Feb. 1, 1966 LOUIS-MARIE OUELLET 3,232,828

VARIABLE STROKE SHAKER MECHANISM FOR PAPER MAKING MACHINES

Filed July 15, 1963 3 Sheets-Sheet 1

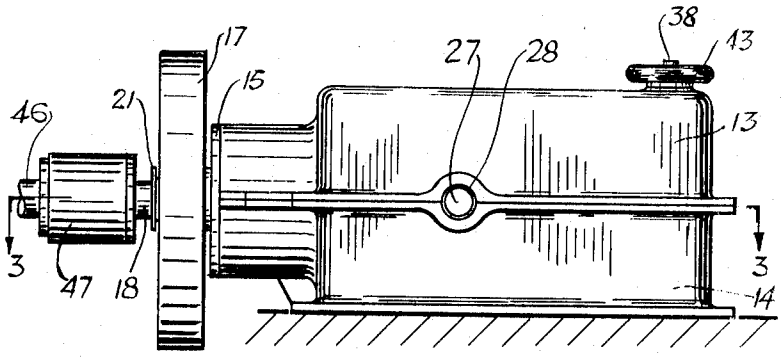


FIG. 1

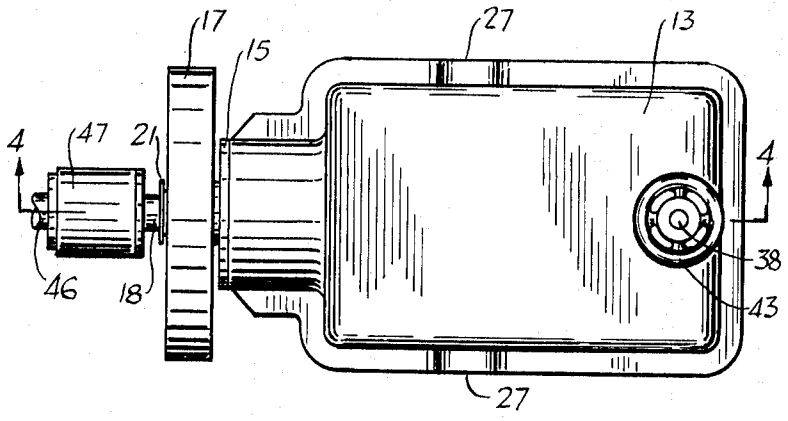


FIG. 2

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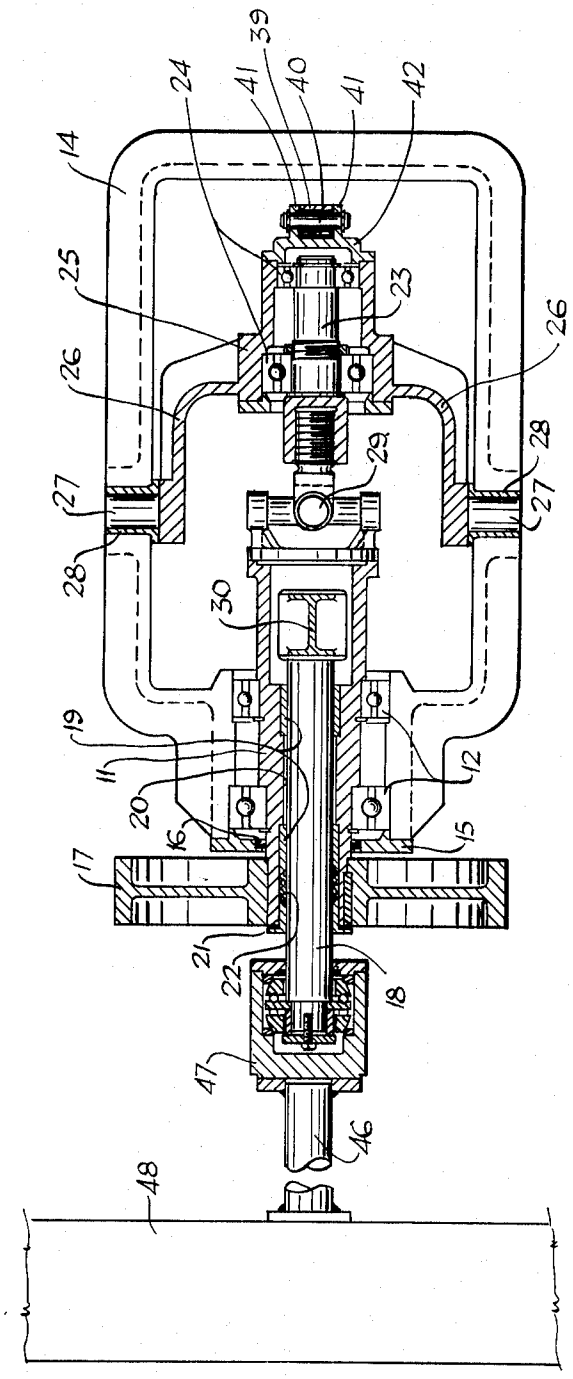


