July 23, 1957 K. L. BANDY 2,800,327

STRIP FEEDING LINE

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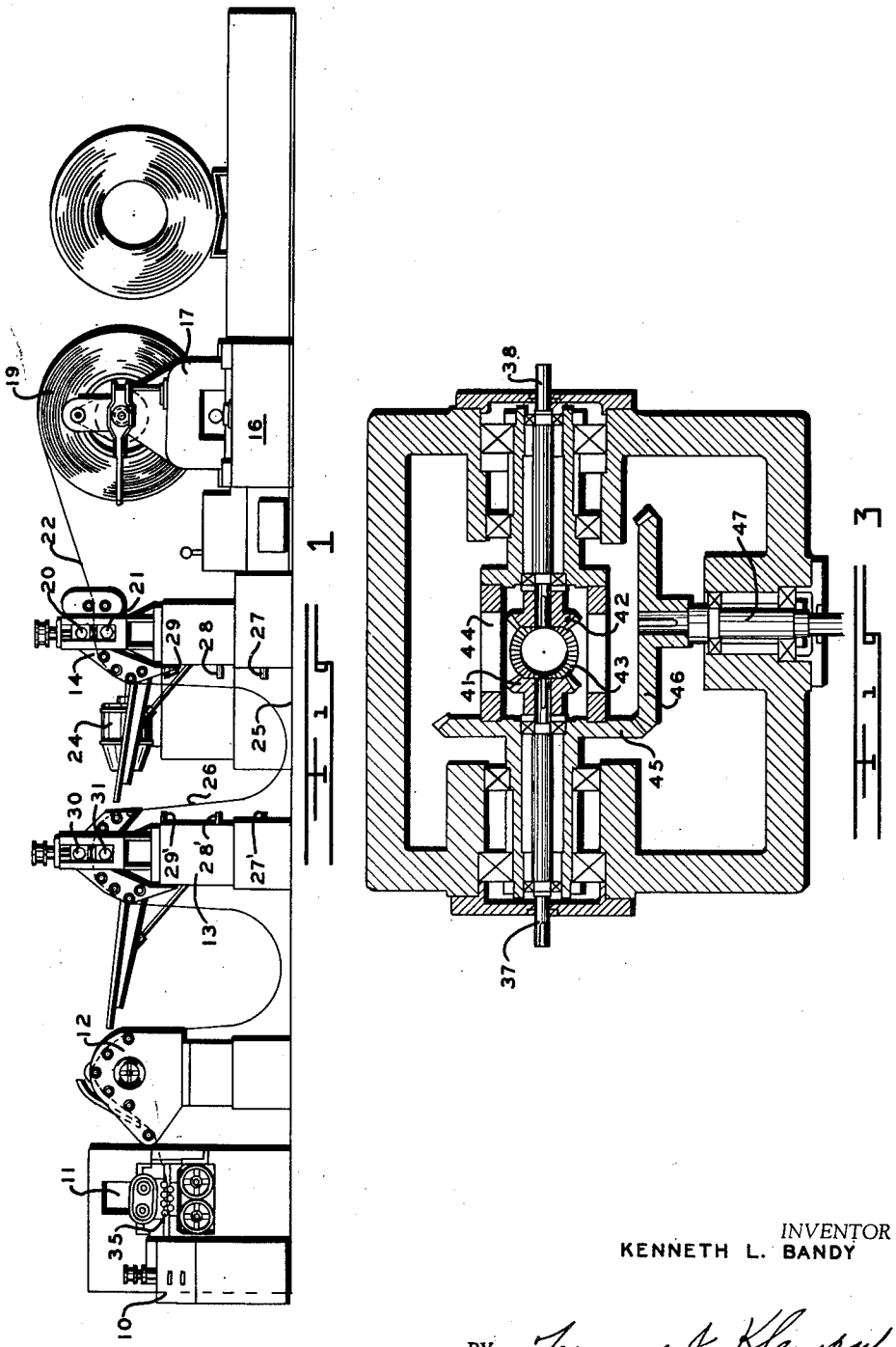

