Jan. 17, 1956 A. F. GROLL 2,731,213

STRIP STOCK FEEDER

Filed June 29, 1951 2 Sheets-Sheet 1

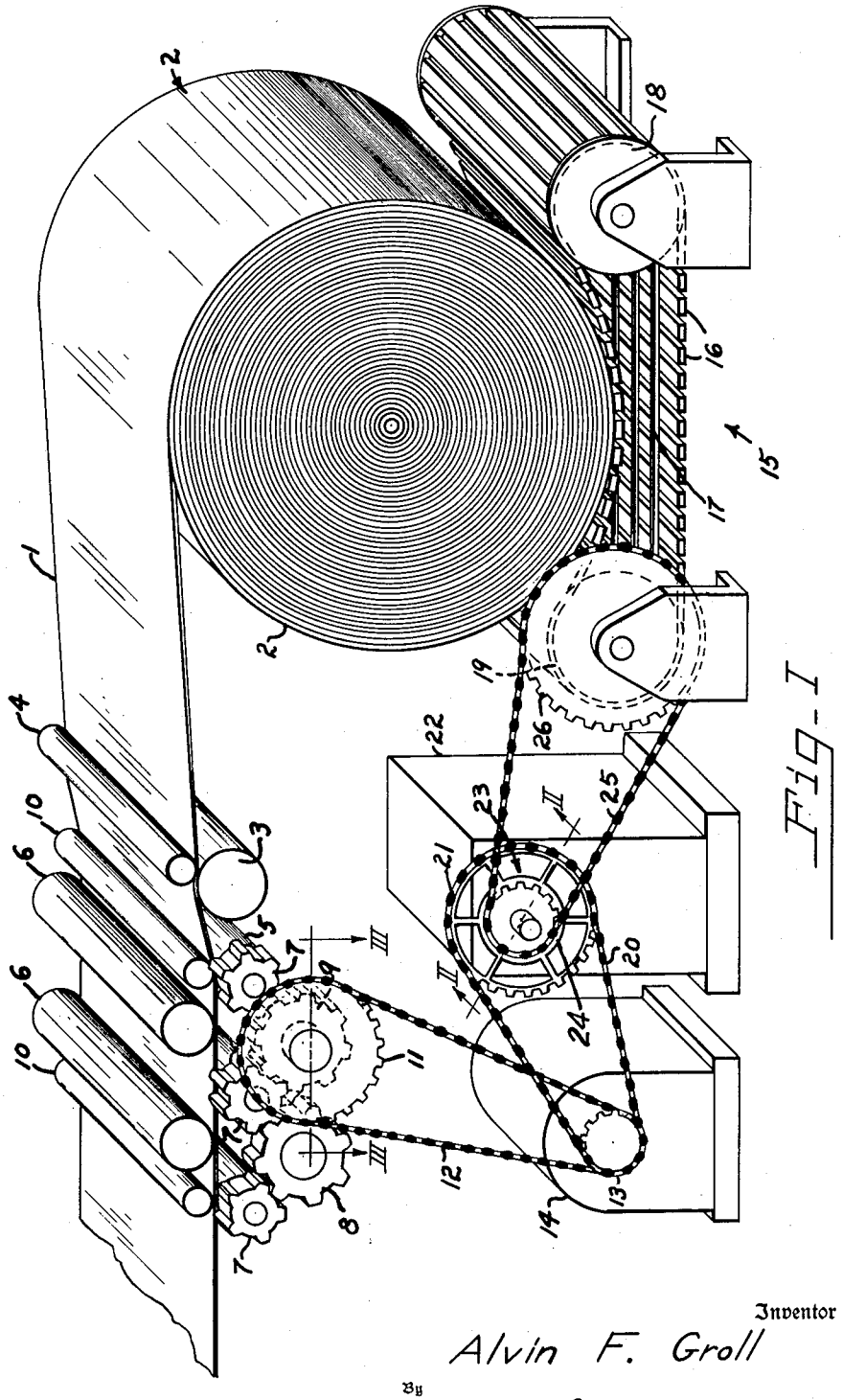


Fig. 1

Inventor

Alvin F. Groll

By

Marshall and Marshall

Attorneys

Jan. 17, 1956 A. F. GROLL 2,731,213

STRIP STOCK FEEDER

Filed June 29, 1951 2 Sheets-Sheet 2

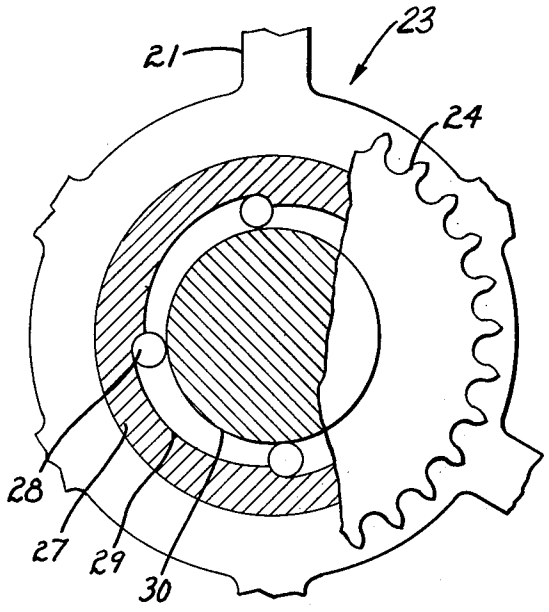


Fig. II

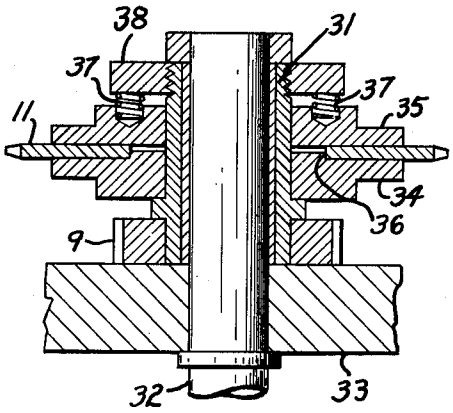


Fig. III

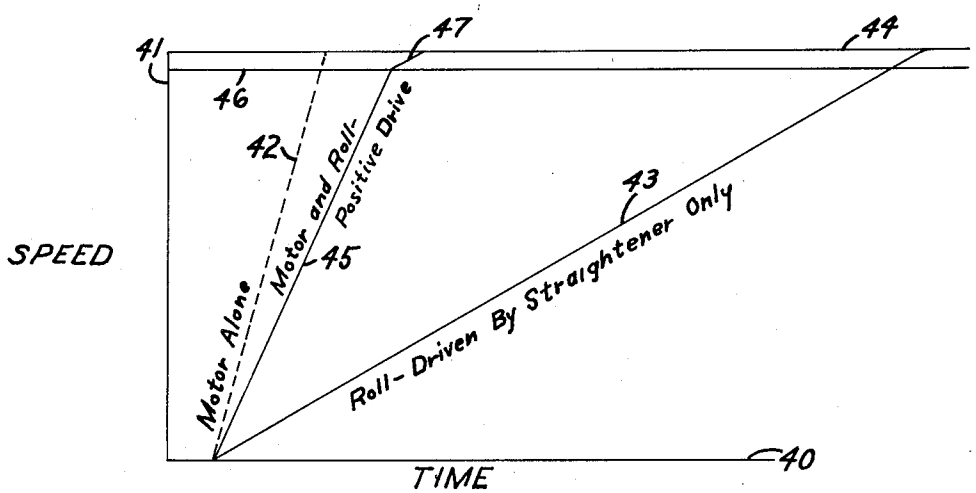


Fig. IV

Inventor

Alvin F. Groll

By

Marshall and Marshall

Attorneys

United States Patent Office 2,731,213 Patented Jan. 17, 1956

2,731,213

STRIP STOCK FEEDER

Alvin F. Groll, Napoleon, Ohio

Application June 29, 1951, Serial No. 234,243

5 Claims. (Cl. 242—78)

This invention relates to strip stock feeders for punch presses and in particular to driving mechanism for such feeders.

Strip stock for punch presses is usually supplied in large rolls each of which often weighs several tons or more. The roll of strip stock is supported on a cradle which may or may not be power driven and the stock is drawn from the roll by a feeding and straightening mechanism comprising a series of power driven rollers some of which act as pinch rolls in order to positively drive the stock.

It is customary to provide a control for the motor driving the feeding mechanism which control is arranged to maintain a slack loop of stock between the straightening device and an intermittent feeder on the press itself.