FIG. 3

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FIG. 5

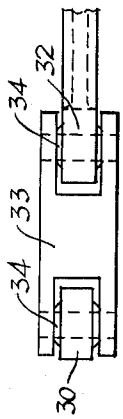
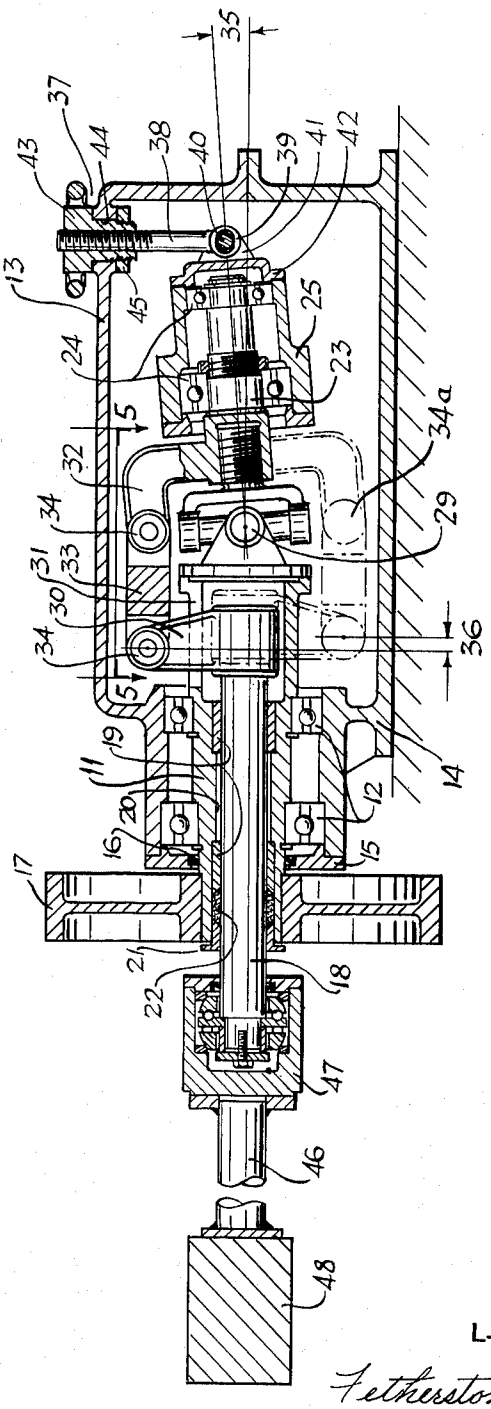


FIG. 4



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VARIABLE STROKE SHAKER MECHANISM FOR PAPER MAKING MACHINES

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8 Claims. (Cl. 162—355)

This invention relates to paper making machine fourdriniers and particularly to an improved mechanism for imparting a shaking motion, of variable stroke amplitude, to the drainage screen of a fourdrinier.

