March 25, 1958 M. A. GROSSU 2,827,944

ROLLER APPARATUS FOR OPENING AND FLATTENING TUBULAR STOCK

Original Filed Oct. 24, 1952 3 Sheets-Sheet 1

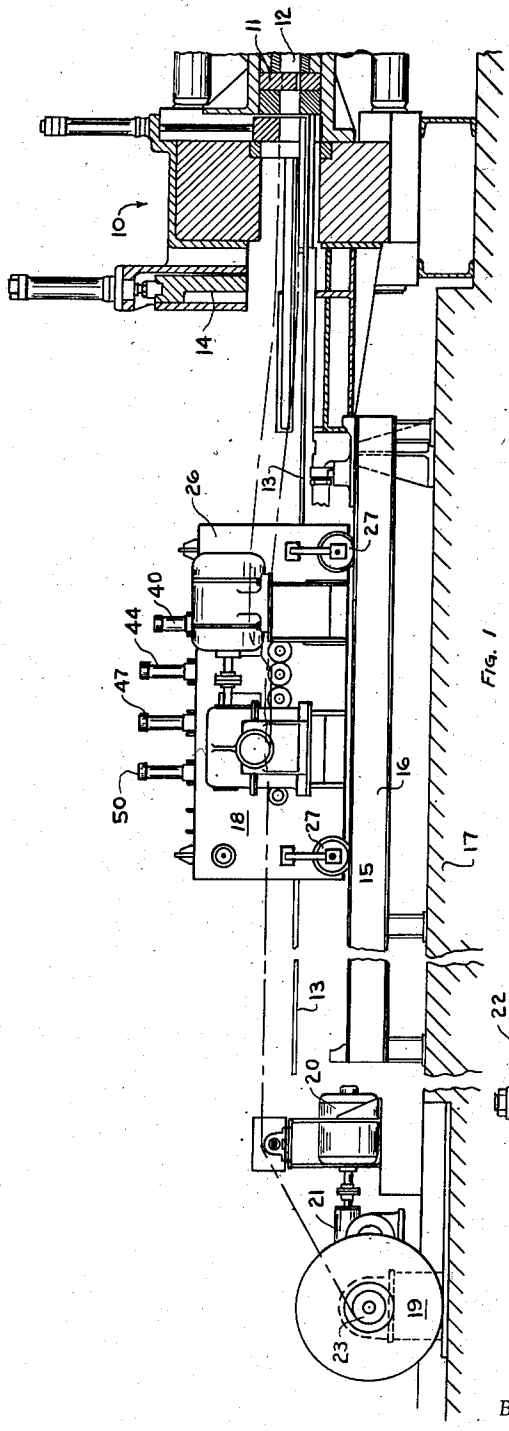


FIG. 1

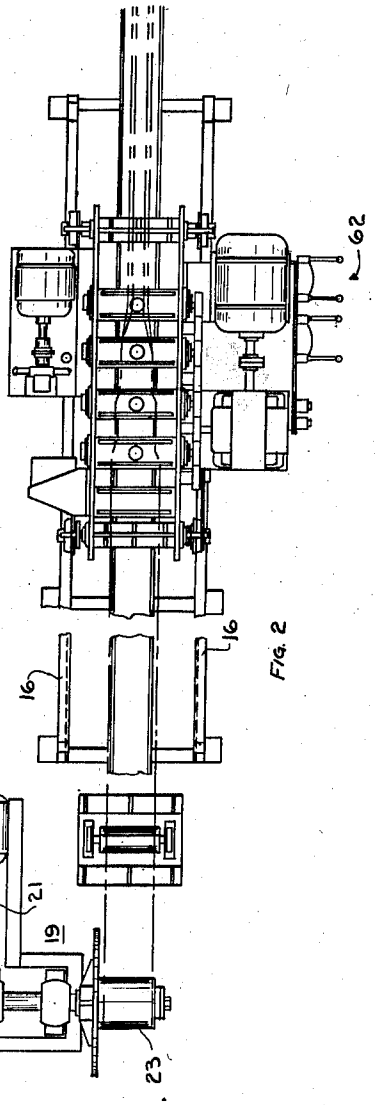


FIG. 2

INVENTOR
MIRCEA A. GROSSU

BY Francis J. Klimpay
ATTORNEY

March 25, 1958 M. A. GROSSU 2,827,944

