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R. J. MANN ETAL

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APPARATUS FOR TREATMENT OF TEXTILE MATERIALS

Filed Nov. 7, 1957

2 Sheets-Sheet 1

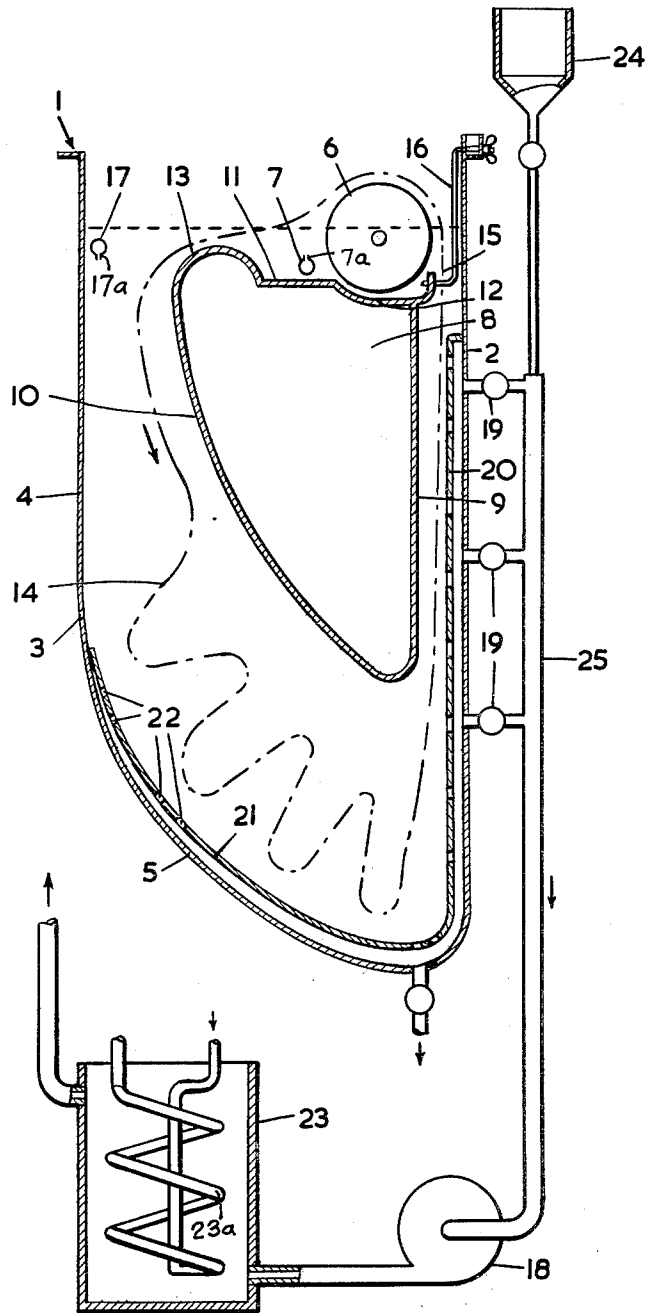


FIG. 1

INVENTORS  
RALPH JAMES MANN &  
ROBERT WILLIAM NOON

BY

ATTORNEYS

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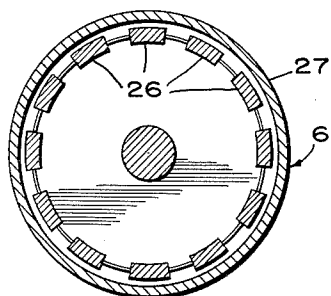