It will also be understood that the principle of this invention can be applied to any situation where it is required to convert a rotary input into a reciprocating output.

In the manufacture of certain grades of paper the fourdrinier table, around which the fourdrinier drainage screen is draped, must be shaken in the plane of the screen at right angles to its direction of travel.

In fourdriniers of this type, the fourdrinier table is pivotally mounted to permit oscillation or shaking motion at right angles to the direction of travel of the screen and is normally centered by spring means such that the bias towards null position is proportional to the displacement. Therefore, the table tends to oscillate with simple harmonic motion.

Thus, any mechanism which is used to impart a shaking motion to a fourdrinier table should, for minimum stress and wear, have the characteristic of simple harmonic motion.

It is also desirable that the shaking mechanism be provided with variable stroke amplitude control and that the output characteristic is simple harmonic over the range of amplitude control from zero to maximum.

A well known mechanism, which is used to impart a shaking motion to fourdrinier tables, employs an eccentric crank of fixed throw which imparts reciprocating motion to the output shaft by way of an adjustable toggle linkage.

One of the disadvantages of this well known mechanism is that at full stroke the deviation from simple harmonic motion is considerable.

Another disadvantage is that it is impossible to run the mechanism at zero stroke.

Still another disadvantage is that when at or near minimum stroke setting the output frequency, for a given input speed, is doubled.

These kinematic defects result in early structural and mechanical failure of the shaking mechanism and/or the fourdrinier table and the service life of the assembly is thus very unsatisfactory.

These inherent kinematic defects cannot be corrected by increasing component strength for, strengthening the shaking mechanism causes the table structure to fail and strengthening the table structure causes the shaking mechanism to fail.

The disadvantages inherent in the aforementioned well known mechanism are overcome in the present invention by the provision of an improved mechanism which converts uniform rotary motion into simple harmonic reciprocating motion of controllable stroke amplitude. This is achieved by the provision of a hollow input shaft rotatably journalled in the shaker casing and an output shaft coaxially mounted to reciprocate in said hollow input shaft. Stroke regulating means interconnects the input and output shafts such that rotation of the input shaft imparts reciprocating motion to said output shaft.

The stroke regulating means includes a secondary shaft rotatably journalled in a secondary housing which is pivotally mounted in the shaker casing to adjustably position the secondary shaft in positions of angular misalignment with the input shaft. The secondary shaft is coupled to the input shaft by means of a universal joint, the transverse centre line of which lies on a line through the pivotal axes of the secondary housing, thus the shafts will rotate together when they are axially aligned and also when their axes are angularly misaligned. An arm extending laterally from the output shaft through a slot in the input shaft is operatively connected to the secondary shaft through a ball joint linkage.

Thus, rotation of the input shaft when the input and secondary shafts are angularly misaligned, will result in reciprocation of the output shaft, from zero stroke when the input and secondary shafts are axially aligned to finite stroke when the input and secondary shafts are angularly misaligned. The operaing principle of this invention can be considered as analogous to the basic principle of the adjustable angle swash-plate mechanism by substituting for the swash-plate two shafts coupled together by a universal joint.

It is, therefore, the main object of this invention to provide a mechanism which will impart simple harmonic reciprocating motion to a fourdrinier table.

Another object of this invention is to provide a mechanism which will impart simple harmonic reciprocating motion, with variable stroke amplitude control, to a fourdrinier table.

Another object of this invention is to provide a shaking mechanism, the output characteristic of which is simple harmonic, over the range of stroke amplitude control from zero amplitude to maximum amplitude.

Another object of this invention is to provide a fourdrinier table shaking mechanism in which wear and stress is kept to a minimum.

Another object of this invention is to provide a mechanism, for imparting shaking motion to a fourdrinier table, in which the stroke amplitude can be varied during operation.

A further object of this invention is to provide a fourdrinier table shaking mechanism which is of simple yet robust construction, is of compact design and is relatively inexpensive, as compared with shaking mechanisms of the well known type.

