Feb. 3, 1931. E. E. BERRY 1,790,852

SUCTION BOX

Filed Nov. 14, 1927 2 Sheets-Sheet 1

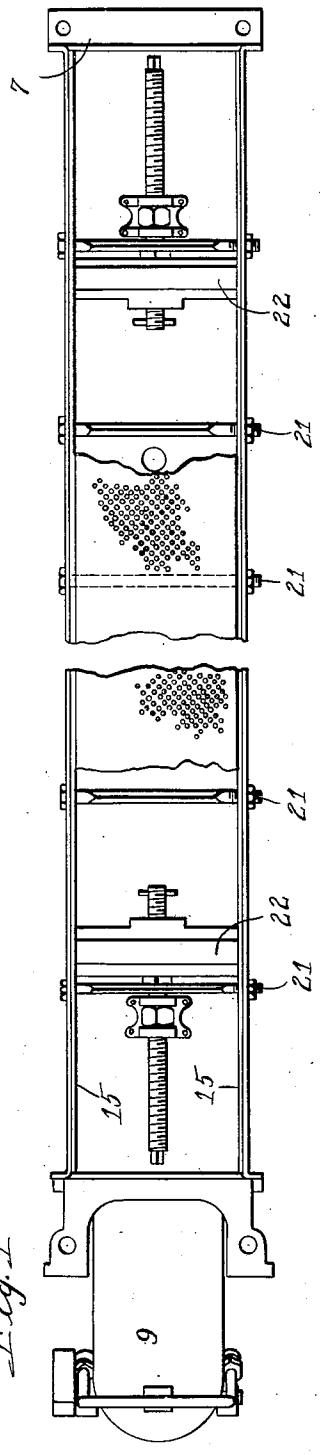


Fig. 1.