FIG. 3

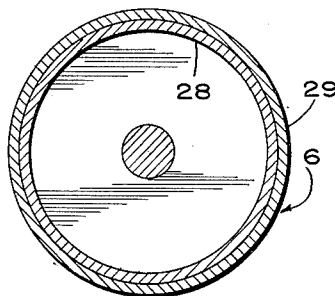


FIG. 4

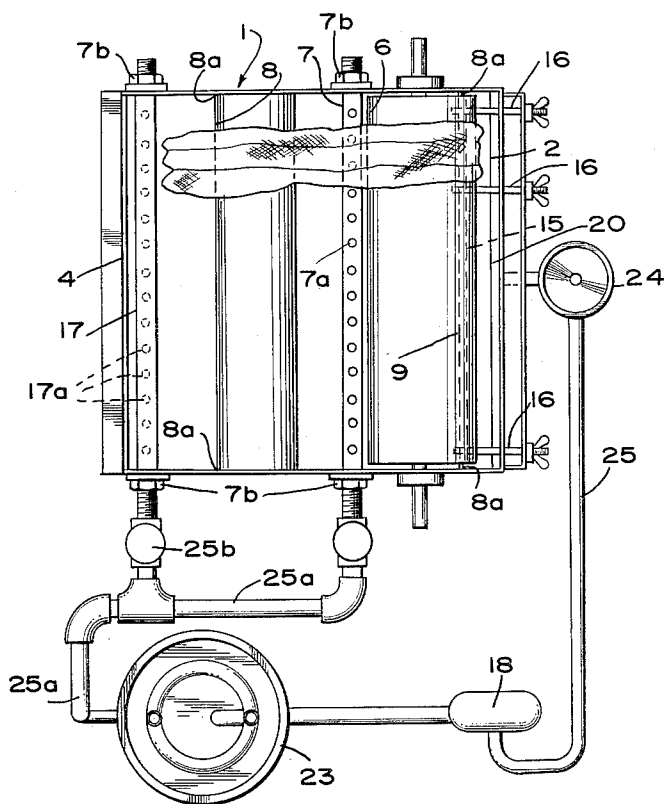


FIG. 2

INVENTORS

RALPH JAMES MANN &  
ROBERT WILLIAM NOON

BY

*Felix Klass + Abram Sheffer*  
ATTORNEYS

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## APPARATUS FOR THE TREATMENT OF TEXTILE MATERIALS

Ralph James Mann, Spondon, near Derby, England, and Robert William Noon, Whitchurch, Glamorgan, Wales, assignors to British Celanese Limited, a corporation of Great Britain

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3 Claims. (Cl. 68—177)

This invention relates to apparatus for the liquid treatment of textile fabrics in long lengths, particularly long lengths of rigid knitted fabrics and woven fabrics.

It is frequently necessary, at one or more stages in the processing of textile fabrics, to subject long lengths of such fabrics to the action of a dyeing or other treatment liquid and there are many machines designed for such a purpose. The dye-winch is one example of such a machine and, as is well known, the textile fabric in the form of a continuous length is caused to travel through a bath of the liquid, contained in a "bark," by means of a horizontal propelling winch roller disposed above the surface of the liquid therein and over which the fabric passes. In essence the action of the winch roller is to lift the fabric out of the liquid at one point in the bark and return it at another point in the bark so that it may descend in the latter and travel back to a point where it may again be lifted by the winch roller. Generally, at any one moment most of the fabric is within the liquid as a series of folds which move slowly through the liquid to the point at which the fabric is again drawn out by the action of the winch roller. Usually the fabric is bunched transversely to form a "rope" and several such ropes may be processed side-by-side simultaneously. Often the several ropes are formed of an endless length of fabric, the latter then moving through in spiral form from one side of the bark to the other from whence it is returned directly to the starting side.

In the earlier forms of dye-winch the ratio of the length-to-depth of the bark was generally around 1:1. By "length" is meant the horizontal dimension in a direction at right angles to the axis of the winch roller. However, in the case of cellulose acetate fabrics, the combined effect of the low density of cellulose acetate and entrapped air tends to cause the fabric to float near the surface of the liquid so that the lower part of the bark is not effectively utilized. Accordingly winches for processing such fabrics commonly have a length-to-depth ratio greatly in excess of 1:1 e.g. 3:1 to 5:1 or more. In such winch machines the ropes of fabric are commonly drawn upwardly out of the liquid and over a "fly roller" or other form of guide near the front of the bark by the winch roller which is disposed above the back of the bark. While such winch machines are satisfactory for the processing of most types of knitted fabrics they are much less satisfactory for rigid knitted fabrics and for most types of woven fabric. The tension necessary in that part of the rope out of the liquid to ensure satisfactory propulsion by the winch roller without slipping leads to the formation of creases which do not subsequently disappear and so show in the finished fabric both as such and/or as differentially dyed streaks. To achieve the tension necessary for satisfactory non-slipping propulsion the winch roller is normally considerably above the liquid level. If, to diminish tendency to creasing, the tension is reduced, as by lowering the winch roller, there is risk of slipping and formation of glaze marks.