These and other objects of this invention will be apparent by reference to the following detailed specification and figures in which:

FIG. 1 is a side view of a shaking mechanism embodying the features of this invention.

FIG. 2 is a plan view of a shaking mechanism embodying the features of this invention.

FIG. 3 is a sectional view, to an enlarged scale, taken on 3—3 in FIG. 1 and showing details of the invention.

FIG. 4 is a sectional view, to an enlarged scale, taken on 4—4 in FIG. 2 and showing further details of this invention.

FIG. 5 is a view to a further enlarged scale, taken on 5—5 in FIG. 4.

To obtain simple harmonic motion from the reciprocating output of the improved mechanism of the present invention, the universal joint used must be of the constant velocity type. However, when this improved mechanism is applied to shake a paper making machine fourdrinier table the range of shaft angular misalignment required to provide the required shake stroke amplitudes is small and permits the use of the simpler and less expensive Hooke's joint type universal joint, where the error thus introduced due to the small shaft angular misalignment is considered negligible. In the follow-

ing description of the preferred execution of this invention a Hooke's joint type universal joint is shown incorporated into the mechanism for simplicity.

With reference now to the figures, input shaft **11** is rotatably journalled in bearings **12** located in upper half casing **13** and lower half casing **14**. End cap **15** closes the open ends of upper and lower half casings **13** and **14** respectively and seal **16** seals the bore in end cap **15** through which input shaft **11** passes. Input pulley **17** is attached to the outer end of input shaft **11** and is driven by a driving motor (not shown) to provide the required input rotation. Output shaft **18** is coaxially mounted to reciprocate in bearings **19** positioned in bore **20** in input shaft **11**. Packing gland **21** retains shaft packing **22** to effectively seal bore **20**.

Secondary shaft **23** is rotatably journalled in bearings **24** in secondary housing **25**. Pivot arms **26** extend outwardly from secondary housing **25** with trunnions **27** extending outwardly from pivot arms **26** and transverse to secondary shaft **23**. Trunnions **27** are pivotally mounted in bearings **28**, positioned in upper and lower half casings **13** and **14** respectively.

The inner end of input shaft **11** is coupled to secondary shaft **23** by universal joint **29**, the transverse centre line of which is arranged to lie on a line through the pivotal axes of trunnions **27**. Thus, input and secondary shafts **11** and **23** respectively will rotate together when they are axially aligned and also when their axes are angularly misaligned, as shown in FIG. 4.

Output arm **30** extends laterally from the inner end of output shaft **18**, through a slot **31** in input shaft **11** and secondary arm **32** extends laterally from the inner end of secondary shaft **23**. Slot **31** in input shaft **11** is dimensioned to locate output arm **30** such that output arm **30** can move axially in slot **31** but with output shaft **18** prevented from rotating relative to input shaft **11**.

Output and secondary arms **30** and **32** respectively are operatively connected by link **33** and ball joints **34**. Reference again to FIG. 4 shows secondary shaft **23** angularly misaligned with input shaft **11** by an angle **35**. It will therefore be seen that rotation of input shaft **11** produces a corresponding rotation of angularly misaligned secondary shaft **23**, ball joint **34**, of secondary arm **32**, being axially displaced when input shaft **11** is rotated 180° to the lower vertical position shown in broken line at **34***a*. This axial displacement is transferred, through link **33**, to output arm **30**, as shown at **36**.

Thus, when the axes of input and secondary shafts **11** and **23** respectively are angularly misaligned, as at **35**, rotation of input shaft **11** will result in reciprocation of output shaft **18** by the amount shown at **36**.

The axial displacement, or stroke, **36** will vary from a predetermined maximum amplitude, corresponding with the predetermined maximum angle of misalignment **35** between shafts **11** and **23**, to zero stroke, when shafts **11** and **23** are axially aligned.

Adjustment of angle **35**, corresponding to adjustment of stroke amplitude, is accomplished by means of the adjusting mechanism shown generally at **37**.