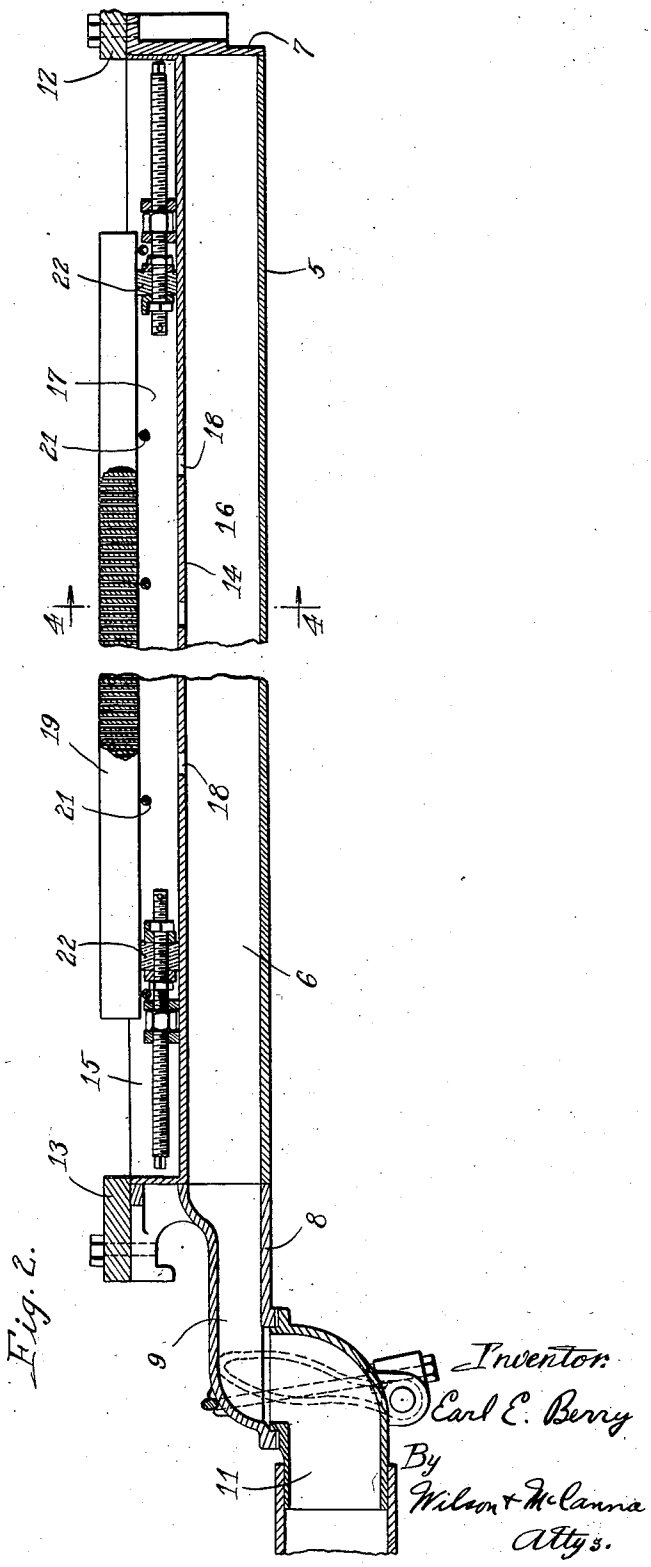


Fig. 2.

Inventor:
Earl E. Berry
By
Wilson & McCanna
Attys.

Feb. 3, 1931. E. E. BERRY 1,790,852

SUCTION BOX

Filed Nov. 14, 1927 2 Sheets-Sheet 2

Fig. 3.

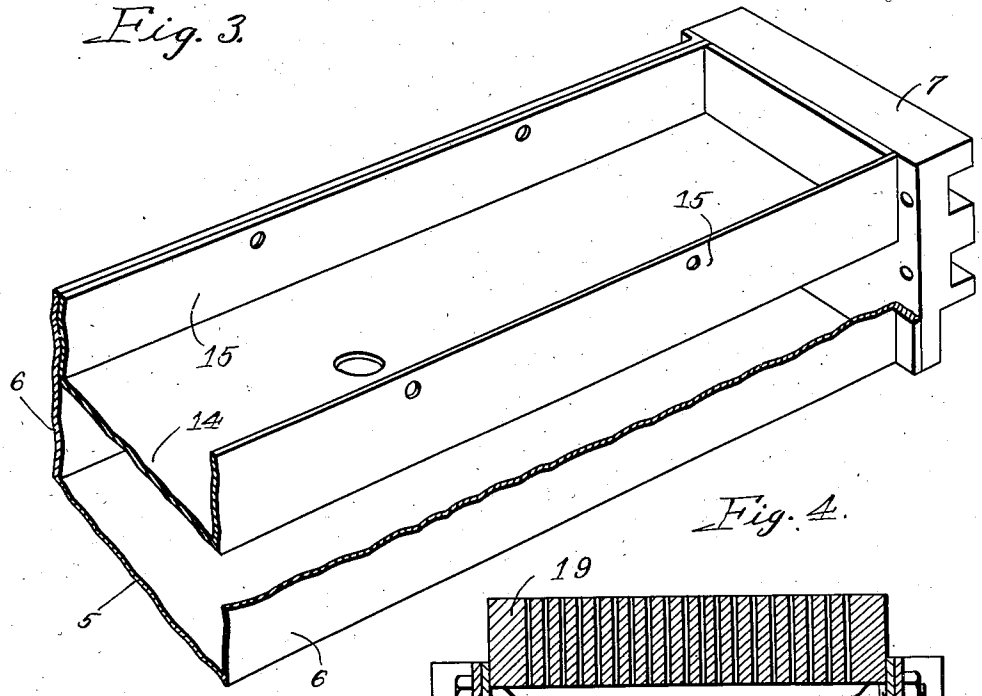


Fig. 4.

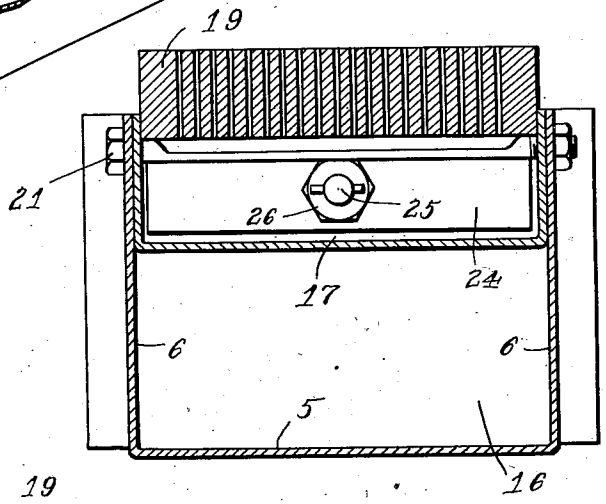
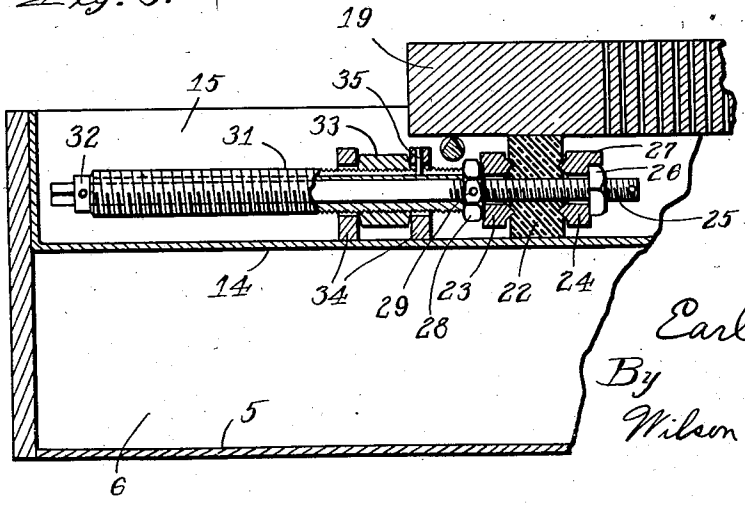


