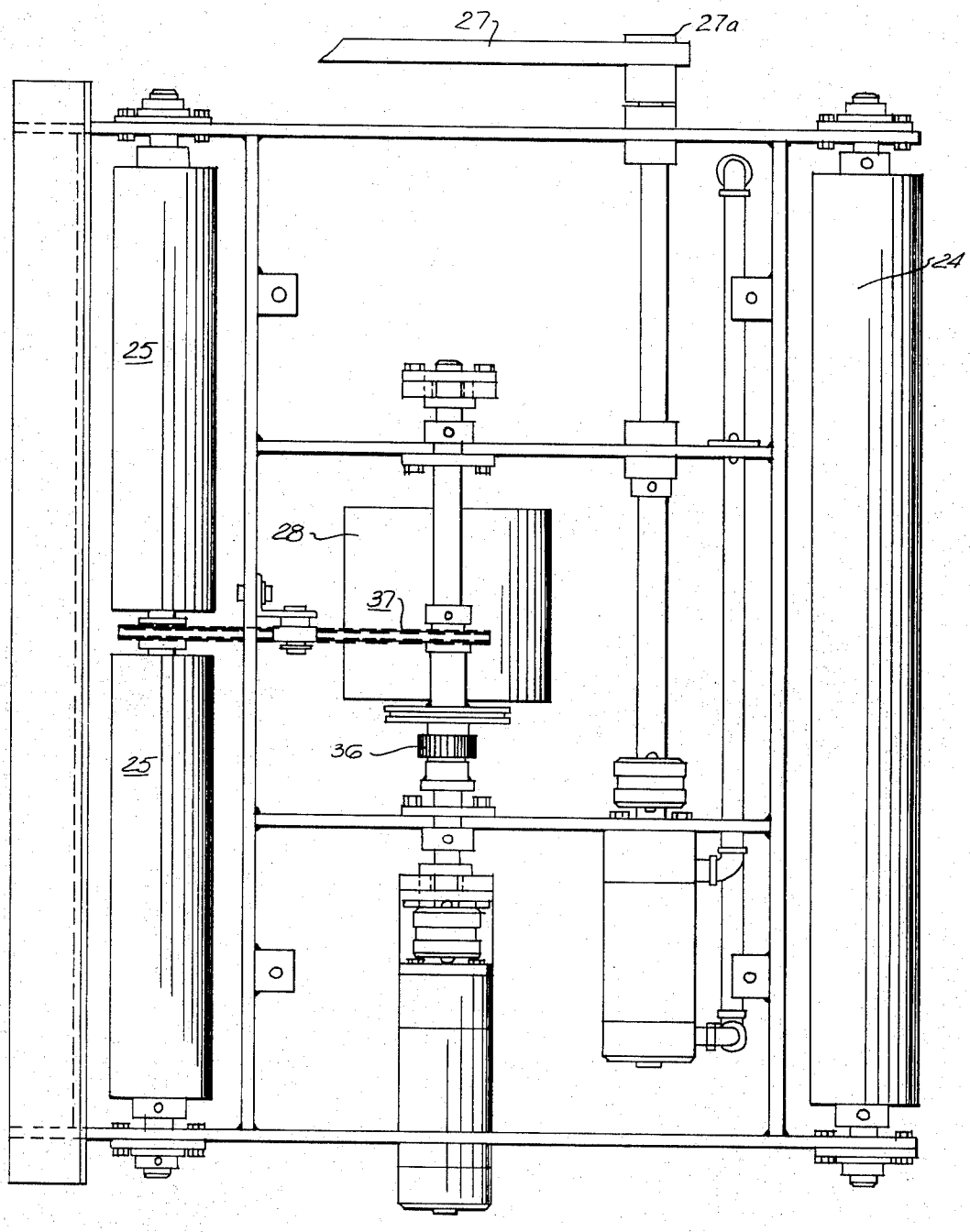

FIG 3

PAPER FEEDING DEVICE

BRIEF SUMMARY OF THE INVENTION

In the handling of metal strip having a polished surface, e.g., stainless steel, copper and aluminum strip which has been bright annealed, or bright annealed and polished, it is important to maintain the surface quality thereof. With some rolling mills, a metal strip is rolled back and forth to bring it to gauge. Some such mills have coiler mandrels which are not collapsible, so that for further processing where the coil must have an open center, it is necessary to take the strip off the mandrel and recoil it on a coiler with a collapsible mandrel. The strip is again uncoiled for annealing and pickling, and then recoiled. Unprotected strip will sustain a considerable amount of inter convolutional scratching at each coiling and uncoiling operation. For many uses of steel such scratches are inconsequential; but where the strip is required to have a high surface finish, it is imperative to avoid such scratches. It is known that scratching can be prevented, and surface finish maintained, by coiling a strip of paper along with the steel, so that the convolutions of steel are separated, throughout the length of the coil, by paper. Heretofore the paper strip has been fed into the nip of the coil by hand, and after a partial wrap, the coil simply pulled the paper strip along. However, as metal processing lines have been speeded up in recent years, hand feeding has become extremely dangerous to the operators, and a need has developed for automatic means to start the feed of the paper strip.

One solution is represented by U. S. Pat. No. 3,381,906 issued May 7, 1968 to Whitehouse et al. The apparatus disclosed and claimed in said patent has not, however, proved entirely satisfactory.

The present invention overcomes the problems heretofore encountered, and provides for the feeding of paper into the nip of the coil without danger of tearing the paper strip and without bodily risk to the operator. It also makes possible the splicing of paper strip, so that when one paper roll is exhausted, the leading end of another strip may be spliced onto the trailing end of the preceding strip, rather than attempting to feed the leading edge of a new strip into the coil so as to overlap the trailing end of the previous strip.