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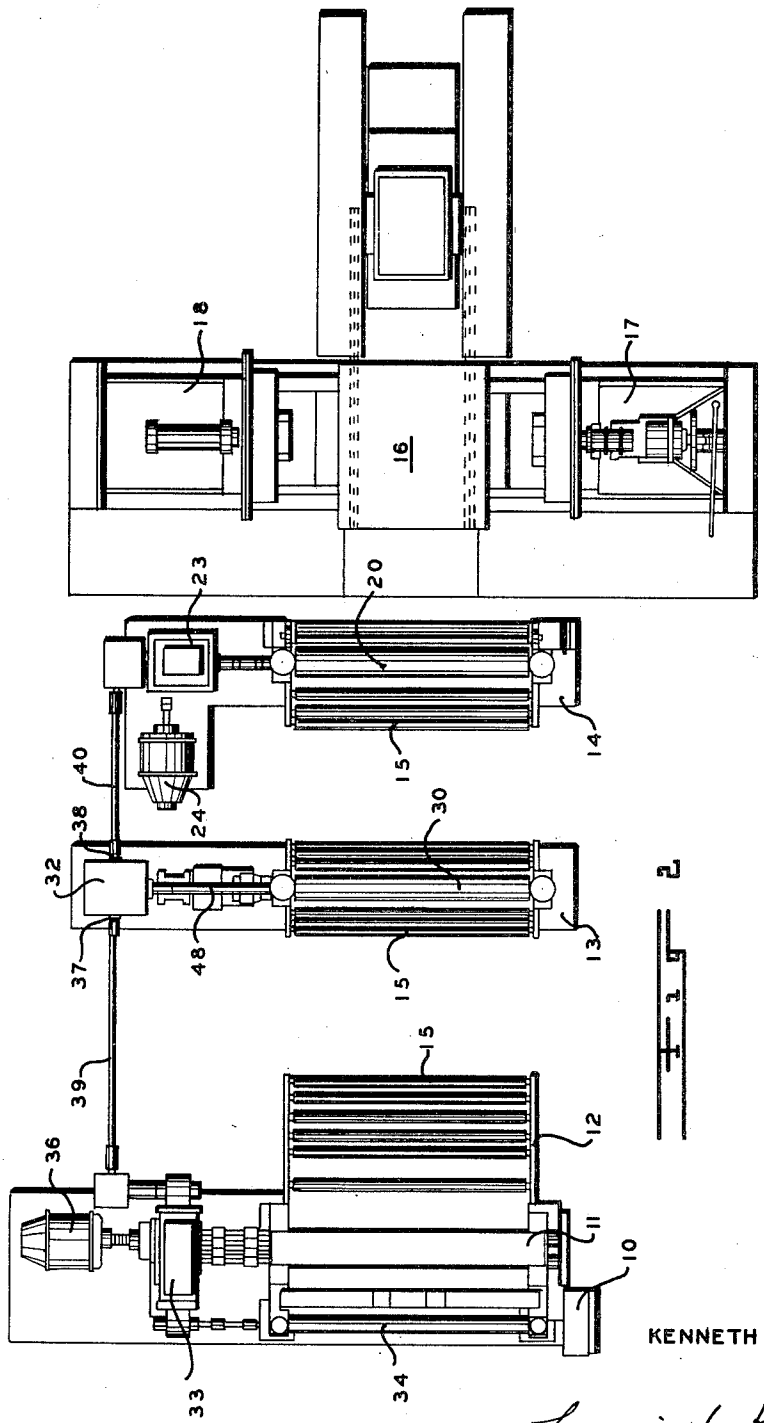

FIG. 2

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STRIP FEEDING LINE

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6 Claims. (Cl. 271—2.2)

The present invention relates to the handling of metal strip and coiled sheet, and has particular reference to apparatus for feeding strip or sheet from a coil thereof into a press, shear or other allied apparatus.

As an overall object, the present invention seeks to provide an improved and simplified apparatus for drawing strip metal from a large heavy coil thereof and feeding the strip material intermittently and at high speed into a press or shear, for example.

In the feeding of strip into high speed presses, shears and the like the strip is rapidly accelerated and decelerated, and alternately moved at high speed and stopped. Thus, since the strip is generally prepared, shipped and handled in the form of large coils, there is provided means for drawing the strip from the coil at a slower, average rate of speed. To accomplish this it is conventional to provide one or more loose loops of slack material between the uncoiling station and the press or other device. Then, when strip is fed at high speed into the press the loop is taken up or reduced, while when the strip is stopped, as during a pressing operation, the loop is increased by the continued average feeding of strip from the coil.

In many cases, particularly where relatively large lengths or increments are fed at high speed, the total loop length must be quite large in order to maintain continuity of operation. This generally necessitates the provision of deep looping pits and/or complicated loop position responsive motor control systems, all of which involves substantial expense in the installation and maintenance of the line. Accordingly, it is an object of the present invention to provide a strip line apparatus including a raised intermediate strip supporting stand positioned between the pull-off stand and the feeder stand by means of which the strip may be conveniently directed through two relatively small loops aggregating the total desired loop capacity. In this manner it is possible to avoid the use of a conventional looping pit.