Fig. 5.



Inventor:
Earl E. Berry
By
Wilson & McCanna
Attys.

Patented Feb. 3, 1931

1,790,852

UNITED STATES PATENT OFFICE

EARL E. BERRY, OF BELOIT, WISCONSIN, ASSIGNOR TO BELOIT IRON WORKS, OF BELOIT, WISCONSIN, A CORPORATION OF WISCONSIN

SUCTION BOX

Application filed November 14, 1927. Serial No. 233,038.

This invention relates to suction boxes for Fourdrinier machines.

In a paper making machine of this kind the suction boxes are located beneath the wire usually between the table rolls and the couch roll and serve to draw water through the wire from the stock. The suction box, usually made of brass, bronze or aluminum, is rectangular in cross-section and equipped at its top with a removable perforated cover made of hard wood such as maple or mahogany or, sometimes, of hard rubber, brass, or some composition. By means of a suitable vacuum pump connected with the box a suction is produced which draws water through the interstices in the wire and the perforations in the cover. The suction pulls the wire down onto the cover of the box and tends to make the wire drag so that there is sometimes considerable friction between the wire and cover. This drag or braking effect on the wire varies with the amount of suction which in some cases is considerably greater than in others due to the particular conditions at hand. In any event the wire wears ridges or grooves in the covers which sooner or later destroys the mesh or causes defects in the paper. To overcome this it is necessary to periodically remove the suction boxes and plane smooth, or otherwise refinish or replace the covers. If the box covers are not refinished in time the wire is liable to jump the grooves and cause trouble and, in any event, the condition becomes increasingly dangerous or damaging.

The wear of the wire on the suction boxes has been a constant source of trouble, not only because of the wearing of grooves in the cover but due to deflection of the boxes in the direction of travel of the wire because of the heavy drag which causes improper contact. The combined drag of the wire and weight of the heavy boxes also causes them to sag in the center. This deflection and sagging sometimes results in chattering or vibration of the boxes and consequent breaking of the vacuum. Such conditions of course cause uneven moisture content and uneven distribution of the fibers in the sheet and consequently impair the quality of the paper. Such conditions are also liable to cause damage to the machine and considerable added cost in the maintenance thereof.

Suction boxes made of brass or bronze, as heretofore, are quite heavy and difficult to remove for refinishing or replacing the covers. With the advent of larger machines in which the suction boxes are of lengths upwards of three hundred inches and more the weight of a single box is so great that a gang of twelve to fifteen men is required to handle a single box. Ordinarily, prior to my invention, more men were required than the usual number known as the machine crew to remove a suction box. While metals such as brass or bronze have been universally used in this art as the most suitable for the purpose, nevertheless they are objectionable for many reasons. In addition to their enormous weight and tendency to deflect and sag especially if the cross-section of metal is not great enough, there is also the objection to the high cost of materials and corresponding high cost of manufacture. They are also objectionable because not altogether free from corrosion and oxidation caused by the conditions peculiar to their use.

Aluminum and aluminum bronze have also been used for suction boxes and although lighter and easier to handle they are objectionable because the cross-section of the material must be so large as to be almost prohibitive in order to positively insure against deflection and vibration tendencies.

I have also found that the materials heretofore used for suction boxes are objectionable because of their electrolytic properties. They are electro-negative; consequently, in the presence of the ordinary paper mill liquids they will gradually waste away or decompose, their copper content flowing on to the various electro-positive elements of the machine. This, of course, results in a gradual weakening or breaking down of the suction boxes which in order to function properly should possess a high degree of rigidity.