According to the present invention a movable frame is provided, which frame may be moved by hydraulic or pneumatic actuators and the like between an active and an inactive position. The movable frame carries a splicing table and a pair of pinch rolls, the lower roll being driven, and the upper roll being individually movable into, and out of, paper feeding position. The movable frame also carries a driver roll, which, in the active position of the assembly, is adapted to bear against the outermost convolution of the coil of metal as it is being coiled, so as to be rotated thereby. A gear train, including a slip clutch, is provided between the said driver roll and the lower pinch roll; and the diameters of the driver roll and the lower pinch roll, and the gear train parameters are such, that the pinch roll will feed the paper strip at the surface speed of the metal strip as it enters upon the coil.

In practice, the paper feeding device is put into its active position long enough to start the paper strip into the metal coil as follows: The upper pinch roll is raised, so that the leading end of the paper strip may be pulled through between the pinch rolls. The upper pinch roll is then lowered into pinching position, and the assembly is moved to the active position. As soon as the driver roll contacts the first convolution of the metal coil, the pinch rolls start to feed the paper strip at the correct speed. In said active position the pinch rolls will be disposed adjacent the nip of the coil, so that as the paper feeds out, it is immediately nipped and pulled into the convolution of the metal. Thereupon the upper pinch roll is raised and the assembly is moved back to its inactive position; and from then on, the paper strip is simply pulled into the coil by the action of the coiler. The purpose of the slip clutch is to permit the paper to move faster than it would be driven by the lower pinch roll, and to permit the paper to be drawn into the coil without tearing when the drive to the lower pinch roll is interrupted by separation of the driver roll from the coil when the assembly starts to move to the inactive position.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

FIG. 1 is a somewhat diagrammatic elevational view of the apparatus of the invention;

FIG. 2 is a somewhat diagrammatic elevational view with parts in section as seen from the right of FIG. 1 showing the drive train; and

FIG. 3 is a somewhat diagrammatic plan view of FIG. 2.

DETAILED DESCRIPTION

Referring first to FIG. **1**, a strip of metal is indicated at **10** about to be coiled on a mandrel indicated generally at **11**. The broken line **12** indicates approximately the diameter of the completed coil. A plurality of paper reels are indicated at **13, 14** and **15**, and the lines **13***a*, **14***a* and **15***a* indicate the path of the paper from each of the reels, it being understood that paper is fed from only one reel at a time.