Another object of the invention resides in the provision of a strip feeding line incorporating an intermediate strip supporting stand between the strip pull-off and feeding stands, wherein means is provided for driving the strip through the intermediate stand in such relation to the feeding of the strip and the paying off thereof from the coil that the loops on either side of the stand are of equal size at all times. In this respect the invention contemplates the provision of a novel drive arrangement for the intermediate strip supporting stand which is mechanically interconnected to the feeding and pay-off drive apparatus in such manner that as a quantity of strip is pulled off of the coil and drawn into the first loop exactly one half of such quantity of strip is transferred from the first to the second loop through the intermediate stand. In this manner all strip drawn off of the coil is distributed equally in both of the loops. Likewise, it is contemplated that as a given quantity of strip is drawn from the loops by the feeding apparatus there will

be a simultaneous transfer of strip from the first loop to the second, through the intermediate stand, of exactly half the quantity of strip fed, so that both loops remain of equal size during feeding operations.

More specifically, it is an object of the invention to provide a strip feeding line incorporating an intermediate strip supporting stand forming loops on either side thereof, in connection with which is provided a novel differential type drive assembly driven interdependently by both the pay-off and feeding drives in such manner that an integrated control is provided for the intermediate stand. Thus, at any instant the speed at which the intermediate stand is driven equals one half the sum of the feed and pay-off speeds. As will become more fully apparent upon further consideration of the present disclosure, this arrangement permits of the use of photo-electric or other loop position responsive pay-off drive controls in connection with only one of the two loops, with the other loop being maintained in an identical condition through my integrated drive arrangement.

The above and other objects and advantages of the invention will become apparent upon full consideration of the following detailed specification and accompanying drawing wherein is disclosed a certain preferred embodiment of the invention.

In the drawing:

Figure 1 is a side elevation of a complete strip feeding line incorporating the apparatus of my invention;

Figure 2 is a top plan view of the strip line of Figure 1; and

Figure 3 is an enlarged section view of the drive mechanism incorporated with the apparatus of Figure 1, in accordance with the teachings of the invention.

Referring now to the drawing, and initially to Figures 1 and 2 thereof, the numeral **10** designates a feeding pinch roll stand for a press or shear apparatus, not shown, which is positioned at the end of the strip line. Adjacent the roll stand **10**, on input or feeding side thereof, is a roller leveler device **11** which is arranged to flatten and process the strip material prior to the same moving into the press or shear.

Positioned rearwardly of the shear and leveler, in spaced relation, are three strip supporting stands **12**, **13** and **14** which are provided with a plurality of freely rotating guiding and supporting rolls **15**.

Adjacent the first stand **14** there is provided a suitable uncoiler device **16** which is provided with a pair of spaced opposed coil supporting heads **17** and **18**. The coil supporting heads are adapted to engage the eye opening of a coil **19** of strip or sheet material so that the coil may be rotated as material in drawn therefrom.

On the uncoiler side of the strip supporting stand **14** there are provided a pair of pinch rolls **20** and **21** which receive strip **22** directly from the coil **19**. At one end of the stand **14** there is mounted a transmission or drive unit **23**, powered by a high power electric motor **24**. The motor **24** is arranged to be actuated at various times and speeds to draw strip from the coil **19** through the pinch rolls **20** and **21**.

Between the first and intermediate strip supporting stands **13** and **14** there is a substantial space, for example four or five feet. The rolls **15** of the supporting stands are, as will be observed in Figure 1, positioned several feet above the floor or foundation **25** so that a looping area is defined, into which a loop **26** of the strip material may be formed.

At spaced points along the base portions of the stands **13** and **14** are mounted photo-electric units **27**—**29** and **27'**—**29'** which constitute light sources and receivers respectively. These photo-electric units form part of a control circuit for the drive motor **24** so that when the loop **26** becomes larger or smaller than desired the drive

motor 24 may be controlled accordingly. Thus, when the strip loop breaks the beam of the lowermost photoelectric unit 27 the motor 24 is stopped. When the loop moves up above the lower units 27—27', while still breaking the beam of unit 28, the motor 24 will be operated at a slow speed. And when the loop moves further upward the motor will be operated at full speed to draw more strip into the loop as rapidly as possible.

In accordance with the teachings of the invention the central or intermediate strip supporting stand 13 is provided with a pair of pinch rolls 30 and 31, driven by a transmission mechanism 32, to be explained in more detail, which is mounted at one end of the stand. When the pinch rolls 30 and 31 are driven strip is fed from the first loop 26 into a second loop formed in the space between the intermediate and last strip supporting stands 12 and 13.