We have now devised a machine which, while utilising a winch roller, overcomes many of the disadvantages of existing winch machines and in particular is suitable for processing a wide range of cellulose acetate fabrics, in-

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cluding rigid knitted fabrics and a wide range of woven fabrics. In our new machine the winch roller is partly submerged in the liquid in the bark (and may be wholly submerged) and means are provided for creating a flow of liquid in the bark to assist the movement of the fabric and in particular a flow tending to carry the fabric away from the winch roller in a direction lengthwise of the bark.

In the new machine satisfactory propulsion of the fabric can be achieved under relatively low fabric tension (so greatly reducing creasing). Further, the fabric need not leave the winch roller while entirely out of the liquid and indeed may remain entirely submerged; entrapment of air is therefore minimised or entirely avoided so that the fabric sinks readily even when its substance is of low density as in the case of cellulose acetate; this in turn permits a relatively deep bark to be employed to advantage.

According to the present invention, an apparatus suitable for the liquid treatment of textile fabrics in rope form comprises a bark to contain the treatment liquid, a substantially circular winch roller positioned to be at least partly submerged in the liquid in the bark, said roller being adapted on rotation to lift the rope of fabric at one point of the bark and deliver it to descend at another point of the bark, and means for creating a flow of liquid in the bark to assist the travel of the fabric there-through and particularly to ensure separation of the fabric from the winch roller.

The depth-to-length ratio of the liquid-containing zone of the bark may be of the order of 1:1 or greater, for example 1.5:1 or 2:1 or more. The back and side walls may be vertical. The front wall may be vertical or it may be inclined inwardly from top to bottom or the upper part may be vertical and the lower part inclined inwardly; preferably however the upper part is vertical and the lower part curved inwardly and continued as the bottom of the bark. Thus the bark may have a substantially rectangular horizontal cross-section.

As already indicated the winch roller is at least partly submerged. It may be disposed so that its axis of rotation is at about the liquid level or somewhat above this level or below this level. Preferably the axis of the winch roller is well below the liquid level. Thus it may be below the liquid level by a distance of at least one quarter of the diameter of the winch roller, for example at least one half of the diameter or even more in which circumstances the winch roller will be completely submerged. It is advantageously placed towards the back of the bark so that it may lift the rope of fabric up the rear part of the bark in a generally vertical direction from a point near the back of the bark. The winch roller may be of the conventional circular type but should have a closed surface, i.e. one which does not permit substantial flow of liquid through it, in order that the means for creating a flow of liquid in the bark to assist the travel of the fabric through the bark and particularly to deflect the fabric away from the winch roller may act efficiently. Thus its surface may be formed of a series of slats, preferably 8, 12 or more, parallel with its axis and covered with a layer of textile fabric. The winch roller may also take the form of a metal cylinder which may be covered with a layer of textile fabric to give sufficient grip on the fabric undergoing treatment.

As stated, the apparatus includes means for creating a flow of liquid in the bark to assist the fabric in its travel therethrough and especially to ensure separation of the fabric from the winch roller. The flow of liquid may be conveniently created by injecting liquid into the bark by means of a submerged feed pipe extending horizontally across substantially the whole width of the bark and provided with an orifice (e.g. a longitudinal narrow

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slot) or a series of orifices for emission of liquid; such a device is hereinafter referred to as a "jet pipe." The liquid is pumped into the bark through the jet pipe, and is preferably withdrawn from the bark at a point remote from the jet pipe and pumped back to the jet pipe to complete the circuit. The preferred position of this jet pipe is below the liquid level close to and slightly to the side of or below the winch roller; the pipe is advantageously disposed so as to deliver liquid in an upwards direction towards the textile material on the delivery side of the winch roller and so ensure the orderly separation of the fabric from the winch roller and prevent the fabric from adhering to the roller and folding up underneath it. The jet pipe is advantageously made angularly adjustable about its longitudinal axis so that the direction of liquid emerging therefrom may be adjusted to that which is found to be most efficient. Thus the jet pipe may be arranged so that the liquid is emitted from it in a direction which is backwards or forwards as well as upwards. Even if the liquid is delivered in a direction mainly upwards, or backwards or forwards as well as upwards, it tends to be deflected by the winch roller in a forward direction ultimately so providing a movement of the surface liquid from back to front of the bark.