The apparatus of the invention comprises basically a rocker arm **16** which is pivoted at the point **17** on the main frame **18** of the apparatus. The frame **18** is arranged for a small amount of movement transversely, i.e. in a direction normal to the paper of the drawing so that the paper strip may be fed into the coil of metal in proper alignment therewith. This is accomplished by means of a ball bushing **19** and a roller **20** adapted to move along a track **21**. The apparatus is physically linked to the coiler, and thus moves laterally as the coiler moves. For clarity of disclosure the linkage is not shown.

The rocker arm carries a splicing table indicated generally at **22** and the splicing table **22** is pivotable with respect to the rocker arm **16** about the point **23**. The splicing table carries an idler roll **24** over which a strip of paper is fed thereto and driven roll **25** and a pinch roll **26** which is mounted on a movable arm **27**. The arm **27** can be moved from the solid line position of FIG. **1** to the broken line position when it is desired to start a paper strip through the pinch roll **25–26**. The splicing table also carries the driver roll **28** which is connected by a gear train with the pinch roll **25** as will be described in more detail hereinafter. The rocker arm **16** is rocked by means of a piston rod **29** operating within a cylinder **30** which may be either pneumatic or hydraulic. The arm **27** is actuated by a rotary actuator of any desired type which does not form any part of the invention and will therefore not be described in detail. The rocker arm **16** is retained in its inactive position by

means of the safety latches **31** (there being one on each side of the apparatus). The latches **31** may be lifted by any desired means, either mechanically or by fluid pressure or electrically, to permit applying pressure to the piston within the cylinder **30** to rock the arm **16** in a counterclockwise direction as seen in FIG. **1** to the position shown at **16***a*. At the same time, a rotary actuator of any desired type indicated at **23** tilts the splicing table **22** to the position indicated at **22***a*. It will be noted that the splicing table has a donwwardly turned nose portion **32** which in the position **32***a* generally points toward the nip of the coil indicated at **33.** It will also be observed that the paper is led off the tops of the respective reels **13, 14** and **15** so that the normal coil set will cause the leading end of the paper strip to curve downwardly beyond the nose **32***a* so that when the pinch rolls advance the paper strip, it will be caught in the nip **33.**

It will be observed that in the active position of the assembly, the roll **28** which has been designated the driver roll occupies the position shown at **28***a* in which it contacts the coil being formed on the mandrel **11.** The roll **28** may be provided with a suitable friction surface **28***b* to enhance the driving effect of the coil on the roll **28.** In the embodiment shown, roll **28** is twice the diameter of roll **25.** The rotation of the roll **28** is transmitted by a chain and sprocket drive indicated generally at **34** to a pinion **35.** Preferably at this point the diameters of the driving and driven sprockets are in the ratio of **2:1** so that the rotational speed of the pinion **35** is twice that of the roll **28.** The drive is further transmitted to the pinion **36** which is the same size as the pinion **35** and the drive from the pinion **36** is transmitted by another chain and sprocket drive indicated generally at **37** (FIG. **3**) to the lower pinch roll **25.** As a result of this drive arrangement, the pinch roll **25** will feed the paper strip at the surface speed of the strip **10** entering upon the coil. The ratios between rolls and sprockets can be changed as desired so long as the overall effect is a 1:1 ratio of paper to steel strip speeds. The pivot axis of the arm **27** is indicated at **27***a*. **38** indicates a slip clutch or overrunning clutch which permits the paper to be withdrawn through the pinch rolls faster than the above described drive train would feed it, whereby the rocker arm **16** may be returned to its inactive position with the pinch roll **26** still in engagement with the pinch roll **25** and while the paper strip is being pulled into the nip of the coil without tearing the paper.

It will be understood that in FIG. **1** the numerals referring to the rocker arm, splice table, and associated parts have been given the postscript "a" when the assembly is in its active position. The numerals without the postscripts indicate the inactive position of the assembly.