ROLLER APPARATUS FOR OPENING AND FLATTENING TUBULAR STOCK

Original Filed Oct. 24, 1952 3 Sheets-Sheet 2

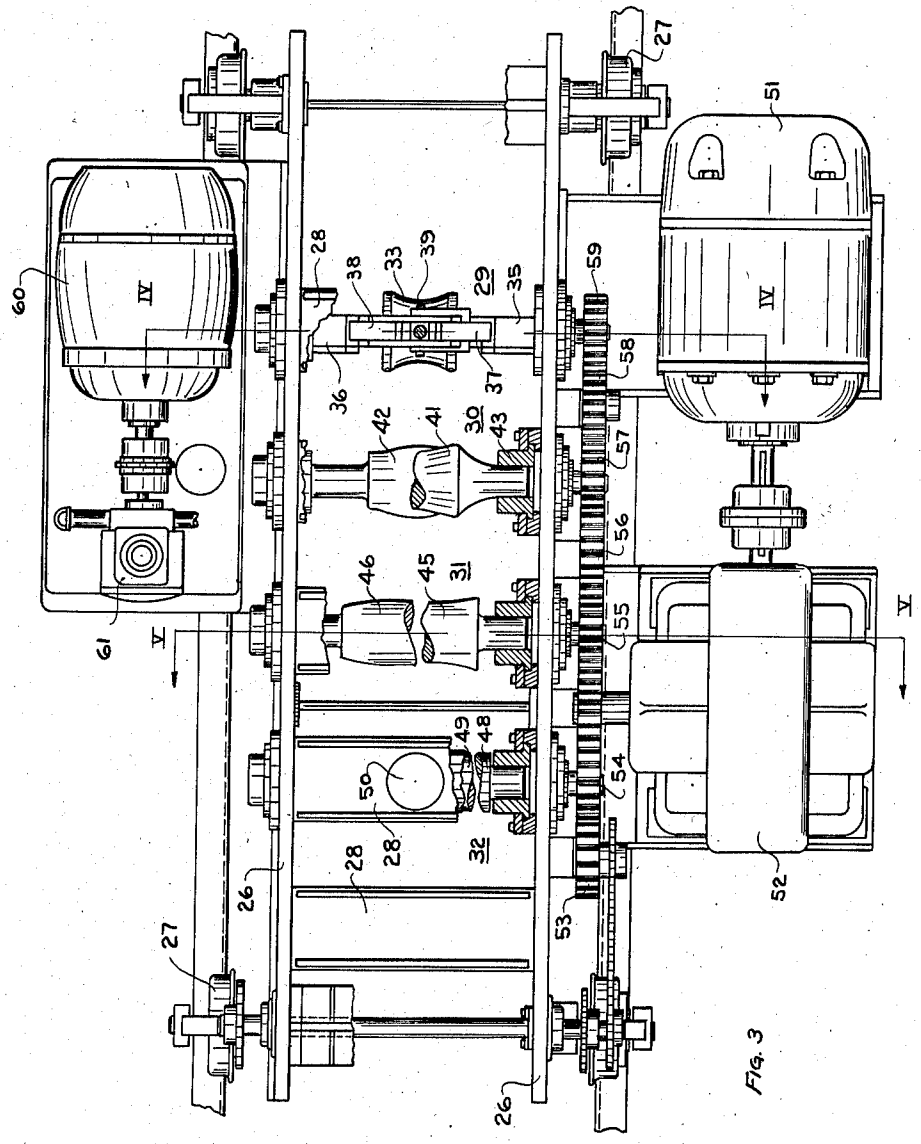


FIG. 3

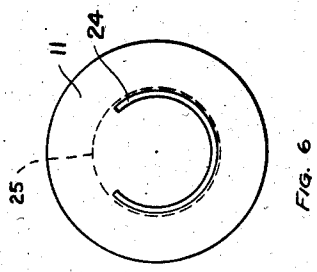


FIG. 6

INVENTOR
MIRCEA A. GROSSU

BY Francis J. Klempay
ATTORNEY

March 25, 1958 M. A. GROSSU 2,827,944

ROLLER APPARATUS FOR OPENING AND FLATTENING TUBULAR STOCK

Original Filed Oct. 24, 1952 3 Sheets-Sheet 3

