Sept. 21, 1965 B. P. SAX ETAL 3,206,786

BUFFING WHEEL

Filed July 16, 1959 2 Sheets-Sheet 1

Fig. 1.

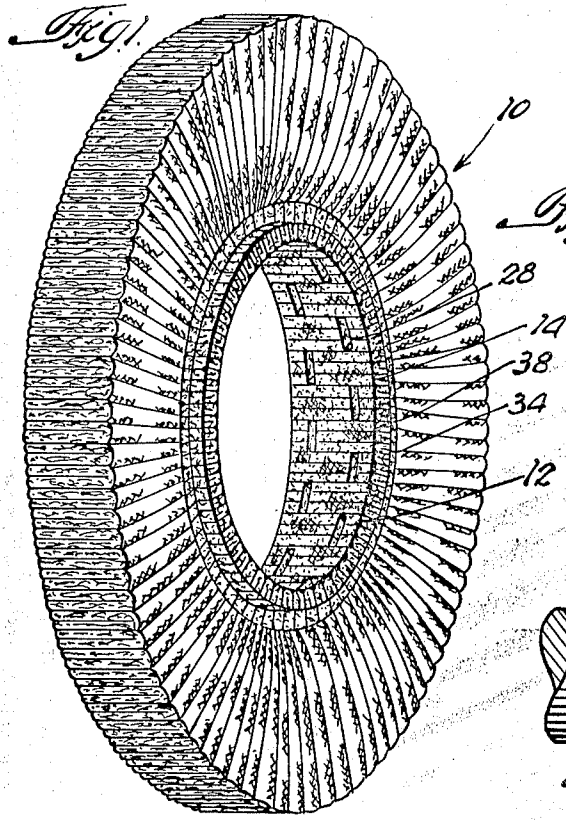


Fig. 3.

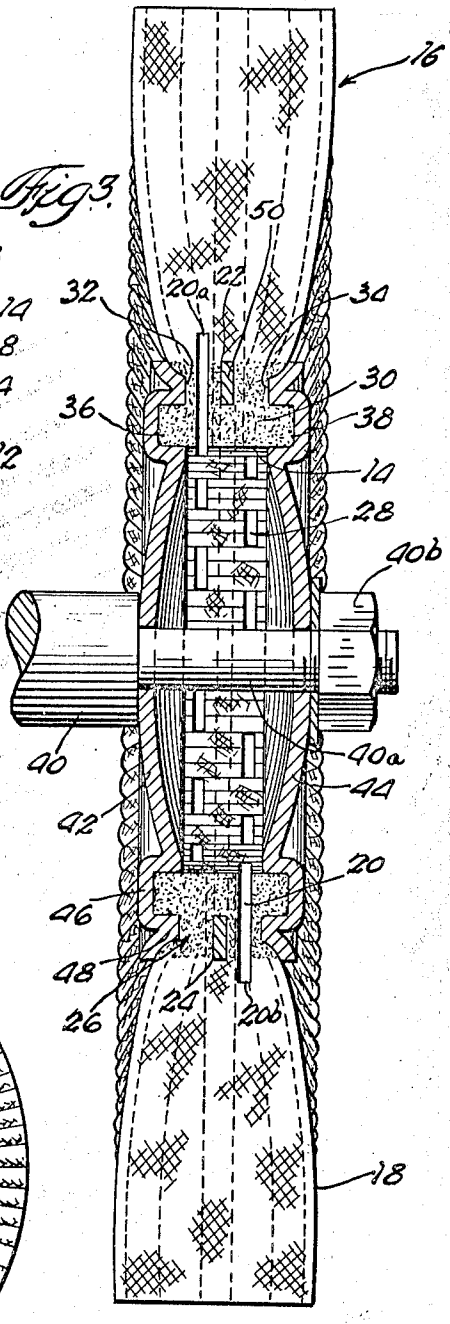
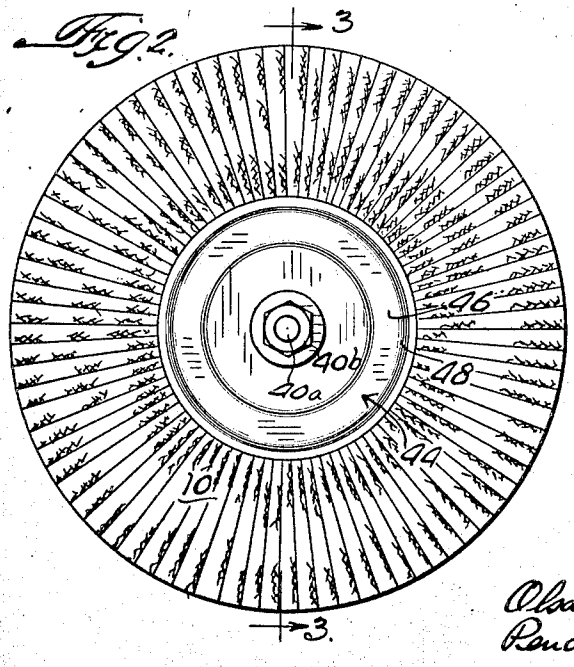


