June 12, 1956 A. E. STEWART 2,749,815

STOCK FEEDING MEANS

Filed Dec. 31, 1953 4 Sheets-Sheet 1

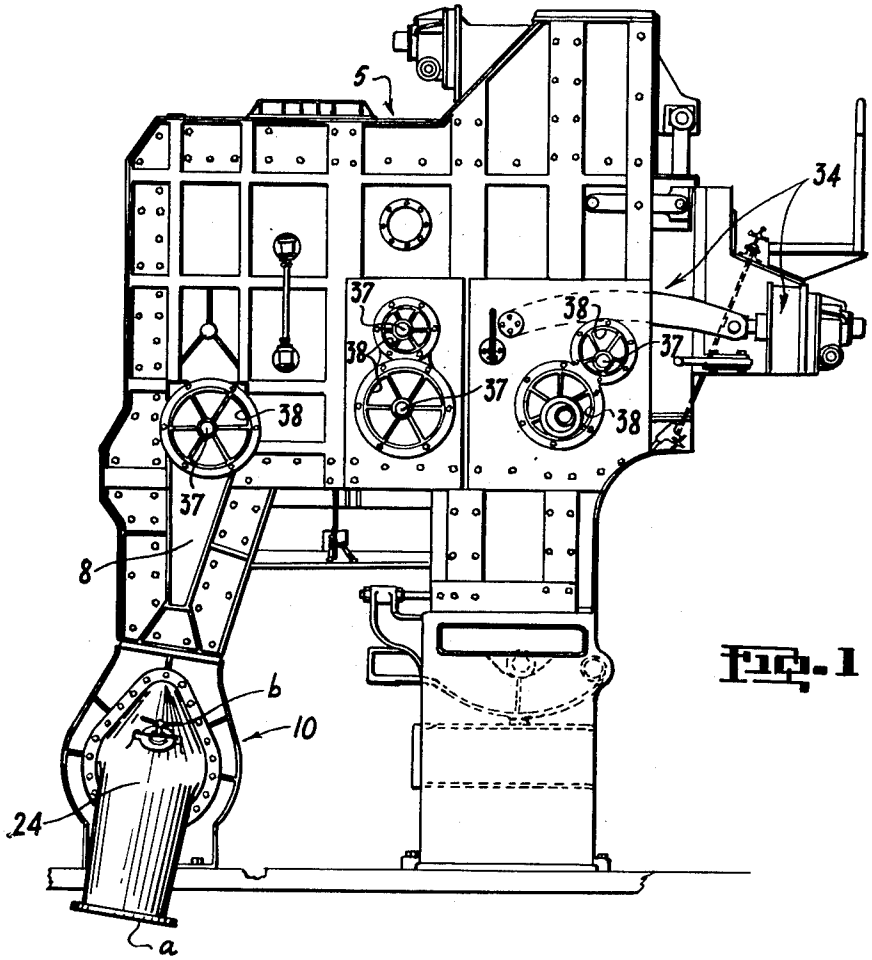


Fig. 1

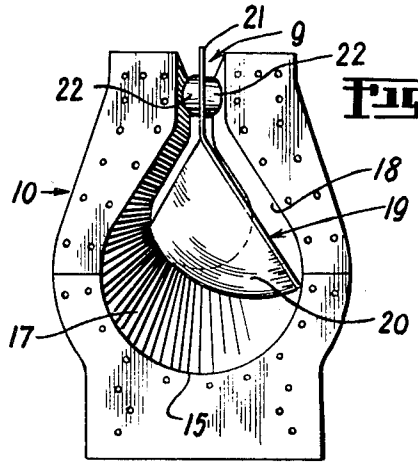


Fig. 4

Inventor
A. E. Stewart
By Fetherstonhaugh & Co
Attorneys

June 12, 1956 A. E. STEWART 2,749,815

STOCK FEEDING MEANS

Filed Dec. 31, 1953 4 Sheets-Sheet 2