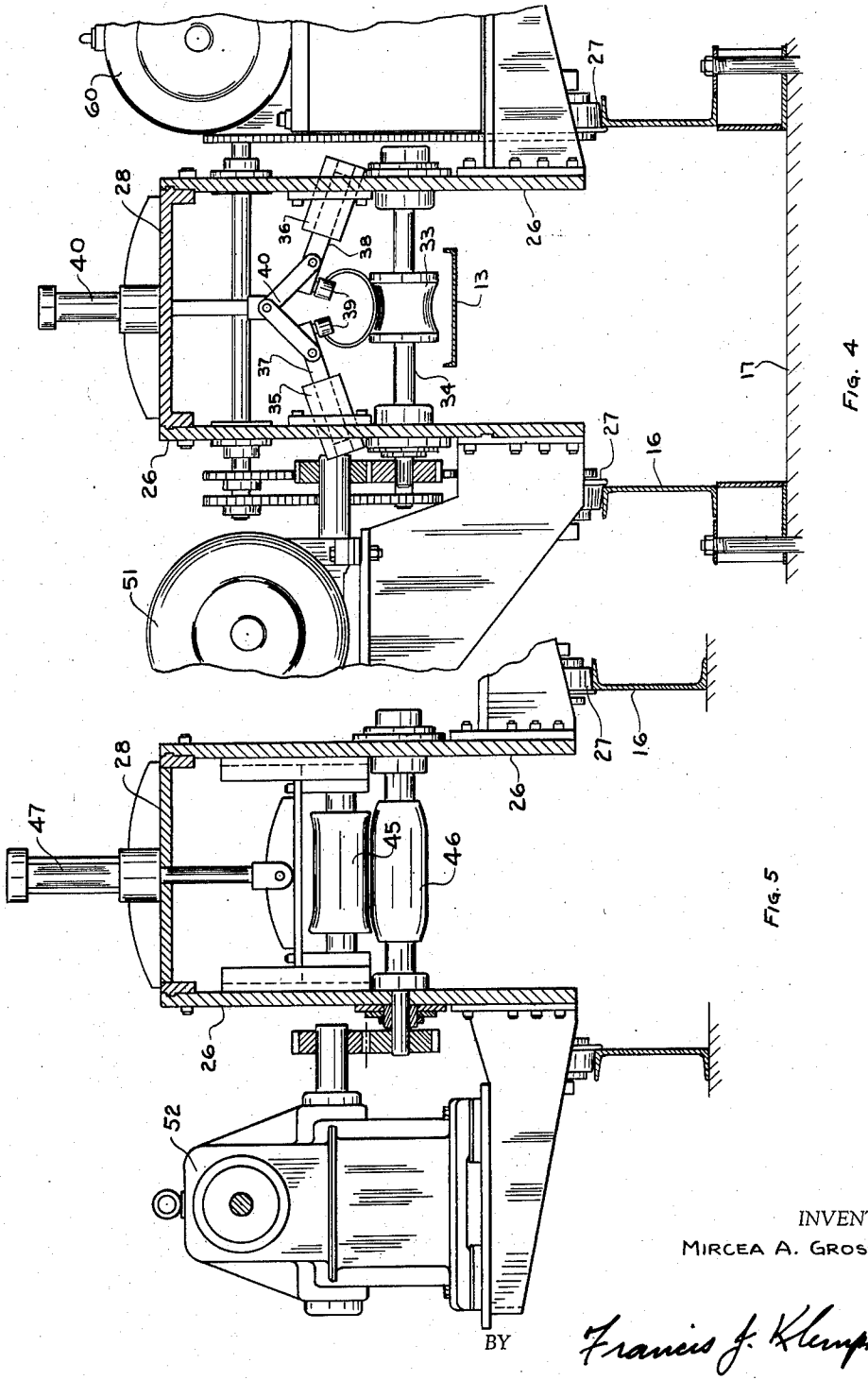


FIG. 4

FIG. 5

INVENTOR
MIRCEA A. GROSSU

BY Francis J. Klumpp
ATTORNEY

United States Patent Office 2,827,944
Patented Mar. 25, 1958

2,827,944

ROLLER APPARATUS FOR OPENING AND FLATTENING TUBULAR STOCK

Mircea A. Grossu, Long Beach, Calif., assignor to Lombard Corporation, Youngstown, Ohio, a corporation of Ohio

