

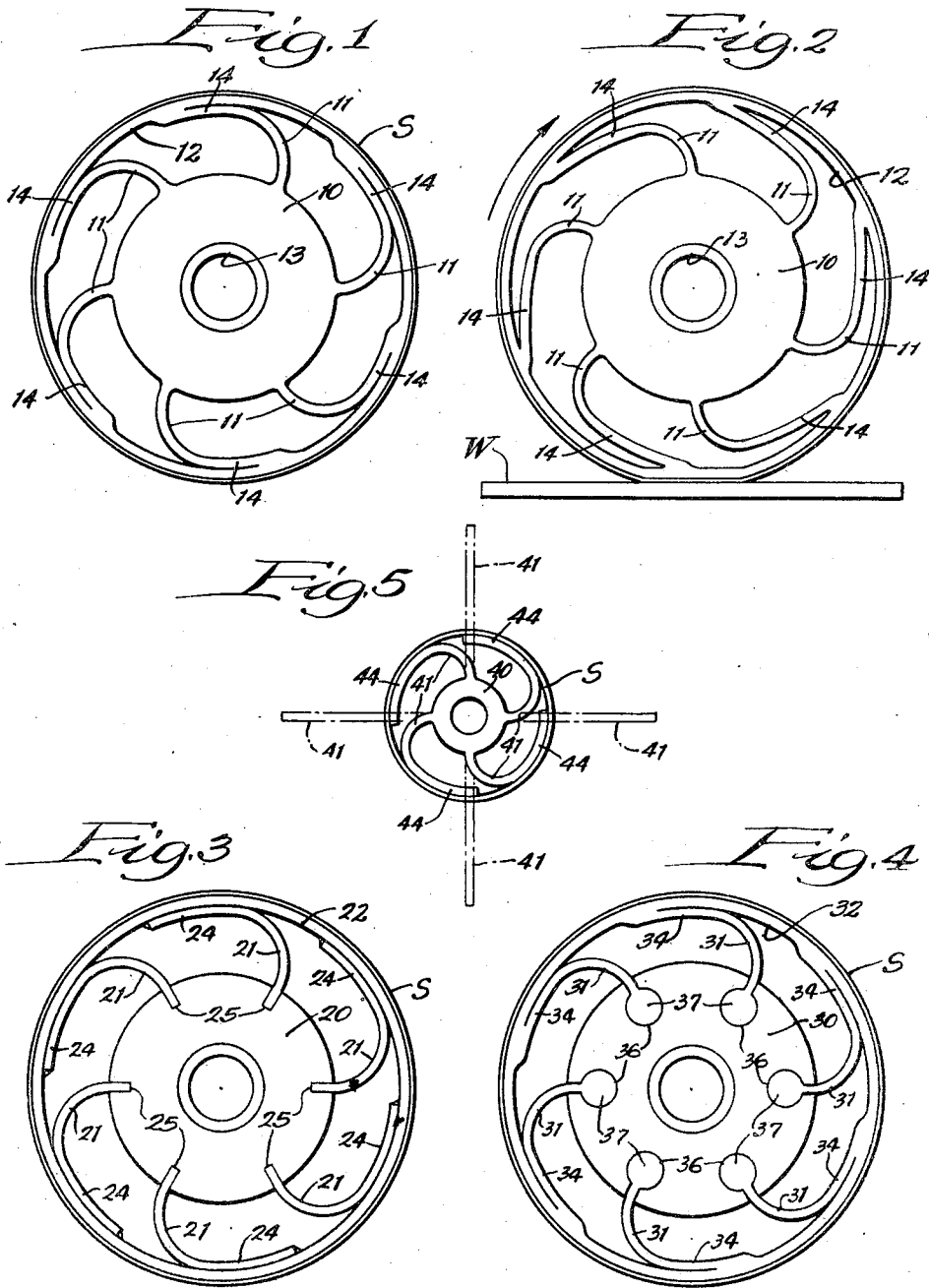
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G. A. LARSON

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ABRASIVE SLEEVE HOLDER

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Inventor:  
George A. Larson.  
By *Wm. & Wm.*  
Attorneys.