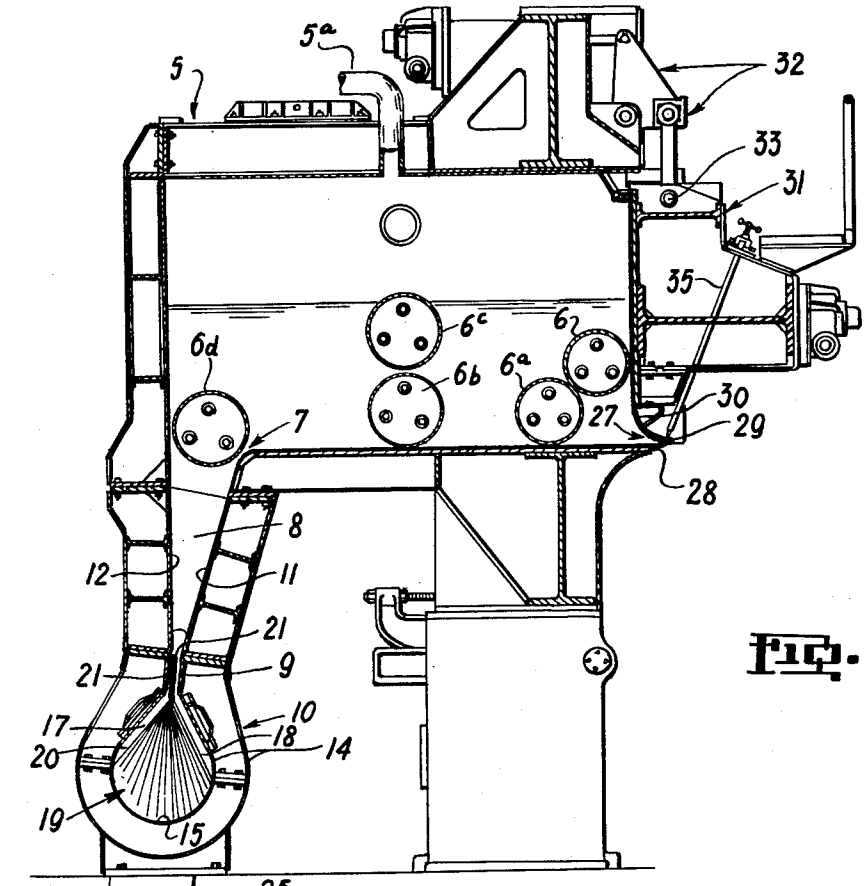


Fig. 2

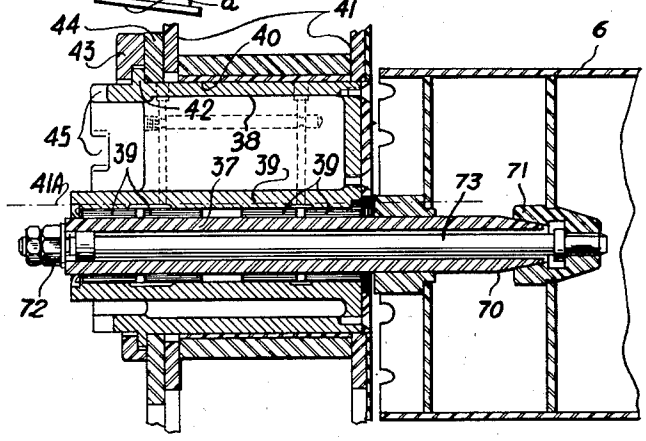


Fig. 5

Inventor
A. E. Stewart
By Fetherstonhaugh & Co.
Attorneys

June 12, 1956 A. E. STEWART 2,749,815

STOCK FEEDING MEANS

Filed Dec. 31, 1953 4 Sheets-Sheet 3

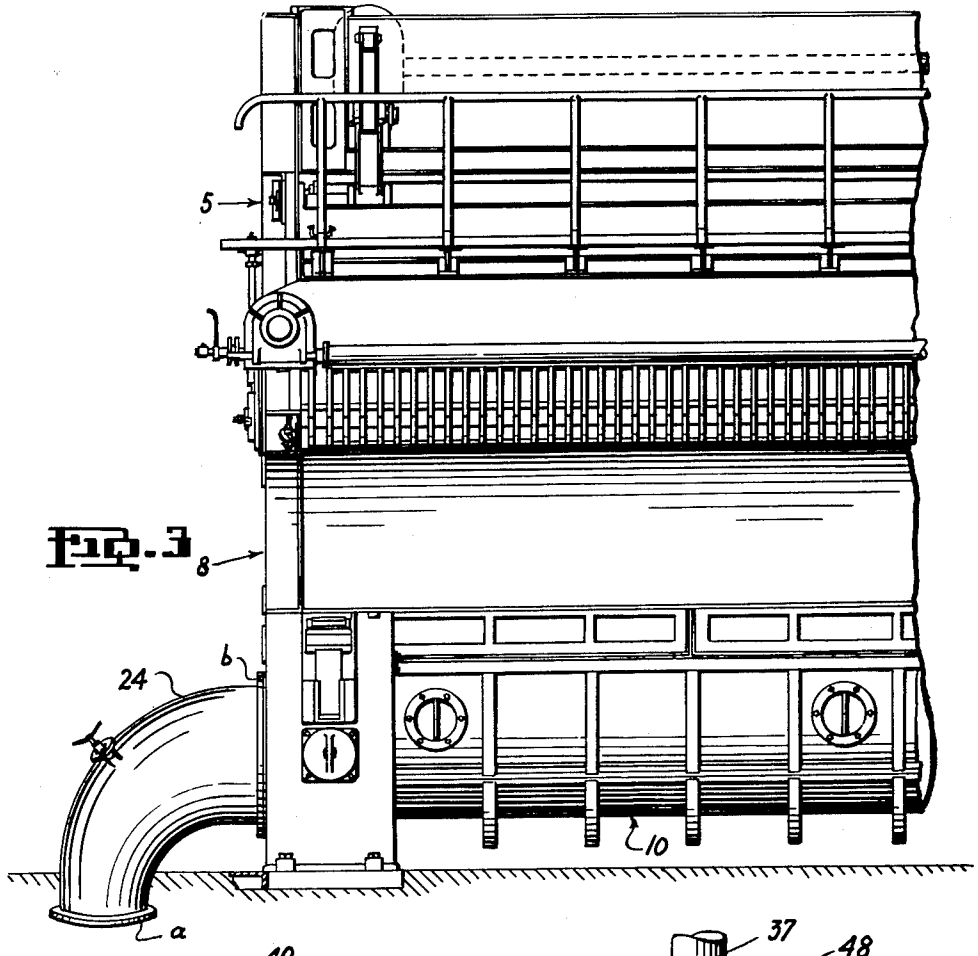


Fig. 3

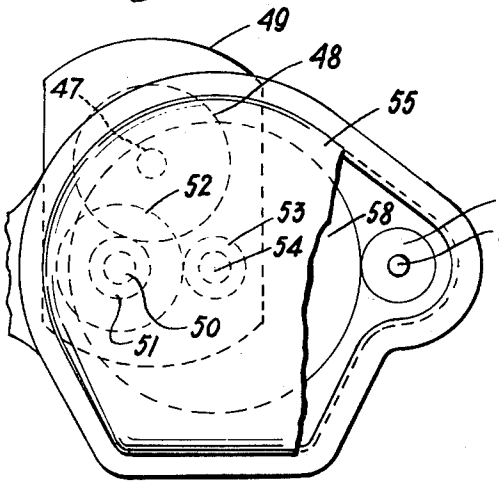


Fig. 8

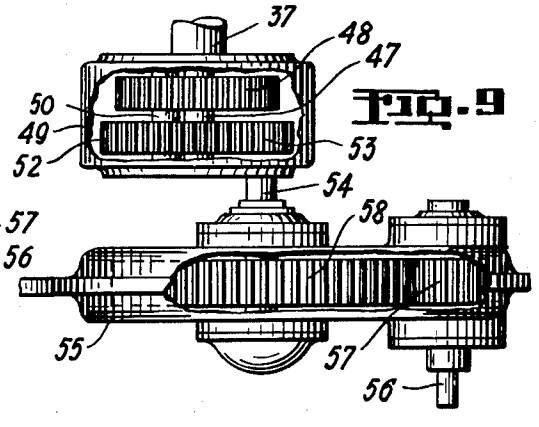