The present invention aims to overcome the objections to prior suction boxes. To this end my invention contemplates constructing the suction boxes of a material having such properties as will enable the use

of a cross-section of metal considerably less than was possible with metals heretofore used. The material which I employ is a chromium bearing iron or steel in which the chromium content is sufficient to prevent corrosion and to resist acids. Other physical properties differing from the metals heretofore employed are considerably greater modulus of elasticity, tensile strength and yield point. Such metal is known in practice as stainless iron or steel. Suction boxes made from this metal are rustless, stainless, lighter in weight, of greater strength and rigidity, and may be produced at less cost than heretofore. With this new metal I am able to employ a much smaller cross-section and to generally improve and simplify the construction of suction boxes. Furthermore, many of the disadvantages above noted are overcome because the new suction boxes are considerably lighter in weight and can be easily handled by the ordinary machine crew; and, because of the considerably greater strength and rigidity the objections incident to sagging and deflection are likewise overcome.

My invention also contemplates the production of a better suction box produced at less cost than was heretofore possible and practicable.

Another object of my invention is to provide a suction box of new and improved construction, especially in respect to the method of supporting and clamping the cover.

Other objects and attendant advantages will be appreciated by those skilled in this art as the invention becomes better understood by reference to the following description when considered in connection with the accompanying drawings, wherein:

Figure 1 is a plan view of a suction box with the cover and intermediate portion partly broken away, embodying my invention;

Fig. 2 is a vertical longitudinal section through the suction box;

Fig. 3 is a fragmentary perspective view showing one end of the suction box;

Fig. 4 is an enlarged cross-section taken on the line 4—4 of Fig. 2; and

Fig. 5 is an enlarged vertical section through one end of the box.

According to my invention the suction box is constructed principally of an iron and steel alloy having a chromium content of approximately 5% or more which gives certain physical properties heretofore unknown in the construction of suction boxes so far as I am aware. By reason of the comparatively high chromium content the alloy is not only stainless, non-corrosive and electro-negative, but its modulus of elasticity, tensile strength and yield point, respectively, are between 200 and 300 per cent greater than the materials heretofore used for making suction boxes. My invention contemplates the use of this alloy for making the entire suction box with the exception of the cover, and further contemplates making the boxes of sheet metal stock which may be bent or pressed to shape and welded or riveted at the joints. This type of construction enables a substantial reduction in the cross-section of metal and at the same time increases the strength and modulus of elasticity which are so essential to stiffness and rigidity of the suction box and, consequently, to the proper functioning thereof. An alloy such as contemplated by my invention is superior to prior metals used for this purpose because it lowers the cost of production, gives a stronger and lighter construction, and improves the functioning of the box. By reason of the greater stiffness, rigidity and strength the suction box will support its cover in the desired working position against the wire without sagging, deflecting, or vibrating. Alloys such as contemplated herein are known commercially as delhi iron and ascoloy, although it should be understood that in the practice of my invention other ferrous alloys might be used having the physical properties herein claimed.

In the present embodiment of my invention a sheet of metal having the properties above described, is formed to provide a bottom part 5 and upright sides 6 coextensive with the length of the box. To one end of said bottom part of the box is suitably secured a plate 7 as by welding or riveting to flanges on said bottom. If rivets are used they would be of the same metal alloy. To the opposite end of the bottom part is similarly fastened a casing 8 shaped to provide a suction fitting 9 adapted for quick connection to a suction pipe 11 which leads to a vacuum pump. The end plate 7 and casing 8 are suitably supported from frame parts 12 and 13, respectively, to permit removal of the suction box for reasons noted above. A horizontal partition 14 of sheet metal similar to and coextensive with the length of the bottom part 5 is bent to channel shape so that its turned up sides 15 fit within the sides 6 of the bottom channel part or section. The sides of the top and bottom channel sections are suitably welded together. This construction and arrangement of channel sections provides a bottom chamber 16 which communicates at one end with the suction fitting 9 and an upper chamber 17 which has communication with the bottom chamber through suitable perforations 18 in the partition wall 14.