Initially, of course, paper is fed off one of the reels **13, 14** or **15** onto the splicing table **22** with the arm **27** in its raised position. The arm **27** is then caused to assume its pinching position by any suitable means (not shown) and the coil having been just started, the safety latches **31** are released and the rocker arm assembly is pivoted to the active position wherein the driver roll at **28***a* contacts the initial convolution of the coil being formed and transmits its drive to the pinch rolls **25***a*, **26***a* to cause the paper to be fed into the nip **33.**

Thereupon, the rocker arm may be returned to its inactive position and the arm **27** may be raised. The slip clutch prevents tearing of the strip in the event that the arm **27** is not immediately raised.

As one of the reels **13, 14** or **15** is exhausted, the apparatus is stopped with the curving end of a strip of paper on the splicing table **22** and the leading end of one of the other reels is led onto the splicing table and secured to the trailing end of the previous strip. These strips may be secured together adhesively and thereupon the operation may be resumed. In the meantime, the reel which has just been emptied may be replaced by another full reel. Thereby the operation will suffer a minimum interruption for changing paper reels.

The power means for tilting the rocker arm **16** have been indicated to be a cylinder and piston which may be hydraulic or pneumatic. Other than this, the means for raising and lowering the arm **27** may be of any suitable kind such as rotary actuators, and similarly the means for tilting the splicing table **22** may be rotary actuators or other suitable devices. Since these do not form any part of the present invention and the controls therefor are well known, they have not been described.

It will be clear that numerous modifications may be made within the spirit of the invention and no limitations not specifically set forth in the claims is intended or should be implied.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A feeder for feeding paper strip into the nip of a coil of metal as said coil is being formed, comprising:

a. a splicing table and a rocker arm,

b. said splicing table being pivotably mounted on said rocker arm and said rocker arm being pivotably mounted for movement between an inactive position and an active position,

c. power means for moving said rocker arm, power means for pivoting said splicing table,

d. said splicing table carrying a lower paper pinch roll, and a driver roll,

e. said driver roll being positioned to bear against said rotating metal coil, whereby the rotation of said coil is imparted to the driver roll when said rocker arm is in the active position,

f. a driving connection between said driver roll and said lower pinch roll, the diameters of said rolls and the parameters of said driving connection being such as to feed the paper strip at the surface speed of the metal strip being coiled,

g. said splicing table also carrying a pivotable arm, an upper pinch roll rotatably mounted on said pivotable arm, and

h. independent power means for raising and lowering said pivotable arm to bring said upper pinch rOll out of, and into, contact with the paper strip fed between said upper and lower pinch rolls.

2. Apparatus according to claim **1,** including a plurality of paper supply reels, whereby if one paper roll is exhausted, the leading end of another paper roll may be lapped over the trailing end of the preceding paper strip on said splicing table, and said ends may then be secured together, and the exhausted roll may be replaced with a new roll of paper to minimize interruption.

3. Apparatus according to claim **1,** wherein said splicing table has an angular nose, which, in the active position of said table approximately bisects the nip be-

tween the metal strip entering the coil and the outermost convolution of metal strip on the coil.

4. Apparatus according to claim 1, wherein the paper supply reel is so arranged that the paper passes over the splicing table from the top of the supply reel, whereby the coil set of the paper promotes entry of the leading end of the paper strip into the nip of the coil.

5. Apparatus according to claim 1, wherein the diameter of the driver roll is twice that of the lower pinch roll, and the driving connections therebetween provides a 1:2 ratio, so that the peripheral speed of said driver roll and lower pinch roll are equal.

6. Apparatus according to claim 1, wherein the said driving connection includes an over-running clutch, whereby paper strip may be withdrawn faster than it is being fed by said pinch roll, to prevent tearing of the paper strip.

7. Apparatus according to claim 1, wherein said rocker arm and its associated elements are arranged for movement parallel to the axis of the metal coil, whereby proper alignment of the paper strip with the metal coil may be obtained.

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