Fig. 2.



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Fig. 6.

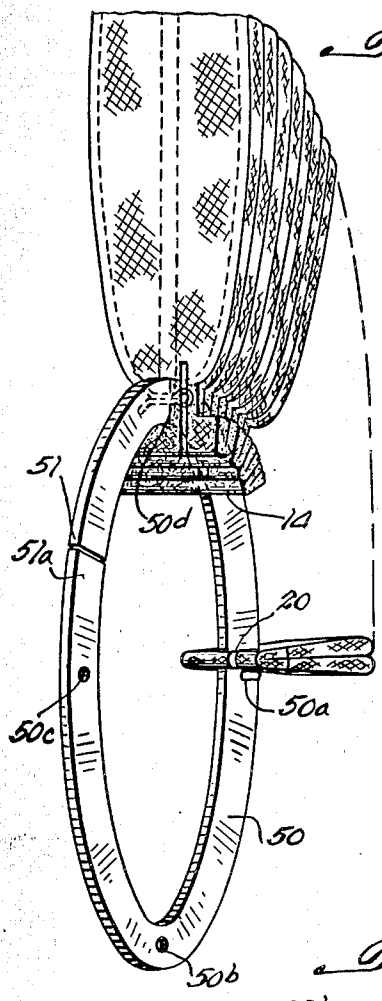


Fig. 4.

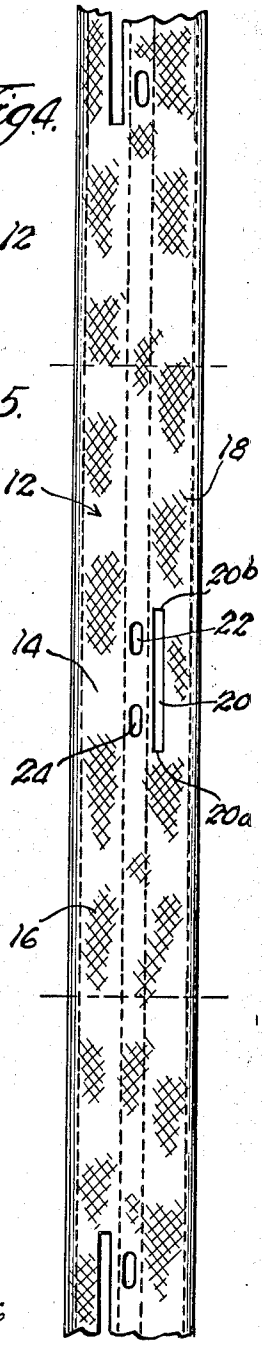


Fig. 5.

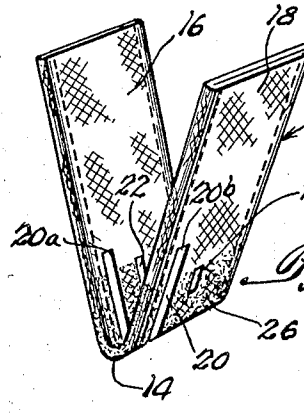


Fig. 7.