Continuation of application Serial No. 316,599, October 24, 1952. This application January 22, 1957, Serial No. 635,517

7 Claims. (Cl. 153—54)

The present invention relates to the commercial production of aluminum strip and the like, and more particularly to the production of such strip by extrusion processes as opposed to rolling processes, for example. Specifically, the invention resides in novel apparatus for producing strip stock from aluminum and other nonferrous metals whereby the production of such strip stock in substantial widths by means of extrusion equipment is rendered possible and commercially practicable.

This application is a continuation of my copending application Serial No. 316,599, filed October 24, 1952, and now abandoned.

The installation of complete rolling equipment for producing metal strip, even in the narrower widths, from ingots, slabs and the like is an extensive and costly matter, and consequently such installations are rather centralized and few in number. However, because of the versatility and comparative small size and lower cost of metal extrusion machines the same have greatly increased in number and dispersion within recent years and a very large number of non-ferrous sections are currently being produced in exceedingly large quantities on such machines. Many of the owners of such machines have use for continuous nonferrous strip while other extrusion machine installations have excess time capacity available so it is altogether desirable that a method be devised for the practical production of metal strip by a more or less conventional metal extrusion machine. It is accordingly the primary object of this invention to provide practical apparatus for the production of continuous non-ferrous strip in substantial widths by the use primarily of a conventional metal extrusion press.

In accordance with the above object the invention provides a practical arrangement whereby flat strip may be produced by first extruding the metal in a form other than a flat form, but of uniform wall thickness equal or approximately equal to the desired strip thickness, and subsequent to the extrusion operation to flatten such extruded form into the desired flat form. For example, I have found that I may advantageously extrude a section of uniform thickness taken about the periphery of a billet and forming the greater portion of a complete circle. This form, when subsequently flattened into strip may be several times wider than the billet itself, yet may be extruded from wholly within the peripheral limits of the billet.

A more specific object of the invention is the provision for use in the above method of producing aluminum strip of a practical apparatus for flattening the extruded form into strip subsequent to the extruding operation. In this connection I have noted that the velocity of stock emerging from an extrusion machine may not be entirely uniform due, for example, to variations in the composition of the billet and/or fluctuations in the hydraulic fluid source or in packing friction and the like, and the invention therefore further seeks to provide an arrangement whereby the flattening apparatus need not be correlated with the instant-to-instant velocity of the extruded stock so that costly sensitive control apparatus is not required.

With specific reference to the above object, the present invention seeks to provide a flattening device comprising one or more pairs of flattening rolls, which device is movable longitudinally a distance equal to or greater than the length of strip which may be produced from the extrusion of a single billet. Thus, I may position the flattening device at one extreme end of its traverse while extruding completely a single billet, and during loading of the press with a subsequent billet the flattening device may travel along the strip from one end to the other of its traverse. The control apparatus for the flattening device may thereby be of utmost simplicity and at no sacrifice to the operating efficiency of the process since the extrusion press is necessarily idle after each stroke while a new billet is loaded into the container therefor.

Another object of the invention is the provision of a processing line in which aluminum strip may be produced in the above stated manner in continuous coiled lengths comprising the strip equivalent of a plurality of billets. And to this end the invention contemplates the inclusion in the processing line of suitable provisions for coiling previously flattened strip during the extrusion of a new billet, and for tensioning the newly extruded metal during the flattening thereof into strip so that the latter operation may be most effectively carried out.

Other objects and advantages of the invention will become apparent upon full consideration of the following detailed specification and accompanying drawing wherein is illustrated a certain preferred embodiment of the apparatus of the invention.