Adjusting mechanism **37** includes an adjusting screw **38** having a head end **39** which is slotted to receive pivot pin **40**. Pivot pin **40** is positioned through lugs **41** on secondary housing end cap **42**. The other end of adjusting screw **38** is threaded to engage in adjusting nut **43**. Adjusting nut **43** has a reduced diameter plain portion which is rotatably positioned in bore **44** in upper half casing **13** and a further reduced diameter threaded portion which engages in lock nut **45**. Lock nut **45** is adjusted to provide free rotation of adjusting nut **43** in bore **44**. Thus, rotation of adjusting nut **43** will result in the raising or lowering of the outer end of secondary housing **25**, thus respectively increasing or decreasing angle **35** according to the direction of rotation.

The outer end of output shaft **18** is connected to shaker shaft **46** by means of a two-way thrust bearing **47**, whereby reciprocation may be transmitted to shaker shaft **46** from reciprocating and rotating output shaft **18**, without rotation of shaker shaft **46**.

Shaker shaft **46** is directly connected to the fourdrinier shake rail **48**.

In the operation of this invention, input rotation provided through input pulley **17** will result in non-rotating reciprocation of shaker shaft **46**, of amplitude predetermined by the angular positioning of secondary shaft **23** by means of the adjusting mechanism **37**.

Shaking mechanisms according to this invention can be operated in pairs by means of a simple worm and screw interconnection between each adjusting mechanism **37**, with each shaking mechanism being positively driven. Differential stroke amplitudes can be obtained by use of suitable worm and screw ratios and corresponding drive ratios.

This invention, therefore, provides a shaking mechanism in which modulated stroke amplitude control is obtained from zero stroke, to maximum stroke, with no double frequency output in any part of the range of stroke adjustment. When a constant velocity type universal joint is used in the mechanism, true simple harmonic motion output is obtained throughout the range of stroke adjustment, but where a small deviation from mathematically exact simple harmonic motion can be tolerated, then a less costly Hooke's joint type universal joint can be substituted for the constant velocity type universal joint.

What I claim is:

1. A shaker mechanism for fourdrinier paper making machines including a shake rail mounted to swing laterally to either side of a central position, a rotary hollow input shaft mounted to rotate about a fixed longitudinal axis, an output shaft mounted to reciprocate within said input shaft and to rotate therewith, said output shaft having an output arm extending laterally therefrom and projecting through slot means in said hollow input shaft, adjustable motion transmitting means interconnecting said input shaft and said output arm for imparting a rotating and reciprocating motion of adjustable stroke to said output shaft in response to rotation of said input shaft, and means connecting said output shaft to said shake rail to impart swinging motion to said shake rail on either side of said central position in accordance with the reciprocating stroke of said output shaft.

2. A shaker mechanism for fourdrinier paper making machines including a shake rail mounted to swing laterally to either side of a central position, rotary input shaft means, an output shaft mounted for rotary and reciprocating movement, motion transmitting means interconnecting said input shaft means and said output shaft for imparting a rotating and reciprocating motion to said output shaft in response to rotation of said input shaft means, said motion transmitting means including a secondary shaft operatively connected to said input shaft means to rotate therewith and operatively connected to said output shaft to impart said rotating and reciprocating motion thereto, and means connecting said output shaft to said shake rail to impart swinging motion to said shake rail on either side of said central position in accordance with the reciprocating stroke of said output shaft.

3. A shaker mechanism for fourdrinier paper making machines including a shake rail mounted to swing laterally to either side of a central position, a rotary input shaft, an output shaft mounted for rotary and reciprocating motion, said output shaft having an output arm extending laterally therefrom, adjustable motion transmitting means interconnecting said input shaft and said output arm for imparting a rotating and reciprocating motion of adjustable stroke to said output shaft in response to rotation of said input shaft, said motion transmitting means including a secondary shaft operatively connected to said input shaft and mounted to rotate therewith, a secondary

arm extending laterally from said secondary shaft, and link means operatively connecting said output and secondary arms, said secondary shaft adapted to rotate about an axis adjustable from a position of axial alignment with said output shaft to a position of angular misalignment with said output shaft to provide said adjustable stroke of said output shaft, and means connecting said output shaft to said shake rail to impart swinging motion to said shake rail on either side of said central position in accordance with the reciprocating stroke of said output shaft.