The winch machine of our invention may include various other features contributing to effective and convenient operation.

(1) Baffles may be provided within the liquid space to assist in keeping the fabric in the desired course within the bark. Thus a generally horizontal baffle may be provided in the upper part of the bark to direct the fabric and the liquid from the jet pipe towards the front of the bark. Such baffle advantageously extends forwards from a point near the surface of the winch roller and may extend beneath the latter. Again a generally vertical baffle may be present beneath the winch roller to define, in conjunction with the rear of the bark, a channel for the upward passage of the fabric from the lower part of the bark. A second descending baffle may be provided towards the front of the bark to define, in conjunction with the front of the bark, a channel for the downward passage of the fabric. Very advantageously the two descending baffles are united at their lower ends, as by curving the front descending baffle backwards to meet the rear baffle, so that the assembly of baffles forms, in conjunction with the walls of the bark, a continuous channel through which the fabric is conveyed by the action of the winch roller and the flow of liquid; the space within the baffles is preferably sealed against ingress of liquid from the bark.

(2) More particularly when a baffle assembly defining a closed path for the fabric as described above is employed, it is advantageous to provide an alternative if restricted conduit for liquid, inaccessible to a fabric undergoing processing but permitting movement of liquid from a point near the front lower portion of the bark to the rear of the bark. In the case of a bark having a curved bottom as hereinbefore indicated, such a conduit may be one defined by the curved bottom of the bark and an inner partition or false bottom following the general course of the bottom of the bark but spaced inwardly away therefrom. Holes in the partition, for example a horizontal row or rows of holes at a suitable point or points, serve to allow liquid to pass into the conduit and emerge at the back and bottom of the bark. A relief conduit of the foregoing character serves, apparently by relieving liquid pressure on the folds of fabric descending the front part of the bark, to reduce or prevent unduly tight packing of the fabric in the lower part of the bark.

(3) A second jet pipe extending horizontally across the width of the bark at about but preferably just below the liquid level, said jet pipe being arranged to direct liquid vertically downward near the front of the bark. This jet pipe may be used to assist the circulation of the

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liquid during processing but is particularly useful when loading the machine with fabric fed, as is convenient, vertically downwards into the bark from a fabric feed device above. The second jet pipe may be fed with liquid drawn from the rear portion of the bark, e.g. by the same pump as feeds the first mentioned jet pipe near the winch roller.

(4) Heating means for the liquid in the bark. This may take the form of a closed steam coil or the like arranged to supply heat to the liquid supplied to the jet pipe or pipes by the pump.

(5) A vertical perforated screen close to the rear wall of the bark from behind which the pump may withdraw liquid to be fed to the jet pipe or pipes.

(6) Guide pegs for preventing entanglement of adjacent ropes of fabric.

(7) A "dye-box," which may be of conventional type, via which additions to the liquid may be made. This may comprise a trough along the upper part of the front wall of the bark and communicating with the latter by a series of perforations in said front wall. Instead of a conventional dye-box, means may be provided for feeding dyes or other treatment agents, in liquid form, into the suction side of the pump system. Such means may comprise a receptacle at a level above the level of the liquid in the bark having an outlet conduit communicating with the suction side of the pump system. By such means the dyes or other treatment agents may be thoroughly mixed with the circulating liquid and spread over the width of the bark via the jet pipe or pipes.

One form of apparatus in accordance with the present invention is shown by way of example in the accompanying drawings and will now be more specifically described with reference to the drawings in which:

FIG. 1 is a sectional side elevation of the apparatus. FIG. 2 is a plan view.

FIG. 3 is a sectional view of one form of winch roller. FIG. 4 is a sectional view of another form of winch roller.