Fig. 9

Inventor
A. E. Stewart
By Jethes ton haugh & Co.
Attorneys

June 12, 1956 A. E. STEWART 2,749,815

STOCK FEEDING MEANS

Filed Dec. 31, 1953 4 Sheets-Sheet 4

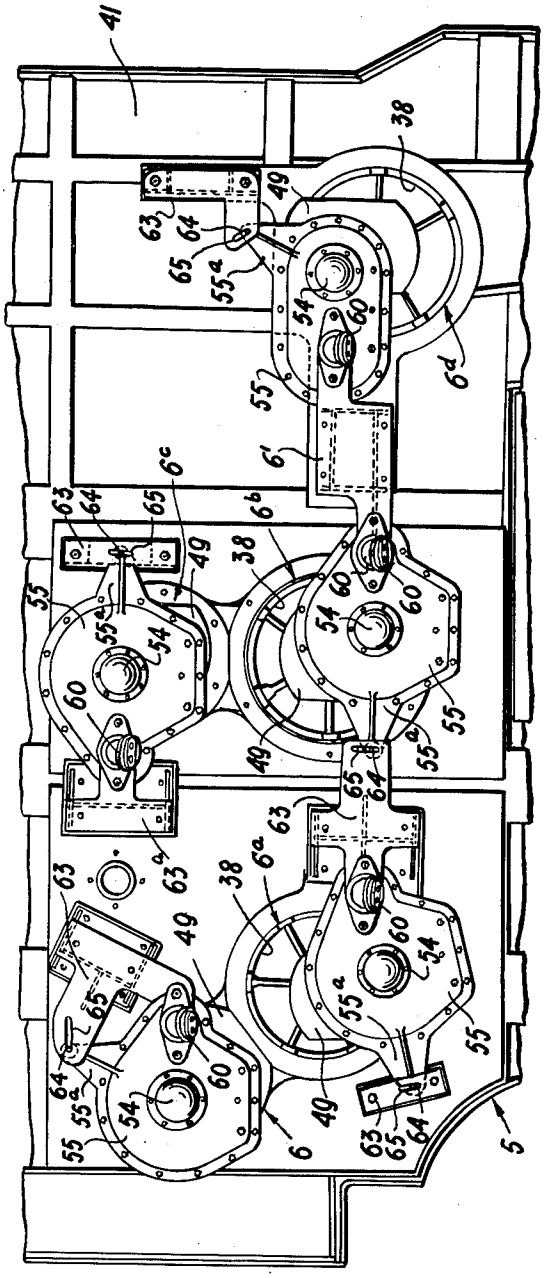


Fig. 6

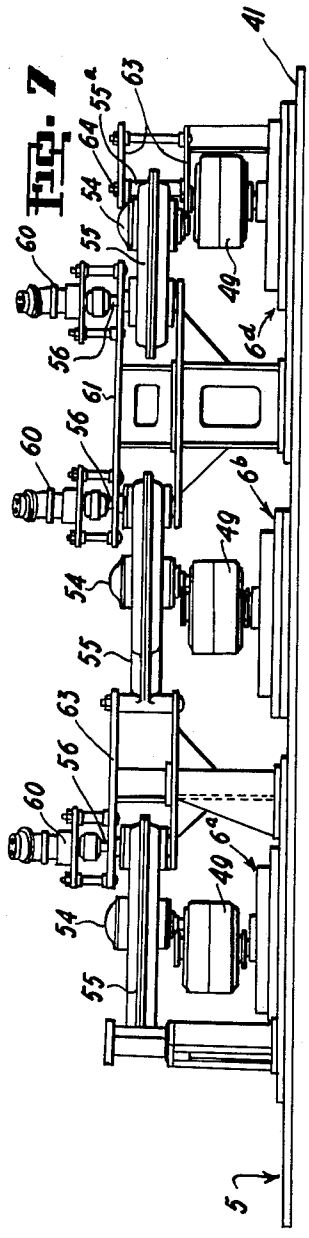


Fig. 7

Inventor
A. E. Stewart
By Jethestonhaugh & Co.
Attorneys

United States Patent Office 2,749,815
Patented June 12, 1956

2,749,815

STOCK FEEDING MEANS

Alexander Eric Stewart, St. Lambert, Quebec, Canada, assignor to Dominion Engineering Works Limited, Montreal, Quebec, Canada

Application December 31, 1953, Serial No. 401,637

4 Claims. (Cl. 92—44)

This invention relates to improved means for feeding stock onto the forming wire of a paper making machine.