4. A shaker mechanism for fourdrinier paper making machines including a shake rail mounted to swing laterally to either side of a central position, a rotary hollow input shaft mounted to rotate about a fixed longitudinal axis, an output shaft mounted to reciprocate within said input shaft and to rotate therewith, motion transmitting means interconnecting said input shaft and said output shaft for imparting a rotating and reciprocating motion to said output shaft in response to rotation of said input shaft, said motion transmitting means including a secondary shaft operatively connected to said input shaft to rotate therewith and operatively connected to said output shaft to impart said rotating and reciprocating motion thereto, and means connecting said output shaft to said shake rail to impart swinging motion to said shake rail on either side of said central position in accordance with the reciprocating stroke of said output shaft.

5. A shaker mechanism for fourdrinier paper making machines including a shake rail mounted to swing laterally to either side of a central position, a rotary hollow input shaft mounted to rotate about a fixed longitudinal axis, an output shaft mounted to reciprocate within said input shaft and to rotate therewith, said output shaft having an output arm extending laterally therefrom and projecting through slot means in said hollow input shaft, adjustable motion transmitting means interconnecting said input shaft and said output arm for imparting a rotating and reciprocating motion of adjustable stroke to said output shaft in response to rotation of said input shaft, said motion transmitting means including a secondary shaft operatively connected to said input shaft and mounted to rotate therewith, a secondary arm extending laterally from said secondary shaft, and link means operatively connecting said output and secondary arms, said secondary shaft adapted to rotate about an axis adjustable from a position of axial alignment with said output shaft to a position of angular misalignment with said output shaft to provide said adjustable stroke of said output shaft, and means connecting said output shaft to said shake rail to impart swinging motion to said shake rail on either side of said central position in accordance with the reciprocating stroke of said output shaft.

6. A shaker mechanism for fourdrinier paper making machines including a shake rail mounted to swing laterally to either side of a central position, a casing for said shaker mechanism, a rotary hollow input shaft mounted in said casing to rotate about a fixed longitudinal axis, an output shaft coaxially mounted to reciprocate within said input shaft and to rotate therewith, said output shaft having an output arm extending laterally therefrom and projecting through slot means in said hollow input shaft, adjustable motion transmitting means interconnecting said input shaft and said output arm for imparting a rotating and reciprocating motion of adjustable stroke to said output shaft in response to rotation of said input shaft, said motion transmitting means including a secondary shaft operatively connected to said input shaft and mounted to rotate therewith, a secondary arm extending laterally from said secondary shaft, link means operatively connecting said output and secondary arms, said secondary shaft rotatably mounted in secondary housing means, said secondary housing means pivotally mounted in said casing for adjustment of said secondary shaft from a position axially aligned with said output shaft to a position of angular misalignment with said output shaft to provide said adjustable stroke of said output shaft, said secondary housing means including a body portion having two arm members extending outwardly therefrom, said secondary shaft being rotatably journalled in said body portion, said secondary housing means being pivotally mounted on trunnion portions at the outer ends of said arm members and journalled in said casing, the axes of said trunnion portions adapted to lie on the transverse centre line of the operative connection between said input and secondary shafts, and thrust bearing means connecting said output shaft to said shake rail to impart swinging motion to said shake rail on either side of said central position in accordance with the reciprocating stroke of said output shaft.

7. A shaker mechanism as set forth in claim 6 in which the operative connection between said input and secondary shafts comprises a universal joint.

8. A shaker mechanism as set forth in claim 6 including adjusting screw and nut means connected between said secondary housing means and said casing for adjusting the pivotal position of said secondary housing within said casing and thus the angular position of said secondary shaft relative to said output shaft.

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