The perforated cover 19 upon which the wire rides may be of suitable material. This cover is interposed between the sides of the box above the partition 14 and clamped thereto by a series of cross bolts 21. These bolts, upon which the cover may rest, are preferably of the same kind of metal as the box and

may be of an elongated cross-section throughout the greater part of their length so as not to retard the suction and flow of water through the perforations in the cover. As an alternative the cover may be supported on the bolts slightly spaced therefrom as by means of ferrules. It will be seen that the sides of the box above the partition 14 may be flexed sufficiently to clamp and release the cover as the case may be, without danger of springing joints or causing leakage from the vacuum chambers. This also allows a simple and practical method of holding the cover in position which permits of comparatively quick and easy removal and replacement of the cover.

The top vacuum chamber 17 is closed at each end by a rubber piston 22 which fits the space between the bottom 14 and sides 15 of the top channel and the bottom of the cover 19. Each piston is clamped between blocks 23 and 24 which are loose on a screw rod 25. A nut 26 on said screw rod is held from rotation by a flange 27 on the block 24. A nut 28 fixed by a pin 29 to the screw rod 25 provides an abutment for the block 23. Upon this screw rod is mounted to turn loosely an adjusting screw 31, a collar 32 fixed on the screw rod 25 serving to hold the screw 31 from lengthwise displacement. Lugs 34 fixed to the partition 14 serve to prevent axial movement of the nut 33 and to support the screw 31. A pin 35 in one of the lugs 34 engages in a groove in the screw 31 and holds the latter from rotation. By rotating the screw rod 25, independently of the screw 31 the nut 26 will be tightened or loosened for the purpose of clamping or releasing the rubber piston 22 between the blocks 23 and 24. The rubber piston will be expanded to provide a tight joint between the cover and the box and when released will be free for adjustment to take care of different widths of paper. This adjustment as to width is made by turning the nut 33 which, obviously, narrows or widens the suction area between the pistons at opposite ends of the suction box.

It will be apparent from the foregoing that my invention consists essentially in constructing a suction box of an iron or steel alloy or any ferrous alloy having a comparatively high chromium content, as for example, 5% or more, or in any thin-section material having a modulus of elasticity of not less than 25 million pounds per square inch and being corrosion resistive to liquids used in paper making machines. Among the advantages of my invention are that a smaller cross-section of metal may be used in making a suction box; that the suction box is lighter in weight and can be easily and readily removed by the average machine crew for refinishing and replacement of the cover, as well as being easier to shake if shaker mechanism is employed; that the cost of manufacture is reduced because of the lesser amount of material used, its cost, and the method of manufacture made possible by the use of sheet metal; that the suction box is stainless, non-corrosive and electro-negative, and consequently not subject to the deteriorating effects of the liquids used in paper mills; and that the suction box is superior to prior constructions because it has a much greater modulus of elasticity, tensile strength and yield point. My invention provides, therefore, a suction box of greater stiffness, rigidity, and strength with smaller cross-section of metal and lesser weight. This suction box will function better than prior types in respect to supporting and maintaining its cover in position against the wire and the forces thereof which tend to cause sagging, deflection, and vibration.

I claim:

1. A suction box for a paper making machine having a top and a bottom channel section the former of which is nested within the latter and the sides of which are united as by welding, said sides being laterally flexible, a perforated cover interposed between said sides, and means for clamping said cover between said sides.

2. A suction box for a paper making machine having a bottom and a top channel section, the former of which is nested within the latter and serves to divide the box into a top and a bottom chamber, a perforated cover located in the top chamber, and means for clamping the sides of the box to the cover.

3. A suction box for a paper making machine having a sheet metal bottom part the sides of which are turned upwardly, a horizontal partition between said sides, a perforated cover interposed between said sides above the partition, and bolts through the sides beneath the cover for clamping said sides to the cover.

4. A suction box for paper making machines fabricated of comparatively thin-wall sheet material composed of an alloy including chromium, said material having a high modulus of elasticity and being corrosion resistive to liquids used in these machines.

5. A suction box for paper making machines fabricated of thin-section metal having a modulus of elasticity of not less than 25 million pounds per square inch and being corrosion resistive to the liquids used in these machines.

6. A suction box for paper making machines fabricated of thin-section chromium content ferrous metal having a modulus of elasticity of not less than 25 million pounds per square inch and being corrosion resistive to the liquids used in these machines.

7. In a paper making machine, a suction box of thin section stainless steel.

8. A suction box for a paper making machine having flexible longitudinal side walls,

a cover interposed between and fitting against said walls, and means for clamping said walls to the interposed cover comprising a series of bolts extending through and between the side walls.

In witness of the foregoing I affix my signature.

EARL E. BERRY.