The object of the invention is to provide stock feeding means in which provision is made for so controlling the velocity and other flow characteristics of the stock as to assure the delivery thereof onto the forming wire in the form of a flowing stream which is projected onto the forming wire at a velocity consistent with the speed of the machine and with a minimum amount of turbulence and which is of substantial uniform thickness across its width and does not have "thin edges."

The novel features and combinations of features by which the foregoing and other objects and various characteristic advantages of the invention are realized will be more clearly understood from the following detailed description of the preferred modification shown in the accompanying drawings, in which—

Fig. 1 is a side elevational view of the improved stock feeding means provided in accordance with the invention.

Fig. 2 is a vertical sectional view of the stock feeding means shown in Fig. 1.

Fig. 3 is a fragmentary front elevational view of the stock feeding means shown in Figs. 1 and 2.

Fig. 4 is an end view of a cross flow distributor forming part of the invention.

Fig. 5 is a detailed view illustrating the eccentric mounting of the rectifying rolls forming part of the invention.

Fig. 6 is a side elevational view of a drive mechanism for operating the rectifying rolls.

Fig. 7 is a bottom plan view of the drive assembly shown in Fig. 6, and

Figs. 8 and 9 are detailed figures illustrating part of the drive assembly shown in Figs. 6 and 7.

Referring more particularly to the drawings, **5** designates a headbox containing a plurality of reticulate rectifying rolls **6**, **6***a*, **6***b*, **6***c* and **6***d*. The paper making stock enters the headbox through a rear bottom inlet opening **7** communicating with the upper end of an upflow stock delivery passage **8** having its lower end communicating with an upflow outlet slot **9** provided at the top of a cross-flow distributor **10**.

The upflow stock delivery passage **8** is bounded at the front and rear by inclined front and rear walls **11** and **12** which diverge as they approach the upper end of said passage. By reason of this construction, the upflow passage **8** serves as a decelerating flow section in which the velocity and turbulence of the stock is substantially reduced as the stock travels from the lower to the upper end of said panel.

The cross-flow distributor **10** presents a cross flow passage **15** from which stock is delivered through the upflow outlet slot **9** to the upflow delivery passage **8**. The cross flow passage **15** is substantially pear-shaped in cross section and is divided longitudinally into two oppositely tapering flow channels **17** and **18** by means of a longitudinally extending baffle **19** including a warped portion **20**, located entirely within the cross flow passage **15**, and a straight upper vertical portion **21** located in the outlet

slot **9**. The warped portion **20** of baffle **10** is warped or twisted in both directions across the passage **15**, as indicated in Fig. 4, to give the channels **17** and **18** their tapered configuration. The straight portion **21** of baffle **19** is centered between and in spaced parallel relation to the vertical side walls of the outlet slot **9** by means of suitable spacer elements **22**.

The stock is delivered to one end of cross flow passage **15** through an elbow **24** (Fig. 1) secured to one end of the cross-flow distributor **10** and is also delivered to the opposite end of said passage **15** through a second elbow **25** (Fig. 2) which is secured to the other end of cross flow distributor **10** and is a duplicate of elbow **24**.

As will be clearly evident from Figs. 1 and 3, each of the elbows **24** and **25** is a transition elbow having a cross section progressively changing from a circular section of suitable area at the intake end *a* to a substantially pear-shaped cross section at the outlet end *b* connected to cross flow distributor **10**. In this connection it may be noted that each of the elbows **24** and **25** gradually increases in area through a series of combined parabolic and circular sections toward the outlet end *b*. By virtue of this construction the elbows **24** and **25** serve as decelerating elbows in which the velocity of flow and the turbulence of the stock is substantially reduced as the stock travels through the elbows. The gradual transition from a circular cross section at the intake end *a* to a substantially pear-shaped cross section at the outlet end *b* of each elbow also serves, in conjunction with the substantially pear-shaped cross section of the internally partitioned cross flow passage **15**, to facilitate the smooth merging of the horizontal flowing streams delivered to the cross flow channels **17** and **18** into an upwardly flowing stream toward the outlet slot **9** through which the stock passes into the upflow delivery passage **8** leading to the headbox inlet opening **7**.