In the drawing:

Figure 1 is a fragmentary front elevation of a processing line for producing continuous aluminum strip in accordance with the method of and by means of the apparatus of my invention;

Figure 2 is a fragmentary plan view of the apparatus of Figure 1;

Figure 3 is a plan view, partly in section, of a strip flattening device constructed in accordance with the teachings of my invention, the flattening device being of the type used in the processing line illustrated in Figures 1 and 2.

Figure 4 is a fragmentary section view taken generally along line VI—VI of Figure 3;

Figure 5 is a fragmentary section view taken generally along line V—V of Figure 3; and

Figure 6 is an enlarged view illustrating a type of extruding die which is suitable for use in the processing line of Figure 1.

Referring now to the drawing, and initially to Figures 1 and 2 thereof, the numeral 10 designates, generally, an extrusion press which may be of conventional construction comprising a die 11, billet container 12 and ram, not shown, the latter being associated in the usual manner with a high powered hydraulic cylinder, also not shown. In accordance with usual practice, the press apparatus 10 includes a run-out table 13 for supporting the extruded shape in front of the die 11 and a suitable shear 14 for cropping off the ends of an extruded length when desired.

Positioned in straddling relation to the run-out table 13, and extending from adjacent the forward end of the press 10 to a point located forwardly thereof a distance somewhat greater than the contemplated longest length of strip to be produced from the extrusion of a single billet of metal, is a guiding track 15 comprising spaced channel members 16 supported on the principal base or foundation 17. In accordance with the teachings of the invention the track 15 is adapted to support and guide for longitudinal movement toward and away from the extrusion press a flattening device 18, to be described hereafter.

Positioned forwardly of the extreme forward end of the track 15 is a coiling device 19 which may be of con-

ventional construction comprising, for example, a reel 23, a suitable motor 20, gear reducers 21 and 22, and a suitable clutch mechanism, not specifically illustrated, whereby the motor 20 may effect appropriate rotation of the reel 23 or may slip with respect to the reel 23 while maintaining a predetermined torque force thereon. Such arrangements are well known in the prior art.

Figure 6 illustrates a die 11 of the type preferred for carrying out the method of my invention, and it will be observed therein that a die opening 24 is provided which is generally circular in outline but which forms less than a complete circle, as for example, an arc in the order of 270°. Broken line 25 indicates the relation of a billet to be extruded to the die opening 24, and it will be noted that the latter is wholly within the peripheral outline of the billet. This is in accordance with preferred extrusion practice and with the teachinsg of the invention.

The present method of producing wide strip contemplates the initial extrusion through the die opening 24 of a section of uniform thickness and having an arcuate outline comprising, for example, a major fraction of a complete circle. The extruded shape thus formed is caused to move along the run-out table until substantially all of the billet has been consumed. At this stage of the operation the flattening device 18 is inoperative and is positioned at the extreme forward end of the track 15. But immediately upon completion of the extrusion stroke the flattening device 18 is caused to engage with the extruded shape and is moved toward the press 10, deforming the extruded shape into the desired flat strip as it is so moved. During the time interval when the flattening device 18 is in operation the press 10 is reloaded with another billet, and upon the device 18 reaching the limit of its traverse it is again rendered inoperative and a second stroke of the extrusion press 10 is initiated. It will be understood, of course, that during the second stroke of the press 10 the second billet will be caused to fuse completely with the first whereby the extruded length will be continuous and wholly unaffected by the discontinuity of the billets.

After the first traverse of the flattening device 18 the forward end of the extruded shape will, of course, be flat and this end is attached to the reel 23 and the coiling device 19 set into operation whereby during extrusion of the second billet the prior extruded and flattened length will be coiled up in the manner desired.

During the second extrusion operation the flattening device 18 is returned to its initial position at the forward end of the track 15, and as will be understood, this device is again rendered operative at the end of such second extrusion operation. During the second, and all subsequent traverses of the flattening device 18 the coiling device 19 operates to maintain a predetermined tension on the strip so that the flattening operation may be more readily accomplished and with improved results.

The above cycle of operations may be carried out repetitiously until the reel 23 is filled to capacity, whereupon the strip may be severed at the reel, the coil removed, and the operation continued as above described.