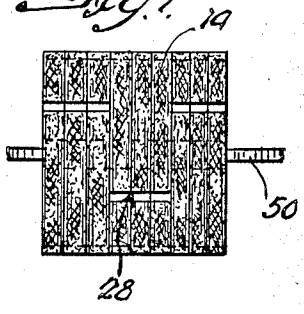
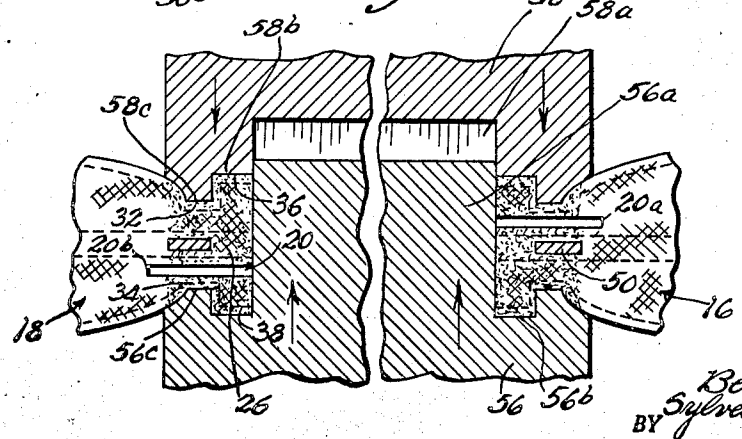


Fig. 8.



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BUFFING WHEEL

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Filed July 16, 1959, Ser. No. 827,612
10 Claims. (Cl. 15—230.1)

This invention relates to buffing wheels having radially extending buffing elements and to an improved method for constructing such buffing wheels.

Buffing wheels employing radially extending work contacting buffing elements have been constructed in many different ways. In most prior designs the buffing elements are connected to a central hub by means of metal clamps, supporting pins, or the like and lie principally in a plane normal to the wheel axis. Quite often the wheel constructions are not adapted to rapid fabrication techniques, and a number of separate parts are often required to maintain the buffing elements in their proper operative position on the wheel. These parts tend to add considerably to both the weight and the cost of the buffing wheel. In addition, since buffing wheels usually rotate at high speeds, the presence of a number of separate parts increases the danger to the operator. Great care must, therefore, be exercised by the manufacturer in securely joining all parts together to insure against subsequent separation of the buffing wheel in use. Moreover, buffing wheels which operate at high speed must be balanced. This is not only difficult when a number of parts are used in the design, but also any buffing wheel employing deformable parts may be easily unbalanced through dropping or other similar abuse tending to alter the shape or position of any of the numerous parts.

It is one important object of this invention to provide an improved fabric buffing wheel which may be prepared as a single integral unit having any predetermined axial length.

It is another object of the invention to provide an improved integral buffing wheel section of substantial axial length having enhanced provisions for ventilation and cooling.

It is still another object of this invention to provide an improved buff of substantial axial length which will greatly reduce the tendency to produce streaks or burns on the work product.

Another object of the invention is the provision of an improved buffing wheel section especially adapted to interlock with similar adjacent sections and with supporting members.

It is another particular object of this invention to provide an exceptionally safe buffing wheel in which all of the parts are securely joined together in a novel manner, which buffing wheel will remain balanced even after it has been subjected to much abuse.

It is another object of this invention to provide a buffing wheel which is light and reliable for producing uniform results over long periods of use.

It is still a further object of this invention to provide a buffing wheel which is exceptionally safe, light in weight, and which employs a minimum number of parts.

It is still another object of this invention to provide an inexpensive buffing wheel which may be easily attached to a rotating mount and which eliminates many of the parts which were heretofore necessary in the construction of buffing wheels.

It is still a further object of this invention to provide a rugged, self-cooling buffing wheel which has a light, integral structure and which has no exposed metal parts.

It is another object of this invention to provide a method for molding a plurality of buffing elements into a buffing wheel.

It is an additional object of this invention to provide a method for forming an integral molded buffing wheel which is self-cooling, safe, light and inexpensive, and which may be easily attached to a rotatable mount.

Other objects may be seen and a fuller understanding of the invention may be had by referring to the following description and claims taken in conjunction with the accompanying drawings.

The buffing wheel constructed in accordance with one embodiment of this invention comprises a plurality of flat, elongate, flexible webs, each web transversely folded about a central bight to form two substantially coextensive buffing elements. Each of the webs has an elongate, longitudinally disposed slot extending across its central bight, and the webs are arranged in contiguous groups in an annulus, with their flat surfaces oriented substantially in radial planes and with the slots in each group of webs being coincident and forming a continuous large ventilating slot. The large ventilating slot in each group of webs is axially staggered with respect to the large slots in each of the immediately adjoining groups, and the central bight portions of the webs are juxtaposed and disposed radially inward. The bight portions are assembled on a ring and adhesively interjoined and rigidified with a thermoplastic rubber and synthetic resin to form a hollow, continuous, supporting shell or core through which the large ventilating slots radially extend.