The stock passes from headbox **5** onto the sheet forming wire (not shown) of the paper making machine through a front slice orifice **27** (Fig. 2) bounded at the bottom by apron **28** and at the top by the flexible lip portion **29** of a slice plate **30** secured to a slice plate carrier **31**. Mechanism, generally indicated at **32**, is provided for raising and lowering the slice plate carrier **31** to thereby vary the effective height of slice orifice **27**. The raising and lowering mechanism **32** also provides a horizontal pivotal axis **33** about which slice plate carrier **31** is swingable, by suitable adjusting means **34** (Fig. 1), to swing the lip **29** of slice plate **30** to different positions of adjustment in the lengthwise direction of the forming wire. Conventional slice lip adjustment means, indicated at **35**, is also provided for flexing the lip **29** of slice plate **30** to effect fine or localized adjustment of said lip.

Each of the rectifier rolls **6**, **6***a*, **6***b*, **6***c* and **6***d* is rotatably supported, at each end thereof, by adjustable mounting means so that the said rolls may be independently raised or lowered or shifted forwardly or rearwardly within the headbox **5** to provide the optimum flow rectifying conditions for the operating speed of the forming wire and the type of stock supplied to the headbox. The preferred method of adjustably mounting each end of each rectifying roll is illustrated in Fig. 5. As here shown a stub shaft **37** has a friction cone driving end **70** in engagement with a mating axial friction cone **71** mounted in each end of the rolls **6**, **6***a*, **6***b*, **6***c* and **6**d, and are locked in frictional driving engagement with each other by means of the tightening and locking nuts **72** on the inner stub shaft **73** which is integral with the cones **71**. The stub shaft **37** rigid with and projecting beyond the ends of the rolls **6**, **6***a*, **6***b*, **6***c* and **6***d* is eccentrically journalled in a bearing sleeve **38** by means of a tubular shaft receiving bearing **39**, formed integral with said sleeve, the shaft **37** being rotatably supported in the bearing **38** by suitable anti-friction elements **39**. The bearing sleeve

38 is rotatably supported in an opening 40 provided in the side walls 41 of the headbox 5 so that said bearing sleeve may be turned about its central axis 41*a* to raise or lower the rectifier rolls or to shift the latter forwardly or rearwardly in the lengthwise direction of the forming wire. The bearing sleeve 38 is retained in the side opening 40 of the headbox by means of a flange 42 integral with the outer portion of the bearing sleeve and held in place between inner and outer flange retaining members 43 and 44 fastened to the side wall structure 41 of the headbox. The outer end of the bearing sleeve 38 is provided with a series of notches 45 to facilitate rotary adjustment of said sleeve by engagement of a suitable tool with said notches.

A further feature of the invention, as illustrated in Figs. 6 to 9 inclusive, consist in driving each of the rectifier rolls through the agency of a simple and compact gear drive, the component elements of which are mounted to enable the drive to automatically adjust itself to the different positions of adjustment to which the rectifier rolls are shifted by turning movement of the bearing sleeves in which the roll shafts are eccentrically journalled. The manner in which this is accomplished will be clear from the following description of Figs. 6 to 9 inclusive.

The shaft 37 at one end of each rectifier roll has an extension shaft section 47 thereof projecting a substantial distance beyond the outer end of its bearing sleeve 38 and equipped with a spur gear 48. A gear casing 49, enclosing gear 48, is mounted on shaft section 47 so that the latter affords a movable pivotal axis about which gear casing 49 is free to swing in the manner of a link. A counter-shaft 50, rotatably journalled in gear casing 49, carries a relatively small spur pinion 51 and a relatively large spur gear 52. The pinion 51 meshes with and drives gear 48 while the gear 52 meshes with and is driven by a pinion 53 fixed to one end of a shaft 54 which extends into gear casing 49 and affords a second movable pivotal axis about which said casing is swingable. Shaft 54 is journalled in a second gear casing 55 mounted to swing about a fixed pivotal axis afforded by a power shaft 56 extending through the side walls of said casing and equipped, within the casing, with a pinion 57 driving a relatively large gear 58 on shaft 54. By reason of this construction the gear casings 49 and 55 and the gear train through which torque is transmitted from drive pinion 57 to shaft section 47 of the rectifier roll are free to move with shaft section 47 to thereby accommodate themselves to the different positions to which the rectifier roll and its supporting shaft are shifted by turning movement of the bearing sleeves 38 in which the roll shafts are eccentrically journalled.