If it becomes desirable to alter the width of the strip produced, it is merely necessary to interchange the die 11 with another having a die opening of different length. It should also be noted that the die opening need not be circular, as illustrated, but may, for example, be corregated or other shape.

Referring now to Figures 3–5 of the drawing the flattening device 18 comprises a carriage of rigid construction and having a plurality of flanged wheels 27 arranged to engage and be guided by the spaced members 16 of the track 15. The carriage proper comprises spaced vertical side plates 26 braced by members 28 and arranged to support a plurality of pairs of flattening rolls as will appear.

mechanism of the flattening device 18 comprises four

It will be observed in Figure 3 that the principal spaced working stations consisting respectively of a spreading device 29, and three pairs of cooperating working rolls 30–32.

The spreading device 29 is illustrated in Figure 4 and is shown therein to comprise a lower supporting roll 33 which is of generally elliptical contour and is rotatably supported in the side plates 26 by an elongated shaft 34. Mounted in the side plates 26 above the supporting roll 33 and disposed to incline upwardly to a certain degree is a pair of opposed guiding blocks 35 and 36 which are provided with suitable bores or slots for slidably receiving carrier rods 37 and 38. The rods 37 and 38 mount at their outer ends spreader rolls 39 which depend downwardly from the rods toward the supporting roll 33. Connecting the rods 37 and 38 is a toggle device 40 which is operated by means of a vertically disposed hydraulic or pneumatic cylinder 40 mounted on one of the brace members 28 as shown. The arrangement, as will be understood, is such that energization of the cylinder 40 will effect simultaneous extending or retracting movement of the spreader rolls 39 through the action of the toggle device 40. In the intended operation of the spreading device the rolls 39 are initially moved to a retracted position whereby the same may be readily received within the narrow opening or cleft in the initially extruded shape. As soon as the rolls 39 have been received between the opposed edges of the extruded shape the cylinder 40 is energized and caused to move downwardly to thereby move the rolls 39 into extended position. Thereafter, as the extruded material passes through the spreading device 23 the side edges of the shape will be spread sufficiently so that the same will not tend to fold over in passing through the working station 30 positioned adjacent the device 29 and next following the same in the direction of movement of the strip.

Working station 30 comprises upper and lower working rolls 41 and 42, respectively, which are respectively of concave and convex contour as shown. In accordance with the teachings of the invention the rolls 41 and 42 are so shaped as to subject the strip passing therebetween to a relatively severe reverse bend, such bend being desired in order to cause a permanent deformation in the strip from its originally generally circular shape to approximate flatness. It will be understood, of course, that a relatively severe deformation is required due to the fact that the interior surface of the extruded circular shape is somewhat shorter in peripheral dimension than is the exterior surface.

Also in accordance with the teachings of the invention the lower roll 42 is journaled directly in the side plates 26 while the upper roll 41 is journaled in blocks 43 which are adapted for vertical sliding movement with respect to the side plates 26. The arrangement is such that the roll 41 may be moved from a lower extreme position wherein the same is adapted to act cooperatively with lower roll 42 to engage and deform the extruded shape to an upper extreme position wherein the working station 30 is wholly inoperative and the flattening device 18 may pass freely over the extruded length, as for example, in moving from end to the other of its traverse immediately subsequent to the completion of a flattening operation. A suitable fluid actuator 44 is provided in the illustrated embodiment of the invention for the purpose of effecting movement of the roll 41 to and from its operative and inoperative positions.

Working station 31 is similar in all material respects to the station 30, it being noted, however, that the upper and lower working rolls 45 and 46 thereof are somewhat differently contoured. Specifically, the rolls 45 and 46 are shaped so as to bend the outer edges of the strip downwardly to provide a relatively uniform flatness in the strip. And it will be noted that the rolls of the preceding station 30 are substantially narrower than those of the station 31, the reason for this residing in the fact that the extruded shape is not sufficiently flattened at the time of its passing through the first roll station 30 to

permit entry of a wide roll, such as roll 45, within the opening provided by the spreading device 29. Roll 45, as roll 41, is vertically movable between operative and inoperative positions, and a suitable fluid actuator 47 is provided for effecting such movement.

