March 17, 1959 G. J. THIESSEN 2,877,694

ATMOSPHERIC SUCTION ROLL SILENCER DEVICE

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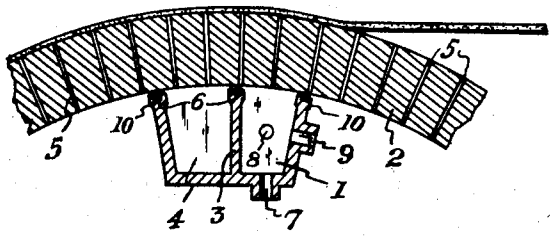


FIG. 1

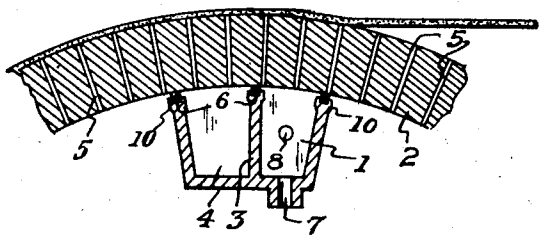


FIG. 2

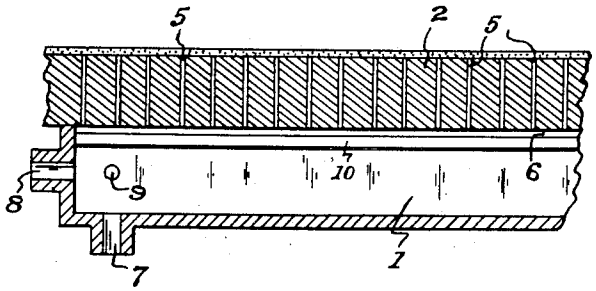


FIG. 3

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ATMOSPHERIC SUCTION ROLL SILENCER DEVICE

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3 Claims. (Cl. 92—53)

The present invention relates to an atmospheric silencer device for suction rolls and in particular to an atmospheric silencer device for the "couch" used in paper machines.

In the manufacture of paper, one of the problems is the removal of the water in which the stock is carried to the machine. It is customary to do this by the passage of the stock, supported on a screen, over vacuum or suction boxes. Some of these boxes are on the inside of rotating drums the low pressure being transmitted to the stock or paper by perforations in the drum surface. As these holes enter or leave the vacuum box air will suddenly flow out of, or into, these holes in the drum surface. This action is similar to that in a siren and results in the high pitch scream which is so characteristic of paper machines and which is usually referred to as "couch noise." The "couch drum" is, however, not the only one making this noise since any suction roll will behave in the same way.

Because of the large amount of air flowing, and the length of the drum which is about 20 feet, the noise intensity is very high. Sound levels of 110 to 120 decibels are quite common (depending on the speed of the machine) in the areas near the machine commonly occupied by machine operators. Besides the extreme annoyance caused by such noise, communication is made very difficult and what is even more important damage is caused to the operators' hearing.

Attempts have been made in the past to reduce the noise to a level and intensity not detrimental to the machine operators. One such attempt is disclosed in United States Patent No. 2,274,641 to E. J. Abbott and J. D. Krause which consists of a solid wedge attached to the leaving edge of the suction or vacuum box, the upper surface of the silencer device having a radius of curvature approximately equal to that of the inside surface of the couch roll but not concentric with it. The surface of the wedge is nearly in contact at the leaving edge of the sealing strip of the vacuum box, the gap between the upper surface of the wedge and the surface of the couch roll increasing with the distance from the leaving edge.

In the operation of the silencer device above described, it appears that the gap adjustment changes with the wear of the silencer. Since the size of the gap is critical, the silencer is out of commission after a relatively short period of use. A second noted disadvantage of the known silencer above described is that the gap is prone to become plugged with the pulp or paper being processed by the couch roll. Unless, therefore, arrangements are made periodically to clean the gap, the silencer ceases operating after a period of time of the order of days.

Another attempt to provide a silencer device for a suction roll is disclosed in United States Patent No. 2,107,812 to Berry et al. The solution provided in this patent specification is to attach to the suction box an enclosure having an open top and the bottom wall provided with an opening the full length of the chamber. In this suggested device the sound emitted from the suction holes is muffled before it is permitted to leave the enclosure, either by leading the sound through a layer of packing material or by leading it through a water seal.