As the stub shafts 37 are eccentrically journalled in the bearing sleeves 38 in each side wall 41 of the head box 5, any displacement of the axis of the rolls through the medium of the drives above described will be transmitted through the rolls to the eccentric bearings 38 in the opposite wall thereby keeping the shafts 37 and the rolls in parallel alignment.

The power shaft 56 of the gear drive serving each of the rectifier rolls 6, 6*a*, 6*b*, 6*c* and 6*d* is driven by an oil motor 60 of standard design coupled to said shaft.

On referring to Figs. 6 and 7 it will be noted that the power shafts 56 and oil motors 60 of the gear drives serving rectifier rolls 6*d* and 6*b* are supported by opposite ends of a bracket structure 61 secured to one side of headbox 5, the power shafts 56 being supported by said bracket structure to provide the fixed pivotal axes about which said gear casings 55 are swingable as previously described.

The gear casing 55 serving roll 6*d* is provided with an extension 55*a* connected to a stationary bracket 63 by means of a clamping bolt 64 movable in a slot 65 provided in said bracket. The extension 55*a*, bracket 63 and bolt 64 provide fastening means whereby the gear casing 55 of roll 6*d* may be secured in each new position to which said casing is swung about its supporting shaft 56 each time the roll 6*d* is shifted to a different position by turning movement of its bearing sleeves 48. Identical means are also provided for securing the gear casings 55 of the remaining rectifier rolls in the various adjusted positions to which said casings are swung about the power shafts 56 in response to changes in the positioning of said rolls. In this connection it will be noted that each of the gear casings 55 serving rolls 6, 6*a*, 6*b*, 6*c* and 6*d* is also provided with an extension 55*a* fastened to a bracket 63 by a bolt 64 working in a slot 65. It will be noted that, in the illustrated arrangement, the power shaft 56 and oil motor 60 of the gear casing 55 serving rectifier roll 6*a* are supported by the same bracket 63 to which is secured the extension 55*a* of the gear casing 55 serving roll 6*b*. It will also be noted that the oil motor 60 and power shaft 56 of the gear casing 55 serving roll 6 are mounted on the same bracket structure 63 to which the extension 55*a* of said gear casing is secured. The bracket supporting the shaft 56 and oil motor 60 of the gear casing 55 serving roll 6*c* is indicated at 63*a*.

While the mounting of the various gear casings 55 in the specific manner illustrated in Figs. 6 and 7 is not absolutely essential and may be departed from it may be noted that this method is of advantage in that it gives a compact arrangement which occupies a minimum amount of space.

The head box 5 is of the enclosed pressure type equipped with an air inlet pipe 5*a* (Fig. 2) through which air is introduced into the upper portion of the headbox to control the velocity of discharge at slice orifice 27.

The characteristic features and advantages of the stock feeding means hereinbefore described may be briefly reviewed as follows. By reason of the shape of the elbows 24 and 25 the stock is caused to enter opposite ends of the cross flow distributor 10 with considerably less velocity and turbulence than has heretofore been the case. The shaping of the outlet ends of the elbows to conform to the substantially pear-shaped cross section of the cross-flow passage 15 also contributes to reduction in the velocity and turbulence in the upflow from the cross distributor 10 to the outlet slot 9. The straight vertical upper portion 21 of the baffle 19 serves to separate and maintain parallel upward flow of the two streams of stock entering the upflow passage 8 from flow channels 17 and 18 of the cross flow distributor 10. This reduces turbulence at the entry of the upflow passage 8 and a further decrease in velocity and turbulence is provided for by the previously described inclination of the front and rear walls 11 and 12 of the upflow passage 8. A further substantial reduction in velocity and turbulence occurs as the stock flows through the inlet opening 7 into the main deceleration chamber provided by the interior of the head box 5. During flow of the stock from the headbox inlet opening 7 to the slice orifice 27 the flow characteristics of the stock are rectified by the action of rectifying rolls 6, 6*a*, 6*b*, 6*c* and 6*d* which, as previously explained, may be adjusted to suit the nature of the stock and the operating speed of the forming wire. The net result, to which these features of the invention mutually contributes, is the delivery onto the forming wire of a flowing stream of stock which is of uniform velocity, and thickness across the width of the stream and which is delivered onto the forming wire at a velocity consistent with the speed of the machine and with a minimum amount of turbulence.