Following the strip-deforming working stations 30 and 31 in order of the direction of relative movement of the strip with respect to the flattening device 18 is another working station 32 comprising a pair of cooperating rolls 48 and 49 which are preferably cylindrical and which serve merely to impart a final smoothing and flattening operation to the strip and prepare the same for subsequent coiling on the reel 23. The upper roll 48 of the last-mentioned pair of rolls is also provided with vertically slidable journaling means and a fluid actuator 50 for effecting movement between operative and inoperative positions.

As before stated, flattening of the extruded shape into flat strip is carried out while the press 10 is idle and by causing the flattening device 18 to move along the track 15 toward the die. For effecting such movement of the device I have employed in the illustrated apparatus an electric motor 51 mounted at the side of the roll carriage adapted to drive one or both pairs of wheels 27 through a gear reducer 52 and intermediate mechanism. As shown in Figure 3, the motor 51 is directly associated with the gear reducer 52 which in turn drives a plurality of gears 53—59, alternate ones of which are connected to working rolls 33, 42, 46 and 49, and the end one of which is connected by means of chain drives to the forward pair of wheels 27. The arrangement is, of course, such that the rotation of the rolls is directly and correctly correlated to the speed of advance of the roll carriage along its traverse. There is thus no tendency for the strip to stretch or buckle during the flattening operation.

For operating the fluid actuators 40, 44, 47 and 50 I have provided a fluid source comprising a second electric motor 60 and pump 61 connected thereto. Suitable conduit and control apparatus, not shown, is provided to connect the above-mentioned actuators with the fluid source, and preferably the controls are such as may be operated from a centralized control station 62 located on the front side of the flattening device. It is usually preferred that the plurality of actuators be provided with independent control means whereby, for example, during initial threading of the extruded stock the rolls and spreading device may be moved into operative position in sequence.

The advantages of the invention should now be apparent. I have illustrated a novel method of producing aluminum strip by an extrusion process wherein the width of the strip obtained may be substantially greater than the billet capacity of the extrusion apparatus. And in accomplishing this I do not depart from recognized extrusion practices which suggest that an extruded shape should be confined within the peripheral limits of the billet. My invention involves the principle that a desired product may be extruded in other than the desired form and thereafter bent or otherwise deformed as desired. And in this respect it should be understood that the teachings of the invention are not necessarily restricted to the production of flat strip or of a product of uniform thickness.

The invention also discloses a novel apparatus for carrying out the desired method in a most expeditious manner. Thus, for example, the invention teaches a novel combination of apparatus including a flattening device which is operated independently of the extrusion press and during periods of idleness of the latter. With this arrangement it is not necessary to attempt to control the speed of operation of the flattening device in relation to the instant-to-instant velocity of the extruded stock. Rather, the extrusion press and flattening device may operate at completely different speeds since at all times one of the devices is idle while the other is in operation. This arrangement has the further desired effect of more evenly distributing the power requirements of the processing line as will be understood.

Having thus disclosed my invention in its preferred embodiment, what I claim and desire to secure by Letters Patent is:

1. For use with means which intermittently advances lengths of continuous split tubular stock, the combination of a track positioned in general alignment with the tubular stock, a reel at one end of said track to take up flattened stock, a carriage reciprocably mounted on said track and mounting a plurality of forming roll stands for engaging the tubular stock successively to progressively open and flatten said stock, power means on said carriage to drive said forming roll stands, means connected with said power means to move said carriage along said track at a speed equal to the pass speed of said forming roll stands whereby said carriage may move from a position adjacent said reel to a position outwardly of the reel, and means on said carriage to open and close said forming-roll stands whereby upon said carriage reaching the end of its stroke outwardly of said reel the forming-roll stands may be disengaged from the stock and returned to their initial starting positions adjacent said reel.