Difficulty has been experienced with feeders of this type particularly during starting periods when the inertia of the roll of strip stock prevents the feeding mechanism from accelerating the roll and drawing sufficient stock for each press cycle to avoid the production of defective pieces. If a positive drive from the motor or the straightening device to the cradle is provided, so that more torque may be supplied to the roll of strip stock to overcome its inertia, difficulty is experienced in maintaining precise synchronization between the speeds of the straightening device and the roll of stock. If the speed ratio is too small, so that the roll tends to lag, the tension in the strip of stock between the roll and the straightening device becomes excessive and the straightening rollers may slip on the stock and mar or tear it. If the speed ratio is too large the stock on the roll tends to loosen and unwind and often telescopes laterally so that the edge of the stock interferes with guides and may be curled or torn.

The principal object of this invention is to provide driving mechanism for a roll of strip stock which may be operated at high rates of acceleration without substantial slipping of the stock feeder and without producing excessive tension in the strip stock or relieving it of all tension.

Another object of the invention is to provide a positive drive from a driving motor to a roll supporting cradle during periods of acceleration while allowing a straightening and feeding device to drive the roll of strip stock during periods of constant speed operation.

More specific objects and advantages are apparent from the following description of a preferred form of the invention.

According to the invention a strip stock feeding and straightening device is connected to a drive motor by power transmission means including a frictional torque responsive coupling that delivers only sufficient torque to drive the straightener and the roll of strip stock during constant speed operation, and a second power transmission mechanism including an overrunning clutch, during acceleration, operatively connects the motor to the roll supporting cradle. The speed ratio through the second power

transmission mechanism is such that the roll is driven through the second system at a peripheral speed that is slightly less than the steady state operating speed determined by the straightening and feeding rollers. During periods of rapid acceleration the torque responsive coupling slips sufficiently so that the motor operating through the overrunning clutch positively drives the cradle to rapidly accelerate it to nearly synchronous operating speed. As the steady state speed is approached at the end of a period of acceleration, the straightening device, driven by the torque transmitted through the slipping coupling, slowly accelerates the roll of strip stock to operating speed. The slightly greater speed of the cradle is permitted by the overrunning clutch.

The improved system is characterized by the torque responsive coupling between the drive motor and the straightening and feeding device in combination with an overrunning clutch device operatively connecting the drive motor to the roll supporting cradle and arranged to positively drive the cradle during periods of acceleration when the peripheral speed of the roll tends to fall below the speed determined by the feeding device.

A preferred embodiment of the invention is illustrated in the accompanying drawings.

In the drawings:

Figure I is a schematic perspective illustration showing the general arrangement of the improved roll supporting and strip feeding mechanism.

Figure II is a sectional view taken along the line II—II of Figure I to show the overrunning clutch employed in the drive mechanism between the motor and cradle.

Figure III is a sectional view taken generally along the line III—III of Figure I showing the torque responsive coupling included in the drive between the driving motor and the straightening and feeding device.

Figure IV is a diagram showing the speed-time relationship of the motor and roll during periods of acceleration.

In a strip stock feeding device constructed according to the invention a strip 1 of sheet stock is drawn from a roll 2 as it is fed between upper and lower guide rollers 3 and 4 and then between a plurality of lower straightening rollers 5 and cooperating upper rollers 6. The lower straightening rollers 5 are each provided with gear wheels 7 that mesh with an idler gear 8 and a drive gear 9 arranged so that all the lower straightening roliers 5 are driven in the same direction and at the same speed. A pair of pressure rollers 10, mounted directly above the first and last of the lower straightening rollers 5, are spring or weight urged in a downward direction to pinch the strip 1 of stock and provide positive traction to draw the strip through the series of straightening rollers 5 and 6.

The drive gear 9 is frictionally driven by a sprocket 11 connected by a chain 12 to a second sprocket 13 mounted on a shaft of a drive motor 14. The friction drive between the gear 9 and sprocket 11 is illustrated in detail in Figure III.

The roll of strip stock 2 is supported on a cradle 15 that comprises a plurality of slats 16 mounted on a series of chains or belts 17 running over pulley drums 18 and 19. The belts or chains 17 are long enough so that their upper reaches sag to form a loop that receives and supports the strip stock roll 2. Guide walls, not shown, are included to prevent the roll 2 from working toward the sides of the cradle 15.

In steady state operation the tension in the strip 1 is great enough and the friction in the cradle is low enough so that the roll 2 remains in position and also drives the cradle chains 17. The driving tension in the strip keeps the roll of stock tightly wound.

Provision is also made for driving the cradle 15 from the motor 14. The drive system comprises a drive chain

20 leading from a sprocket on the motor shaft to a large sprocket 21 carried on an intermediate support 22. The large sprocket 21 is coupled through an overrunning clutch 23 (shown in detail in Figure II) to a second sprocket 24 which in turn is connected by a chain 25 to a large sprocket 26 mounted on the drum pulley 19.