One process by means of which such a buffing wheel may be constructed includes the steps of forming the apertured transversely foldable webs, coating the central bight portions of these webs with the thermoplastic adhesive, drying the webs and then threading them onto a split supporting ring. The webs are thence distributed uniformly about this ring by spacing means to form an annulus with the adhesively coated portions thereof juxtaposed and disposed radially inward and with the flat surfaces thereof oriented substantially in radial planes. Heat and pressure are then applied to the adhesively coated portions of the webs through shaped dies to bond and shape these portions into a strong, integral, annular supporting shell. The buffing wheel thus formed is shaped for easy mounting, has ventilating apertures extending radially through the bonded portion, has a minimum number of parts, and is extremely light in weight.

With reference to the drawings:

FIGURE 1 is a perspective view of a buffing wheel constructed in accordance with this invention;

FIG. 2 is a side elevation view of the buffing wheel fastened to a rotatable mount;

FIG. 3 is a sectional elevation view of the buffing wheel taken substantially along line 3—3 of FIG. 2 and showing means by which the wheel may be fastened to a rotatable mount;

FIG. 4 illustrates the manner in which the buffing wheel may be formed;

FIG. 5 is a perspective view of one of the webs, showing the method of folding the webs transversely along a central bight and showing the orientation of the slots therein;

FIG. 6 illustrates the manner in which the webs may be distributed about the supporting ring in an annulus in the process of constructing a buffing wheel;

FIG. 7 is a view looking radially outward from the center of the wheel being constructed and illustrating the manner in which the large ventilating slots may be formed in the adjoining groups of folded buffing webs; and

FIG. 8 shows a method for applying heat and pressure to the buffing web annulus for fusing and shaping them after they have been adhesively coated and have been properly oriented on the supporting ring.

With more particular reference to the drawings:

Buffing wheel **10** is constructed in accordance with this invention and includes a plurality of flat, elongate, flexible webs **12**. Each web may be made of folded cotton or other conventional buffing fabric, or may be constructed of a combination of materials in accordance with the teaching of United States Patent No. 2,803,096. Each of these webs is transversely folded about a central bight **14** to form two elongate, longitudinally coextensive buffing elements, **16** and **18** (see FIG. 5).

As best illustrated in FIG. 5, each web **12** has an elongate, longitudinally disposed slot **20**, extending across transverse bight **14** into each of the buffing elements **16** and **18**. This slot is disposed toward one side of the web and its ends **20***a* and **20***b* lie equidistance from bight **14** in their respective buffing elements **16** and **18**. Disposed on the longitudinal center line of web **12** in buffing elements **16** and **18**, respectively, are two smaller slots **22** and **24**. These slots are also disposed equidistance from the transverse bight **14** in web **12**, although, as may be seen in FIGS. 5 and 8, the outermost extremities of slot **20**, i.e., ends **20***a* and **20***b*, are disposed farther from bight **14** than are the outermost extremities of smaller slots **22** and **24**. When web **12** is folded about its central bight **14**, both halves of slot **20** will align, as will smaller slots **22** and **24**.

For purposes of this description the central area **26** between approximately the outermost extremities of smaller slots **22** and **24** is termed the bight portion of the web.

As may be seen in FIG. 1, the folded webs **12** are arranged in contiguous groups in an annulus, with the flat surfaces of the webs oriented substantially in radial planes and with the central bight portions **26** of the webs juxtaposed and extending radially inward. It will be noted that the central bight **14** of each of the thus-oriented webs extends axially, i.e., parallel to the axis of the annulus.

As may be seen in FIGS. 1, 3 and 7, the webs **12** are arranged in groups of three in the preferred embodiment, and the slots **20** in each group of webs are coincident and aligned, forming a continuous large slot **28**. The large slot **28** in each group of webs is axially staggered with respect to the large slots in each of the two immediately adjoining groups, i.e., the groups on each side thereof. This staggering of the large slots serves to balance the wheel and serves to more evenly distribute the strength of the webs over the entire buffing wheel. As will be seen, these large slots provide ventilation for the buffing wheel.