2. For use with means which intermittently advances lengths of continuous split tubular stock, the combination of a track positioned in general alignment with said tubular stock, a carriage reciprocably mounted on said track and mounting a plurality of forming roll stands for engaging the tubular stock successively to progressively open and flatten said stock, power means on said carriage to drive said forming-roll stands, means connected with said power means to move said carriage along said track at a speed equal to the pass speed of said forming roll stands whereby the carriage may move from one end of the track to the other while automatically opening and flattening said stock, and means on said carriage to open and close said forming-roll stands whereby upon said carriage reaching the end of its stroke at said other end of the track the forming-roll stands may be disengaged from the stock and returned to their initial starting positions at the said one end of the track.

3. The combination claimed in claim 2 and including a device for holding the stock in tension while the carriage moves from said one end of the carriage to the other end of the carriage.

4. For use with means which intermittently advances lengths of continuous split tubular stock, the combination of a track positioned in general alignment with the tubular stock, a carriage reciprocably mounted on said track and mounting a plurality of forming roll stands for engaging the tubular stock successively to progressively open and flatten said stock, power means to drive said forming roll stands whereby when said carriage is moved from one end of said track to the other the tubular stock is automatically opened and flattened, means on said carriage to open and close said forming roll stands whereby upon said carriage reaching the end of its stroke at said other end of the track the forming-roll stands may be disengaged from the stock, and means to return said carriage to its initial starting position at said one end of the track.

5. For use with means which intermittently advances lengths of continuous split tubular stock, the combination of a track positioned in general alignment with said tubular stock, a carriage reciprocably mounted on said track and mounting a plurality of forming roll stands for engaging the tubular stock successively to progressively open and flatten said stock, a reel at one end of said track to take up the flattened stock, power means to move said carriage along said track whereby the carriage may move from a position adjacent said reel to a position outwardly of the reel while automatically opening and flattening the stock, and means on said carriage to

open and close said forming-rod stands whereby upon said carriage reaching the end of its stroke outwardly of said reel, the forming-roll stands may be disengaged from said stock and returned to their initial starting positions adjacent said reel.

6. For use with means which intermittently advances lengths of continuous split tubular stock, the combination of a track positioned in general alignment with the tubular stock, a carriage reciprocably mounted on said track, stock opening means mounted on said carriage for progressively opening said stock, forming roll stands mounted on said carriage behind said stock opening means for progressively flattening said stock, power means to drive said forming roll stands whereby when the carriage is moved from one end of the track to the other the stock is automatically opened and flattened, means on said carriage to open and close said forming roll stands whereby upon said carriage reaching the end of its stroke at said other end of the track the forming-roll stands may be disengaged from the stock, and means to return said carriage to its initial starting position at said other end of the track.

7. For use with means which intermittently advances lengths of continuous split tubular stock, the combination of a track positioned in general alignment with the tubular stock, a carriage reciprocably mounted on said track, a spreading device mounted at one end of said carriage for progressively opening said stock as the carriage moves from one end of the track to the other, said spreading device comprising a supporting roll adapted to engage the lower outer peripheral surface of said stock and a pair of angularly related spreader rolls adapted to engage the opposed longitudinal edges of the stock, said carriage also mounting a plurality of forming-roll stands behind said spreader device to progressively flatten said stock, power means on said carriage to drive said supporting roll and said forming roll stands, means connected with said power means to move said carriage along said track at a speed equal to the pass speed of said forming roll stands and said supporting roll whereby the carriage may move from said one end of the track to the other while automatically opening and flattening the stock, and means on said carriage to open and close said forming roll stands and to change the spacing between and the vertical position of said spreading rolls whereby upon the carriage reaching the end of the track the forming roll stands and spreading rolls may be disengaged from the stock and returned to their initial starting positions at said one end of the track.

References Cited in the file of this patent

UNITED STATES PATENTS

418,459	Griswold	Dec. 31, 1889
1,423,361	Rockwell	July 18, 1922
1,820,936	Carns	Sept. 1, 1931
2,133,874	Sparks	Oct. 18, 1938
2,295,953	King	Sept. 15, 1942
2,313,702	Allen	Mar. 9, 1943
2,458,686	Davie	Jan. 11, 1949
2,692,421	Cozzo	Oct. 26, 1954

FOREIGN PATENTS

103,215	Great Britain	Jan. 18, 1917
465,161	Germany	Sept. 8, 1928
835,850	France	Oct. 3, 1938