According to the present invention there is provided a silencer device suitable for use with apparatus of the type including a rotated suction roll having radially extending holes, a stationary suction box co-operating with the inner periphery of the roll as the roll is rotated, and means for transferring the formed web from the suction roll in such manner that the web remains in contact with the roll during a portion of its travel after leaving the suction box. Paper making machinery of this type is illustrated for example in United States Patent 2,714,342, granted August 2, 1955, to Edward D. Beachler.

It is one object of the present invention to provide a silencer device of very simple construction and one which can be adapted to operate substantially without interruption or disturbance.

It is a further object of the present invention to bring the noise emitted as a result of the air entering the holes in the couch roll or drum to a level not detrimental to the operator's health and to the safe operation of the couch rolls.

It is a further object of the invention to effect the silencing by preventing the source of sound from radiating in its preferred direction while at the same time allowing the sound free access to the outside. It is another object of the invention to render the source of sound inefficient.

Having regard to these and other objects the present invention will be appreciated by a study of the following specification in conjunction with the accompanying drawings.

In the drawings:

Figure 1 is a vertical sectional view of one embodiment of the silencer device of the present invention having three openings at each end of the chamber,

Figure 2 is a vertical sectional view of another embodiment of the present invention in which there are two openings provided at each end of the chamber, and

Figure 3 is a transverse cross sectional view of the device illustrated in Figure 1.

Referring in more details to the drawings, the silencer device of the invention comprises a chamber 1 extending substantially the length of the suction roll 2 and arranged next to the leaving edge 3 of the suction box 4. The suction roll 2 has radial holes 5 arranged along the roll, the holes being spaced at desired intervals and extending across most of the surface of the roll 2. The suction box 4 as well as the chamber 1 are held as close as possible against the underside of the suction roll 2, sealing strips 6 being provided at the top of both the suction box 4 and the chamber 1 to ensure the co-operation with the suction roll 2. The sealing strips 6 are shown in Figure 1 to be mounted in extensions 10 of the side walls of both chamber 1 and suction box 4. The suction box 4 is provided with a wide opening from which suction is applied through the radial holes 5 to the material, such as paper, pulp or the like travelling over the outer surface of the suction roll 2. The chamber 1 is wide open at the top from which air is supplied to the radial holes 5 to replace the air evacuated from the suction box 4. One or more openings 7 are provided at each end of the chamber 1 for supply of air into the radial holes 5. Three openings are shown in Figure 1 at each end of the chamber 1, the opening 7 being provided in the bottom wall of the chamber, the opening 8 in the front wall of the chamber and the opening 9 in the leaving wall of the chamber 1.

Figure 2 shows another embodiment of the device of the present invention in which only two openings are

provided at each end of the chamber 1. In the embodiment according to this figure the openings 7 and 8 are provided in the bottom wall and in the front wall respectively of chamber 1.

Figure 3 is a cross-sectional view made along the length of chamber 1 of Figure 1. Three openings at each end of chamber 1 are provided, the openings being the openings 7 in the bottom wall of the chamber, the openings 8 in the front wall of the chamber and the openings 9 in the leaving wall of the chamber. The openings 7 are placed at a large distance from one another, the distance being substantially the length of the chamber 1. The tight fit between the chamber 1 and the suction roll 2 is ensured by a sealing strip (not shown).

The silencer device of the present invention is made on the principle of modifying the conditions of operation of a source of sound in order to decrease the efficiency of the source as a noise producer. It has been found that a simple modification of the conditions under which the source of sound is made to operate produces a much more effective silencer than the isolation of the source, for example by enclosing the source of sound as described in United States Patent No. 2,107,812 to Berry et al. herebefore mentioned.

When one opening is provided at each end of the chamber, while the central portion of the chamber is imperforate, the source of sound is forced to radiate in the direction of its length and will do so very inefficiently. In this way the intensity of the sound is very considerably reduced, the extent of the reduction in the intensity being essentially governed by the extent to which the source of sound has been rendered inefficient by changing the direction of the sound emitted. Since the line source prefers to radiate in a plane which is at right-angles to the line of the source, the intensity of the radiation along the line is very considerably lower than the intensity of its radiation in a direction at right-angles to the line. This effect is more pronounced the longer the line of the source and the higher the frequency of the sound emitted.