The apparatus comprises a bark, generally indicated at 1, of the form hereinbefore indicated, namely, one having a generally vertical back 2 and side walls and a front wall 3 of which the upper part 4 is vertical while the lower part 5 is curved backwardly and continued as the bottom of the bark. It may have a length of 3 to 4 feet and a depth-to-length ratio of 1.5:1 to 2:1. Near the back 2 of the bark 1 there is disposed a rotatable circular winch roller 6 having its axis at or below liquid level and preferably well below the liquid level. As shown in FIG. 3, the roller 6 may comprise a series of slats 26 parallel with its axis covered with a layer of fabric 27. Again as shown in FIG. 4 the roller 6 may take the form of a metal cylinder 28 covered with a layer of fabric 29. It is convenient to mount the roller 6 in such a position that the highest point of the surface of the roller 6 is approximately on a level with or below the top of the bark 1. Extending along substantially the whole width of the bark 1 and in a direction parallel with the axis of the roller 6 is a jet pipe 7, having jet holes 7a, which is positioned below the liquid level, close to the front of the roller 6 and which, being rotatably adjustable about its longitudinal axis by adjusting means such as nuts 76 operatively associated with threaded ends of pipes 7 and 17 to lock said pipes in position at any point in the rotation of said pipes, can be adapted to direct liquid in an upward direction.

Within the bark 1 is a baffle assembly, generally indicated at 8, comprising a more or less vertical rear portion 9, a curved portion 10 forming the front and bottom, and a generally horizontal top portion 11. The rear part 12 of the latter follows fairly closely the contour of the lower front part of the winch roller 6 while the front portion 13 is turned up and then curved forwardly, finally continuing as the front portion 10 of the baffle assembly 8. The front portion 13 of the top 11 of the baffle assembly

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bly 8 thus constitutes a submerged raised portion or ramp over which the fabric 14, forwarded by the action of the winch roller 6 and jet pipe 7, passes before descending the front of the bark 1. The baffle assembly 8 extends across the width of the bark 1 and is joined in liquid-tight manner to the side walls of the latter as at 8a.

The rearward end 12 of the top 11 of the baffle assembly 8 may be provided with an upwardly extending plate 15. This may have holes or slots in it to support or position the ends of a series of guide pegs 16 for keeping separate the ropes of fabric 14 (of which one is shown in FIG. 2) undergoing processing. Near the front of the bark and extending across the bark is a second jet pipe 17, preferably just below the liquid level, adapted to direct liquid down the front portion of the bark from a series of holes 17a. A pump 18 is provided to feed the jet pipes 7 and 17, by way of pipes 25a and valves 25b, with liquid drawn from by way of a pipe 25 a point or points 19 at the back 2 of the bark 1 and preferably from behind a vertical perforated screen 20 within but close to the back 2 of the bark.

Within the lower curved portion of the bark is a false bottom 21, having holes 22 in its upper portion, and forming, with the bottom 5 of the bark 1 a conduit permitting liquid to pass via the holes 22 to the rear of the bark. The lower end of the false bottom 21 may turn upwards and continue as the aforementioned vertical perforated screen 20 from behind which liquid may be drawn by the pump 18. Heating of the liquid in the bark may be effected by an indirect steam heater 23, containing a steam heating coil 23a, disposed in the liquid line between the pump 18 outlet and the jet pipes 7 and 17. Dyes or other treatment agents may be added to the liquid in the bark by means of the receptacle 24 and the pipe 25 leading to the suction side of the pump 18.

The bark of a winch machine of the foregoing kind may have a length (from back to front) of 3 to 4 feet and a depth (from the axis of the winch roller) of 5 to 6 feet; the bark may be of any convenient width depending on the number of ropes of fabric it is desired to accommodate therein.

If desired the bark may be provided with a cover and may be lagged to reduce heat losses.

The operation of the dye-winch will be apparent from the foregoing description. The length of fabric to be treated is propelled forwards by the winch roller and is effectively disengaged therefrom by the current of liquid issuing from the rearward jet pipe and directed upon the lower surface of the fabric. The fabric is then carried by the liquid towards the front of the bark down which it descends assuming a plaited configuration near the lower curved surface of the bark. It then passes rearwardly and finally rises up between the back of the bark or the aforementioned vertical perforated screen and the baffle assembly and then between the guide pegs. After passing between the guide pegs the fabric is picked up by the winch roller to repeat the cycle of operation.