The speed ratio effected by the drive chains 20 and 25 and the sprockets is such that, when power is transmitted through the overrunning clutch 23 to the cradle 15, it runs at a speed slightly less than the speed at which the stock is drawn through the straightening rollers 5 and 6 when there is no slippage between the sprocket 11 and the drive gear 9. During normal constant speed operation the peripheral speed of the roll 2 of the strip stock is slightly greater than the speed at which the cradle 15 would be driven by the motor and as a result the sprocket 24 gains slightly on the sprocket 21 such overtaking action being accommodated by the overrunning clutch 23.

Referring now to Figure II the large sprocket 21 drives an outer member 27 of the overrunning clutch 23 in a clockwise direction so that during acceleration a plurality of rollers 28 are wedged between involute surfaces 29 on the interior of the member 27 and the periphery of an inner member 30 that is connected to and drives the small sprocket 24. During constant speed operation, when the strip stock roll tends to drive the cradle 15 slightly faster than the motor 14 would drive it, the sprocket 24 gains in a clockwise direction on the sprocket 21 so that the rollers 28 move to the positions shown where they exert no driving force between the outer member 27 and the inner member 30 of the overrunning clutch. During acceleration when the straightening rollers 5 and 6 are unable to supply the required force to accelerate the strip stock roll 2, the sprocket 21 gains in clockwise direction on the sprocket 24 until the rollers become wedged between the involute surfaces 29 and the inner member 30 so as to provide a positive drive connection.

To protect the strip stock from damage because of excessive tension the driving sprocket 11 is frictionally coupled to the drive gear 9. This connection is illustrated in Figure III where the drive gear 9 is shown mounted on a rotatable collar 31 which is journaled on an axle 32 rigidly mounted in a frame member 33 of the straightening device. The sprocket 11 is frictionally held between a pair of annular coupling members 34 and 35 that are slidably but non-rotatably mounted on the rotatable sleeve 31. Also, the coupling member 34 has a shoulder 36 that engages the bore of the sprocket 11 to hold the sprocket 11 concentric with respect to rotatable sleeve 31. A plurality of helical springs 37, held compressed between the axially slidable coupling member 35 and a nut 38 screwed onto the rotatable sleeve 31, provide clamping pressure to determine the torque transmitting capacity of the coupling. The tighter the nut 38 is tightened on the springs 37 the greater the pressure that is exerted on the sprocket 11 and, in turn, the greater the torque transmitting capacity.

The overrunning clutch and the frictional coupling illustrated in Figures II and III are examples of the general class of elements or subassemblies to be used in the power transmission systems in the practice of the invention. Any other well-known mechanical driving elements having similar characteristics may be employed with similar results as far as driving the roll of strip stock is concerned.

Figure IV illustrates the operation of the feeding device during periods of acceleration. In this figure, which is in the nature of a graph, time is plotted along a horizontal axis 40 while the speeds of the various elements are plotted along a vertical axis 41. In plotting the speeds of the various elements it is assumed that, below normal speed, the driving motor torque is independent of speed so that it accelerates at a uniform rate. The acceleration

of the motor alone is indicated by a line 42. If the cradle is not positively driven, the only driving force from the motor is through the frictional coupling and the straightening device, the heavy stock roll accelerates from standstill along some line such as line 43 the slope of which is determined by the inertia of the roll 2 of strip stock and the maximum torque that is transmitted by the frictional coupling between the sprocket 11 and gear 9. It is noted that a considerable period of time elapses from the time the motor starts until the roll finally reaches its normal operating speed represented by a horizontal line 44 in the diagram. When, according to the invention, the overrunning clutch and cradle drive system is included the acceleration of the system may be much greater as indicated by a line 45 that is much steeper than the line 43 and is slightly less steep than the line 42 representing the acceleration of the motor alone. The acceleration along the line 45 continues until a speed represented by a line 46 slightly below the operating speed represented by the line 44 is reached. During this portion of the acceleration period the roll is being driven in part by the force transmitted through the frictional coupling and straightening rolls and in part by the force transmitted through the overrunning clutch. When the speed at which the roll 2 of strip stock would be driven by the overrunning clutch acting alone, which speed is indicated by the line 46, is reached the overrunning clutch is no longer effective and the final acceleration of the roll to its operating speed proceeds along a line 47 that is parallel to the line 43. During this latter portion of the acceleration period the roll 2 of strip stock is driven solely by the power transmitted through the frictional coupling and the straightening rolls.