As shown in Figure 2, there is mounted one end of the leveler 11 and feeding stand 10 a combined transmission assembly 33 which is connected to the feeding pinch rolls 34 and to the working rolls 35 of the leveler. A heavy high speed motor 36 drives the transmission 33 at desired times to feed strip into the associated press or shear apparatus, not shown, and in this connection it will be understood that a suitable strip length measuring control will be employed so that the strip may be fed in precise increments. By way of example, the strip length control disclosed in my co-pending application Ser. No. 375,698, filed August 21, 1953, may be utilized. With this control the motor 36 is accelerated rapidly at the beginning of a feeding operation, and the strip is fed at high speed until shortly before the desired length is reached, whereupon the motor is decelerated to a slow speed to complete the feeding operation.

In accordance with the teachings of the invention the transmission mechanism 32 for the intermediate strip supporting stand 13 is provided with two input drive connections 37 and 38. One of these input drive connections is coupled with an output connection from the feeder and leveler drive transmission 33 through an elongated drive shaft 39. The other input drive connection is coupled through a second elongated drive shaft 40 with an output connection from the transmission 32 which drives the pull-off pinch rolls 20 and 21.

Referring now to Figure 3, the input drive connections 37 and 38 comprise anti-frictionally journaled drive shafts which mount beveled pinion gears 41 and 42 at their adjacent inner ends. Meshing with the beveled pinions 41 and 42 is a second pair of beveled pinions 43 which are journaled on and carried by a rotary housing 44. The housing 44 has secured to one end face thereof a large bevel gear 45 which meshes with a similar bevel gear 46 carried upon the end of an output drive shaft 47. The output shaft 47 is coupled with the pinch rolls 30 and 31 of the intermediate stand 13 through a drive shaft 48.

The drive mechanism of Figure 3 is akin to a differential drive, except that a single output drive shaft is powered by separate input drives, as distinguished from the usual arrangement wherein the reverse is true.

It will be understood that for each revolution of the shaft 37, for example, with the other input shaft 38 remaining stationary, the housing 44, and hence the gears 45 and 46 and output shaft 47 will rotate one half revolution. And, of course, the same will be true when the other shaft 38 is rotating, with shaft 37 remaining stationary. Thus, it will be further understood that when both input shafts 37 and 38 are rotating the output shaft 47 will rotate at a speed equal to one half the speed of the first input shaft 37 plus one half the speed of the second input shaft 38, or one half the total of the speeds of both input shafts 37 and 38.

During normal operation of the strip feeding line, the feeder drive motor 36 will be energized in response to an appropriate control signal to begin feeding a predetermined increment of metal strip through the leveler 11 and feeder 10 to the allied press or shear apparatus. During this feeding operation the connecting shaft 39 rotates the input shaft 37 of the intermediate drive transmission 32 and thereby drives the output shaft 47 and pinch rolls 30 and 31 at half speed. Thus, during a feeding operation a quantity of strip equal at all times to half of that fed through the leveler and feeder 10 will be transferred through the intermediate stand 13. There is a resulting reduction in the length of strip in the second loop equal to the quantity fed into the leveler less half this amount which is transferred from the first to the second loop through the intermediate stand. Thus, it will be understood that both of the loops will shorten at an equal rate.

As the first loop 26 begins to move upwardly, the photoelectrically controlled pull-off motor 24 is energized to pull strip off of the coil 19 and into the first loop. At this time the connecting shaft 40 is rotated, and the speed of the intermediate pinch rolls 30 and 31 is increased, through the additive effect of the dual input to transmission 32, by an amount equal to half the feeding speed of the pull-off pinch rolls 20 and 21.

Since it is contemplated that the strip will be fed through the leveler and feeding pinch rolls 34 at a much higher rate than that at which the strip will be pulled off of the coil 19 the loops will continue to shorten and raise during feeding operations, even though there is a simultaneous feeding of new strip into the loops. Then of course, after the desired increment has been fed into the press or shear the pull-off motor 24 will continue to operate until the loops are returned to normal size.

Under ideal operating conditions the pull-off motor 24 should operate at a more or less continuous average speed, while the feed motor 36 intermittently stops and starts.

It should thus be apparent that I have fulfilled the several objects initially set forth. I have provided an improved strip feeding apparatus which is characterized by the incorporation of a novel intermediate strip handling stand and drive therefor whereby ample slack strip may be provided between a high speed intermittently operated feeder mechanism and a slower speed strip pull-off apparatus without requiring a looping pit or recess in the foundation. The apparatus of my invention includes a strip supporting stand between the feeder and pull-off apparatus which provides for two strip loops in which the desired quantity of slack strip is contained.