The central bight portions **26** of webs **12** are adhesively interjoined to form a relatively rigid, hollow, continuous, supporting shell or core. The adhesive bonding material may be any material having sufficient bonding strength to hold two fabric webs tenaciously together. One satisfactory adhesive is a thermoplastic material having a specific gravity of about 1.18 and comprising pigment reinforced synthetic rubber and synthetic plastic resin. The rubber contains nitrile groups which have good bonding action, and the combination of resin and rubber gives the bond high strength, hardness, elasticity, and impact resistance. The shell thus formed, although substantially more rigid than the outwardly extending portions of webs **12**, has, nevertheless, properties of elasticity and good impact resistance.

As may be seen in FIGS. 2, 6 and 8, the molded shell extends from the bight **14** of each web radially outward to approximately the outer extremities of slots **22** and **24**. Inasmuch as slot **20** extends further outward in buffing elements **16** and **18** than do smaller slots **22** and **24**, this slot extends completely through the molded supporting shell of the buffing wheel, and large slots **28** formed by the alignment of slots **20** in each group of webs thus also extend completely through the molded shell. Large slots **28** permit the passage of air through the shell as the wheel is rotating and thus provide ventilation for the wheel.

As may be seen in FIGS. 1 and 3, annular channels **32** and **34** are formed in the molded shell on each side of the buffing wheel circumjacent the central aperture. Also formed on the molded shell and disposed inwardly from channels **32** and **34** to define the central aperture in the buffing wheel **10** are annular attaching ridges **36** and **38**. Ridges **36** and **38** and surrounding channels **32** and **34** permit the easy attachment of the buffing wheel to a rotating shaft **40**. For this purpose, two centrally apertured hubs **42** and **44** may be provided. These hubs are identical, each having an annular channel **46** for accommodating attaching ridge **36** or **38** on the buffing wheel, and a protruding peripheral portion **48** which is adapted to engage in the corresponding annular channel **32** or **34** on the buffing wheel. A threaded reduced end portion **40***a* on rotatable shaft **40** is adapted to extend through the central apertures in hubs **42** and **44**, and the hubs with the supporting shell of buffing wheel **10** disposed therebetween are axially compressed somewhat and secured to the end of shaft **40** by means of a nut **40***b*.

A novel process is employed to form the buffing wheel previously described. In this process a plurality of flat elongated webs **12** are formed by folding a strip of fabric, or a plurality of fabrics in the manner described in Patent No. 2,803,096. As illustrated in FIG. 4, webs **12** may be cut from a continuous strip with slots **20**, **22** and **24** formed in the strip either before or after the individual webs are cut therefrom.

The slotted webs, after they have been cut from the strip, are coated on both sides with an adhesive over the central area **26**. This coated central area **26** extends from approximately the outermost end of slot **22** in buffing element **16** to the outermost end of slot **24** in buffing element **18**. Ends **20***a* and **20***b* of slot **20** therefore extend beyond the limits of this coated area. The adhesive used to coat webs **12** should be capable of easy brush or roller application and should have sufficient resilience to withstand vibration and impact when set.

One type of adhesive which is particularly adapted for this process is a solvent-type thermoplastic cement having pigment reinforced synthetic rubber and synthetic thermoplastic resin as the solid components. The rubber contains nitrile groups which have good bonding action on metals and textiles. The synthetic plastic resin provides the high strength and rigidity while the synthetic rubber offers elasticity and good impact resistance. The preferred adhesive is a butadiene-acrylonitrile rubber base adhesive having vinyl acetate or a copolymer of polyvinyl chloride-acetate as the synthetic thermoplastic resin. This adhesive when applied to the webs has a solids content of between 20 and 30 percent, the solvent being methyl ethyl ketone. The adhesive has a specific gravity of between about 0.87 and 0.91, and the specific gravity of the solids is approximately 1.18. The adhesive is capable of dry bonding—that is, bonding through the application of heat after a solution or emulsion of the adhesive has been applied to and permitted to dry on the webs. One such adhesive is manufactured by the Goodyear Tire & Rubber Company under the name "Pliobond."

After the webs have been coated as described they are dried. The dried webs are then transversely folded along central bight **14** and as previously described slots **22** and **24** are aligned. If desired, the slots **20**, **22** and **24** may be formed at this point in the process. These webs are then ready for threading onto split ring **50**. Ring **50** is preferably cut from a ⅛-inch thick steel plate and four holes, **50***a*, **50***b*, **50***c* and **50***d*, are drilled therein. The holes are equally spaced about ring **50** and define the quadrants of the ring. The ring is split in the quadrant between holes **50***c* and **50***d*, and the two ends **51** and **51***a* may be resiliently spread laterally to permit the threading of the folded webs **12** onto the ring. In this operation the end **51** may be inserted into aligned slots

22 and 24 of each web and the webs are distributed about the ring with their coated portions 26 and bights 14 disposed inwardly.