The degree to which the source of sound has been rendered inefficient in accordance with the present invention will depend on the degree to which the direction of the sound has been changed. If the width of the chamber is smaller than the wave length of the sound emitted from the holes of the suction roll, the openings placed at each end of the chamber should be as far apart as possible and the distance between them, for efficient operation, should be at least equal to, or preferably exceed, the maximum wave length expected of the sound emitted from the holes. A figure of 60 inches is found to be convenient in practice. If the chamber is wide and its width is equal to, or greater than, the maximum wave length expected of the sound emitted from the holes, the distance between the two openings at each end of the chamber should be in considerable excess of the maximum wave length of the sound emitted from the holes, for example three times the wave length.

The following numerical examples will illustrate the manner in which the distance between the two openings at each end of the chamber is calculated for efficient operation.

The wave length is calculated in accordance with the formula

$$\lambda = \frac{c}{f}$$

in which λ is the wave length, c is the velocity of sound and f is the frequency. Assuming a frequency of 1000 cycles per second and a velocity of sound of 13,000 inches per second, the wave length will be equal to 13 inches. If the width of the chamber is of the order of three inches, the air inlets or openings at each end of the chamber should be placed at a distance exceeding 13 inches, the distance being for example of the order of 30 inches. For

a chamber approximately 13 inches wide or more, the distance between the openings at each end of the chamber should be considerably in excess of the wave length of 13 inches in this example. The distance in the latter case should be at least three times the wave length, for example 100 inches. It will be noted that the frequency depends on the speed with which the suction roll rotates, the frequency decreasing with a decrease in the speed of rotation. Accordingly, the distance between the two openings at each end of the chamber is calculated with reference to the lowest frequency at the lowest speed at which the suction roll is expected to operate.

The silencer device of the present invention substantially diminishes any danger of clogging in the operation of the suction roll. It is of very simple construction and, if desired, a vacuum box suitably perforated may be used to form the chamber used in the present invention. The silencer device of the present invention permits very effectively to suppress or substantially reduce the noise emitted by suction rolls, in particular couch rolls used in paper machines, substantially without interruption or disturbance. It is thus of considerable advantage both to the health of the operators and to the efficient operation of the suction roll. The chamber does not wear out in operation and this permits the use of the present device without any necessity for adjustment.

It is intended that the present disclosure should not be construed in any limiting sense other than that indicated by the scope of the following claims.

What I claim as my invention is:

1. A silencer device for apparatus of the type including a rotated suction roll having radially extending holes and a stationary suction box co-operating with the inner periphery of the roll as the roll is rotated comprising means defining a chamber extending substantially the length of the roll and arranged next to the leaving edge of the suction box, and sealing strips between said suction box and the inner periphery of said roll and between said chamber and the inner periphery of said roll, said chamber having adjacent the inner periphery of the roll an opening extending substantially the length of the roll and adapted to place the chamber in communication with said holes in succession as the roll rotates, the bottom and side walls of said chamber being imperforate over the central portion of the chamber but having at least one opening outward of said imperforate central portion of said chamber for supply of air to said chamber and to said holes, the width of said chamber being smaller than the maximum wave length of the sound emitted from said holes, and the length of said imperforate central portion being at least equal to said maximum wave length.

2. A silencer device for apparatus of the type including a rotated suction roll having radially extending holes and a stationary suction box co-operating with the inner periphery of the roll as the roll is rotated comprising means defining a chamber extending substantially the length of the roll and arranged next to the leaving edge of the suction box, and sealing strips between said suction box and the inner periphery of said roll and between said chamber and the inner periphery of said roll, said chamber having adjacent the inner periphery of the roll an opening extending substantially the length of the roll and adapted to place the chamber in communication with said holes in succession as the roll rotates, the bottom and side walls of said chamber being imperforate over the central portion of the chamber but having at least one opening outward of said imperforate central portion of said chamber for supply of air to said chamber and to said holes, the width of said chamber being at least equal to the wave length of the sound emitted from said holes, and the length of said imperforate central portion being in considerable excess of said maximum wave length.

3. A silencer device as claimed in claim 2 in which the length of said imperforate central portion is greater than three times the said wave length.

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