Perhaps the most important single feature of the invention is the drive apparatus for the intermediate stand whereby strip may be transferred through the latter, from one strip loop to the other in exact integrated relation to the feeding of the strip from the loops, as well as to the drawing of the strip into the loops from a commercial coil. The intermediate stand is provided with a pair of pinch rolls driven by means of a differential-like transmission which has input drive means connecting both the feeding and pull-off apparatus and which is operative to transfer strip from one loop to the other at exactly half the rate at which the strip is either fed from or pulled into the loops. In this manner both loops are continuously maintained in an equal relative condition, and loop position responsive motor control need be applied to only one of the loops to properly control the feeding of new strip into both loops.

It should be understood, however, that the specific apparatus illustrated herein is intended to be representative only, as many changes may be made therein without departing from the clear teachings of the invention. By way of example only, the teachings of my invention may be applied to strip line assemblies wherein three or more strip loops are provided. Thus, reference should be made to the following appended claims in determining the full scope of the invention.

I claim:

1. In a strip feeding line of the type having a source of

strip, a strip feeding station including a high speed drive motor therefor, a strip pull-off station including a drive motor therefor, and a looping area between said pull-off and feeding stations whereby slack strip may be accumulated; the improvement comprising an intermediate stand between said stations journaling a pair of pinch rolls for supporting said strip in an upraised position to define loops thereof on either side of said intermediate stand, differential-type drive means for said pinch rolls to feed strip through said intermediate stand from one loop to the other, and input means for said differential-type drive means including separate drive connections from said feeding and pull-off stations motivated by said drive motors whereby at all times the rate of transfer of strip through said intermediate stand is equal to one half the sum of the speed of strip movement through said feeding station and the speed of strip movement through said pull-off station.

2. Apparatus according to claim 1 further characterized by said drive means comprising a differential-type transmission mechanism having a common output shaft for driving said pinch rolls and independent input shafts connecting with said separate drive connections from said feeding and pull-off stations.

3. In a strip feeding line of the type having a source of strip, a strip feeding station, a strip pull-off station, and a looping area between said pull-off and feeding stations whereby slack strip may be accumulated; the improvement comprising an intermediate stand journaling a pair of pinch rolls between said stations for supporting said strip in an upraised position to define loops thereof on either side of said intermediate stand, differential-type drive means for said pinch rolls to feed strip through said intermediate stand from one loop to the other, and power input means for said drive means including separate drive connections from said feeding and pull-off stations motivated in response to the rate of strip travel at said feeding and pay-off stations respectively.

4. In a strip feeding line of the type having a source of strip, a strip feeding station, a strip pull-off station, and a looping area between said pull-off and feeding stations whereby slack strip may be accumulated; the improvement comprising an intermediate stand journaling a pair of pinch rolls between said stations for supporting said strip in an upraised position to define loops thereof on either side of said intermediate stand, loop position responsive control means associated with one of said loops and operative to actuate said pull-off station in response

to the position of said one loop, differential-type drive means for said pinch rolls of said intermediate stand to transfer strip from one side to the other thereof, and said differential-type drive means being driven in response to the rate of strip travel at said feeding and pull-off stations whereby said pinch rolls are driven in integrated proportion to the rate of strip travel at said feeding and pull-off stations.

5. In a strip feeding line of the type having a source of strip, a strip feeding station, a strip pull-off station, and a looping area between said pull-off and feeding stations whereby slack strip may be accumulated; the improvement comprising an intermediate stand journaling a pair of pinch rolls between said stations for supporting said strip in an upraised position to define loops thereof on either side of said pinch rolls, and said drive means for said intermediate stand, including differential-type means associated with and responsive to the rate of strip travel at said feeding and pull-off stations whereby the transfer of strip from one side of said intermediate stand to the other is effected in integrated relation to the rate of feeding and the rate of pull-off of said strip.

6. In a strip feeding line of the type having a source of strip, a strip feeding station, a strip pull-off and feeding station whereby strip may be accumulated; the improvement comprising an intermediate stand between said stations, said intermediate stand mounting strip moving means for supporting said strip in an upraised position to define loops thereof on either side of said intermediate stand, drive means for said strip moving means including differential-type means associated with and responsive to the rate of strip travel at said feeding and pull-out stations whereby the transfer of strip from one side of said intermediate stand to the other is effected in integrated relation to the rate of feeding and rate of pull-off of said strip.

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