In order to uniformly distribute the webs about ring 50, cotter pins or similar stops may be employed in connection with each of the holes. The cotter pins extend transversely across the plane of ring 50, and, when in place, are effective to maintain the webs 12 within their respective quadrants. A cotter pin is first inserted in hole 50*a* and webs are threaded onto the ring in the first quadrant. When the webs have been packed tightly into this quadrant a cotter pin is inserted in hole 50*d* to lock them in place. Next, the quadrant between holes 50*a* and 50*b* and the quadrant between holes 50*b* and 50*c* are packed with webs and the webs are locked in the quadrants by cotter pins. Then the last quadrant between holes 50*c* and 50*d* is filled, half the webs in this quadrant being threaded onto end 51 and the other half being threaded onto end 51*a* of the ring. It is preferred that the free ends 51 and 51*a* are butt welded following assembly of all webs on the ring 50. With webs 12 thus uniformly distributed about ring 50, the adhesively coated portions 30 are juxtaposed and disposed inwardly to form an annulus. The flat surfaces of webs 12 are oriented substantially in radial planes.

The next step in the process is the application of heat and pressure to the coated portions 26 of the webs. This step may be accomplished by means of a hot press. The webs are placed on a heated lower die 56, having a core 56*a* which extends into the aperture of the annulus formed by webs 12. Circumjacent core 56*a* in die 56 is an annular channel 56*b* and circumjacent channel 56*b* is protruding ridge 56*c*. Top die 58 which is also heated is centrally apertured to accommodate the core 56*a* of lower die 56, and circumjacent the central aperture 58*a* in upper die 58 is a shoulder 58*b*. Protruding downwardly below shoulder 58*b*, and immediately circumjacent this shoulder is protruding ridge 58*c*.

As may be best seen in FIG. 8, pressure is applied to at least one of the dies in the direction indicated thereon by the arrows, and protruding ridges 56*c* and 58*c* of dies 56 and 58, respectively, form the channels 32 and 34 on the sides of the buffing wheel, and channel 56*b* and shoulder 58*b* of dies 56 and 58, respectively, form attaching ridges 36 and 38 on the side of the buffing wheel circumjacent the aperture therein. The hot press, consisting of dies 56 and 58, is heated to a temperature of approximately 300° F., and the pressure applied to the webs is in excess of 200 p.s.i. This temperature and pressure may be maintained for several minutes until the adhesively coated portions 26 of the webs are fused and molded into a unitary annular core or shell. The press is then cooled and the molded buffing wheel discharged. The bonded and molded core or shell has the qualities of high strength and rigidity combined with elasticity and good impact resistance. It will be noted that ring 50 and the cotter pins are formed into and become an integral reinforcing part of the supporting shell. This ring is disposed intermediate channels 32 and 34.

In the preferred embodiment of the invention an individual buffing wheel section will preferably have an axial length in the range of about 5 to 9 inches. However, any desired length may be assembled between the end hubs 42 and 44 by aligning a plurality of sections on the single shaft 40. Such an assembly may be prepared readily by inserting a metal ring between two adjacent buffing wheel segments to engage the shoulders 36 and 38 and/or recesses 32 and 34 of adjacent sections. When the assembly is axially compressed by nut 40*b*, a rigid balanced unit of the desired length will be obtained.

Other variations will immediately occur to one skilled in the art. For example other slots or recesses may be formed in the fused bight portion 26 to insure adequate ventilation therethrough. It may be desirable to provide plugs or inserts in the ventilating slots during the fusing and bonding operations to insure maintenance of the desired open spaces in the finished product.

In one particular embodiment it was found that an optimum buff having a 20-inch diameter could be produced utilizing nineteen webs in each quadrant, each web being made up of twelve layers of cotton fabric. In this embodiment the fused central bight portion 26 had a radial dimension of about 1¾ inches. It will be obvious that this specification may be varied over a wide range while still incorporating the concepts of this invention.

It may be seen that a very novel, exceptionally strong and lightweight buffing wheel has been provided. This wheel is very strong and exceptionally safe, in addition to being considerably less expensive to manufacture than buffing wheels of previous design. It incorporates a minimum amount of parts and is self-cooling.