It will be noted from Figure IV that in a system operated according to the invention the time required to bring the roll of strip stock up to operating speed is only slightly greater than the time required if a positive drive were employed between the motor and the cradle. This rapid acceleration is obtained, according to the invention, without at any time greatly reducing or increasing the tension required in the strip 1 of stock to keep it tightly wound on the roll 2 as it is being drawn from the roll.

The friction in the cradle 15 is sufficiently high so that the roll decelerates as rapidly as does the motor 14 thereby preventing any premature uncoiling or overrunning of the strip stock.

Various modifications may be made in the mechanism for driving the straightening and feeding means and the cradle without departing from the spirit and scope of the invention.

Having described the invention, I claim:

1. In a device for feeding strip stock to a press, in combination, a cradle for carrying a roll of strip stock, feeding rolls adapted to draw stock from the roll and feed it to a machine, a power source having sufficient torque to rapidly accelerate the cradle and roll of stock, a first power transmission means operatively connecting the feeding rolls to the power source to feed stock at a first speed, a second power transmission means operatively connecting the cradle to the power means to feed stock at a second speed that is less than said first speed, torque responsive means in the first power transmission means arranged to transmit sufficient torque to draw stock at uniform speed but not to rapidly accelerate the roll of stock, and an overrunning clutch in the second power transmission means adapted to positively transmit power to said cradle during periods of rapid acceleration of the motor when the power requirements of said feeding rolls exceeds the capacity of the torque responsive means.

2. In a device for feeding strip stock to a press, in combination, a cradle for carrying a roll of strip stock, feeding rolls adapted to draw stock from the cradle and feed it to a machine, a power source, a power transmission system operatively connecting the power source

to the feeding rolls, a friction clutch in the power transmission means, said clutch being adapted to transmit sufficient torque to draw material from the roll and to slip during acceleration of the roll, and a second power transmission system comprising an overrunning clutch operatively connecting the power source to the cradle, said second system being adapted to drive said cradle at a speed less than the speed at which the feeding rolls withdraw the stock, whereby the second power transmission system supplies only the power required to accelerate the roll of stock.

3. In a device for feeding strip stock, in combination, a cradle adapted to support a roll of strip stock during unreeling thereof, feeding rolls for withdrawing stock from the roll, a power source, a power transmission system connecting the power source to the feeding rolls, a torque responsive member in said transmission system adapted to limit the torque transmitting capacity of the system, and a second power transmission system connecting the power source to the cradle, said second system including an overrunning clutch and being arranged to drive said cradle and roll of stock at a speed less than the speed at which the feed rolls tend to withdraw stock, whereby said second system is effective to drive said roll only when said first system and the feed rolls are unable to supply the required driving effort.

4. In a device for feeding strip stock, in combination, a cradle adapted to support a roll of strip stock during unreeling thereof, feeding rolls adapted to withdraw stock from the roll, said rolls being adapted to drive the cradle by force transmitted through the stock, a power source, power transmission means connecting the power source to the feeding rolls, a friction clutch in said transmission means for limiting the torque transmitted to the feed rolls, a second force transmission system operatively connecting the power source to the cradle, said second system being arranged to drive the cradle at a slower speed than the feeding rolls withdraw stock, and an overrunning clutch included in the second system whereby said second system positively drives the cradle when the friction clutch slips.

5. In a device for feeding strip stock, in combination, a cradle adapted to support a roll of strip stock during unreeling thereof, feeding rolls adapted to withdraw stock from a roll on said cradle, a power source, a torque responsive drive connecting the power source to the feed rolls and serving with the feed rolls as a first power transmission means connecting the power source to the strip stock to feed the stock at a first speed, and an overrunning clutch connecting the power source to the cradle and serving with the cradle as a second power transmission means to the strip stock for driving the stock at a second speed less than the first, said power transmission means acting in parallel during periods of rapid acceleration of the strip stock when the torque capacity of the torque responsive drive is exceeded, and said first power transmission means serving alone to drive the strip stock during periods of constant speed operation.

References Cited in the file of this patent

UNITED STATES PATENTS

1,788,564	Daniel	Jan. 13, 1931
1,867,596	Roseman	July 19, 1932
2,058,329	Littell	Oct. 20, 1936
2,168,071	Perry	Aug. 1, 1939