The loading of the machine with a length of fabric is conveniently effected by feeding the fabric downwardly into the bark at a point between the middle and the front of the bark, e.g. at about the position of the ramp on the upper part of the baffle assembly. During the feeding the forward jet pipe is kept in action to create a current of liquid down the front of the bark and up the back.

As already indicated, winch machines in accordance with the invention may satisfactorily be used to dye or otherwise process a much wide range of fabrics than conventional winch machines. Thus they may be used to dye rigid knitted fabrics and many types of woven fabrics of cellulose acetate without imparting creases which are permanent or difficult to remove. When the apparatus is employed in the treatment of textile fabrics which in general sink readily in the treatment liquid, for example fabrics containing a substantial proportion of cellulose or cellulose acetate fabrics of a heavy construction, the

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winch may be completely submerged in the treatment liquid. For this to be possible, it is desirable that the winch roller should be mounted in such a position that the highest point of the surface of the roller during rotation thereof is somewhat below the top of the bark. Further, since the extent to which the fabric and liquid are exposed to the air may be very small it is possible to use our new machines for dyeing textiles with vat dyes which is not the case with conventional winch machines. Again, for the same reason heat losses may be made very small and temperatures approaching the boil more easily and economically attained.

Having described our invention, what we desire to secure by Letters Patent is:

1. An apparatus suitable for the liquid treatment of textile fabrics in rope form, which comprises a bark to contain the treatment liquid, said bark including back, front and side walls and being of substantially rectangular horizontal cross-section, a winch roller positioned near the back of the bark so as to be at least partly submerged in the liquid in the bark and adapted on rotation to lift the rope of fabric up the rear part of the bark, said roller being of substantially circular form and substantially impermeable to flow of liquid through its surface, means below the liquid level and near the front face of the winch roller for injecting liquid in a generally upward direction to ensure separation of the fabric from the roller, and a baffle assembly within the bark comprising a generally horizontal first portion across the width of the bark extending forwardly from a point near the winch roller to a point short of the front of the bark, a second portion descending substantially vertically from the rearward end of the first portion, and a third portion descending from the front end of the first portion and curving backwardly to meet the lower end of the second portion.

2. Apparatus according to claim 1, wherein said means for injecting liquid into the bark comprises a submerged jet pipe extending horizontally across substantially the whole width of the bark and provided with orifices for emission of liquid.

3. Apparatus according to claim 1, wherein the space within the baffle assembly is sealed against ingress of liquid from the bark.

4. Apparatus according to claim 1, wherein the bark becomes progressively deeper from front to back.

5. Apparatus according to claim 3, including a conduit connecting the front lower portion of the bark to the rear of the bark.

6. Apparatus according to claim 1, including a pump having its suction side connected to the rear portion of the bark and its delivery side connected to the liquid injection means.

7. Apparatus according to claim 6, wherein the delivery line includes a heater for heating passing liquid.

8. An apparatus suitable for the liquid treatment of textile fabrics in rope form, which comprises a bark to contain the treatment liquid, said bark being of substantially rectangular horizontal cross section and becoming progressively deeper from front to back, a winch roller positioned near the back of the bark so as to be at least partly submerged in the liquid in the bark and adapted on rotation to lift the rope of fabric up the rear part of the bark and deliver it to a point nearer the front of the bark, said roller being of substantially circular form and substantially impermeable to flow of liquid through its surface, a submerged jet pipe angularly adjustable about its longitudinal axis and provided with orifices for emission of liquid, said jet pipe extending horizontally across substantially the whole width of the bark below the liquid level in a position close to the delivery side of the winch roller, a baffle assembly comprising a generally horizontally first portion across the width of the bark extending forwardly from a point near the winch roller to a point short of the front of the bark, a second portion descend-

ing substantially vertically from the rearward end of the first portion and a third portion descending from the front end of the first portion and curving backwardly to meet the lower end of the second portion, said baffle assembly being sealed against ingress of liquid from the bark, and a pump connected on its suction side to the rear portion of the bark and on its delivery side to the jet pipe. 5

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