Tests have shown that the stream of stock delivered onto the forming wire in accordance with the present invention is actually of substantial uniform thickness across its width and does not have "thin" edges. The adjustment of the rectifier rolls, which is necessary to provide optimum conditions for various kinds of stock and different operating speeds, makes it difficult to provide a drive mechanism for the rectifier rolls which will readily adjust itself to different positioning of the rolls and, at the same time, will not occupy too much space. The present invention overcomes this difficulty in a simple and efficient

manner by the previously described compact gear drive illustrated in Figs. 7 and 8.

Having thus described the nature and characteristic features of my invention and a preferred embodiment thereof it will be understood that various modifications will be resorted to within the scope and spirit of the invention as defined by the appended claims.

What I claim is:

1. Stock feeding means of the character described comprising a headbox having a rear bottom inlet opening through which stock is supplied to said headbox and a front slice orifice through which stock passes from the headbox onto the forming wire of a paper making machine, an upflow stock delivery passage through which stock is delivered to said inlet, said passage being bounded at the front and rear by inclined front and rear walls which diverge as they approach the upper end of the passage, a cross-flow distributor presenting a cross-flow passage open at both ends and a top upflow outlet through which stock is delivered from said cross flow passage to the lower end of said upflow delivery passage and elbows connected to opposite ends of said cross flow distributor in communication with said cross flow passage, said cross flow passage being substantially pear-shaped in cross section and each of said elbows having a cross section progressively changing from a circular section of suitable area at the intake end to a larger and substantially pear-shaped cross section at the outlet end and a warped longitudinal extending partition whose lower edge is in spiral contact with the lower half of the cross flow channel arranged in said cross flow passage to provide tapering flow channels at opposite sides of said partition, said channels being in communication with said top upflow outlet.

2. Stock feeding means as set forth in claim 1, in which said upflow outlet is bounded throughout its length by straight parallel side walls and in which said warped partition includes a straight upper vertical portion positioned in said upflow outlet in spaced parallel relation to the side walls of said outlet.

3. Stock feeding means as set forth in claim 1, including a series of flow rectifying rolls arranged in the headbox between the stock inlet and the slice orifice of said headbox and means for effecting vertical and horizontal adjustment of said rolls.

4. Stock feeding means of the character described comprising a head box having a rear bottom stock inlet and a front slice orifice, a plurality of flow rectifying rolls arranged in and extending across said head box between said inlet and said slice orifice, adjusting means for individually mounting each of said rolls comprising bearing sleeves rotatably mounted in opposite side walls of the head box, shafts projecting from opposite ends of the said rolls and eccentrically journalled in said sleeves, means for driving each of said rolls, said means comprising a power shaft, a gear casing in which the power shaft is journalled to provide a pivotal axis about which said gear casing is swingable, a second shaft rotatably journalled in said gear casing in parallel relation with said power shaft, spur gearing connecting said shafts within said gear casing, a second gear casing in which a portion of said second shaft and one of the roll shafts are journalled in parallel relation to each other to provide pivotal axes about which said second gear casing is movable, a train of gearing interconnecting said second shaft and said roll shaft within said second gear casing, and link support brackets pivotally connecting said adjusting means.

References Cited in the file of this patent

UNITED STATES PATENTS

2,060,808	Kellett et al.	Nov. 17, 1936
2,225,435	Kellett	Dec. 17, 1940
2,347,717	Staege	May 2, 1944
2,664,033	Hornbostel et al.	Dec. 29, 1953
2,677,991	Goumeniouk	May 11, 1954