Without further elaboration, the foregoing will so fully explain the character of our invention that others may, by applying current knowledge, readily adapt the same for use under varying conditions of service, while retaining certain features which may properly be said to constitute the essential items of novelty involved, which items are intended to be defined and secured to us by the following claims.

We claim:

1. A buffing wheel comprising a plurality of substantially flat, flexible buffing elements arranged in contiguous groups in an annulus with their flat surfaces oriented substantially in radial planes, each of said elements having a slot therein extending outwardly from its inner extremity, the slots in each group of elements being coincident and forming a continuous large slot, the large slots in each group being axially staggered with respect to the large slots in each of the immediately adjoining groups, and the inner extremities of said elements being adhesively interjoined and forming a relatively rigid, hollow supporting shell through which said large slots radially extend.

2. A buffing wheel comprising a plurality of flat, elongate, flexible webs, each web transversely folded about a central bight to form two substantially coextensive buffing elements, each of said webs having an elongate longitudinally disposed slot extending across said central bight, said webs being arranged in contiguous groups in an annulus with the flat surfaces of said webs oriented substantially in radial planes and with the slots in each group of webs being coincident and forming a continuous large slot, the large slot in each group being axially staggered with respect to the large slots in each of the immediately adjoining groups, portions of said webs adjacent the central bights being juxtaposed and disposed radially inward, said bight portions being adhesively interjoined and forming a relatively rigid, hollow, continuous supporting shell through which said large slots radially extend.

3. The structure of claim 2 in which said bight portions are interjoined and rigidified with a thermoplastic adhesive comprising reinforced synthetic rubber and synthetic plastic resin.

4. The structure of claim 2 in which an annular reinforcing ring extends through and is adhesively joined to the central bight portions of said buffing elements.

5. The structure of claim 2 including means on said shell for attaching said buffing wheel to a rotatable mount.

6. The structure of claim 5 in which said attaching means comprises an annular channel formed on each side of said shell circumjacent the central aperture therein.

7. The process of making a buffing wheel which compirses forming a plurality of flat, elongate buffing elements, each having an aperture adjacent one end, coating the apertured end portion of each of said elements with a heat fusible adhesive, threading the apertured end portions of said elements onto an annular ring to form

an annulus with the apertured and adhesively coated end portions juxtaposed and disposed inwardly, and applying heat to said end portions sufficient to bond said end portions together into a strong integral supporting shell.

8. The process of making a buffing wheel which comprises forming a plurality of flat, elongate webs each transversely folded about a central bight and each being apertured adjacent said central bight, coating the portions of each of said webs adjacent the central bight with a heat fusible adhesive, threading the apertured and coated webs onto an annular ring, distributing said webs uniformly about said ring in an annulus with the adhesively coated portions juxtaposed and disposed inwardly and with the flat surfaces of said webs oriented substantially in radial planes, and applying heat and pressure to said coated portions to bond said portions together into a strong integral supporting shell.

9. The process of making a buffing wheel which comprises forming a plurality of flat, elongate webs each transversely foldable about a central bight and each being apertured adjacent said central bight, coating the portions of each of said webs adjacent the central bight with a heat fusible adhesive, threading the apertured and coated webs onto an annular ring, distributing said webs uniformly about said ring in an annulus with the adhesively coated portions juxtaposed and disposed inwardly and with the surfaces of said webs oriented substantially in radial planes, applying heat and pressure to said coated portions to bond said portions together into a strong molded integral supporting shell, and simultaneously forming an attaching formation into the sides of said webs in the coated portions thereof.

10. The process of making a buffing wheel which comprises forming a plurality of flat, elongate webs each transversely folded about a central bight and each being apertured adjacent said central bight, coating the portions of each of said webs adjacent the central bight with a solvent-type thermoplastic adhesive having pigment-reinforced synthetic rubber and synthetic plastic resin, drying the coated web portions, threading the apertured and coated webs onto an annular ring, distributing said webs uniformly about said ring in an annulus with the adhesively coated portions juxtaposed and disposed inwardly and with the flat surfaces of said webs oriented substantially in radial planes, applying heat and pressure to said coated portions to bond said portions together into a strong molded integral supporting shell, and simultaneously forming an attaching formation into the sides of said webs in the coated portions thereof.

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