## UNITED STATES PATENT OFFICE

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## ABRASIVE SLEEVE HOLDER

George A. Larson, Rockford, Ill.

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8 Claims. (Cl. 51-191)

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This invention relates to a rotatable holder whereon may be fitted an abrasive sleeve in the form of a flexible endless band. In particular, the present improvements are concerned with the holder itself which comprises a rotatable hub from which are extended a plurality of resilient arms which at their outer ends, either directly or through the medium of a peripheral band, support a surrounding abrasive sleeve. A feature of importance to this invention is the sleeve support which is yieldable so that, in response to a centrifugal force, it will tend to move out thereby pressing itself tightly against the surrounding sleeve. Conversely, when motionless, the support contracts to a state of relaxation, the abrasive sleeve being then readily movable on or off the holder.

In preferred forms the holders are cylindrical, even when not held to that shape by the sleeve, and are reduced in size by twisting the sleeve in one direction so that the sleeve may slip onto them easily in spite of fitting tightly enough not to fall off prior to reaching high speed.

Certain exemplifications of this invention are set forth in the accompanying drawing in the manner following:

Figure 1 is a view in side elevation of a one-piece expansible holder fitted with a surrounding abrasive sleeve, shown as it appears when motionless;

Fig. 2 which is a similar view shows the holder and sleeve as when rotated and pressed against the work;

Fig. 3 which is a view similar to Fig. 1 shows a holder having a hub, arms, and band formed of interconnected pieces;

Fig. 4 which is a view similar to Fig. 1, shows the holder made up of a band, and arms integral therewith, together with a hub to which the arms are removably connected; and

Fig. 5 which is also a view similar to Fig. 1, shows a one-piece holder of modified construction.

The present holder in each of its forms comprises a central hub 10 from which is extended a plurality of resilient arms 11. In each of the illustrated holders of Figs. 1 to 4, the arms are connected at their outer ends with a peripheral band 12. Through the center of the hub a bushing or shaft 13 may be embedded to adapt the holder for attachment to a shaft or chuck (not shown) whereby rotary motion is transmitted thereto. An abrasive sleeve S which is placed around the holder is supported and driven thereby when the holder is in operation.

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In the constructions of Figs. 1-2, the hub, arms, and band are shown as formed integrally of one piece of resilient material, such as rubber. The arms, while extended outwardly from the hub, are preferably curved to provide arcuate end portions 14 which are concentric with the axis of the holder, these arcuate ends being extended alongside of the band adjacent its inner face and joined thereto at the arm extremities. When at rest, the holder will be relaxed, i. e. it will be neither contracted nor expanded, its diameter then being such that the abrasive sleeve may be easily slipped on or off by twisting the sleeve in the direction in which the arms extend. When a rotary force is applied to its hub, the arms will be pulled around to transmit this force to the peripheral band which tends to expand with increase in the centrifugal force that is developed, the arms offering little or no resistance to this expanding movement of the band. Since the abrasive sleeve is relatively non-stretchable, the expanded band will press closely and tightly against the inner face of the sleeve at every point whereby to establish a secure driving connection therewith. The sleeve may accordingly be depended upon to rotate with the holder without slipping.

When pressed against a piece of work W, as suggested in Fig. 2, the peripheral band will tend to flatten at the point where engagement takes place. There is accordingly a potential substantial area of contact between the abrasive sleeve and the work, instead of merely a line contact as in cases where the holder is incapable of yielding.

A device of this character may be produced in various forms. According to Fig. 3, the hub 20 is one part, the arms 21 while formed separate therefrom are joined thereto, being anchored, as by cementing, in radial slots 25, and the peripheral band 22 upon its inner face is adhesively joined to the extremities of the arcuate ends 24 of the arms 21 which may be extended therealong for an appreciable distance, as shown. In operation, exactly the same results take place. The hub, whether formed of plastic, wood, metal or other material, is rotated to carry the arms forwardly thereby to rotate the peripheral band which expands under centrifugal force to press tightly against the surrounding abrasive sleeve S.

In the showing of Fig. 4, the hub 30 is formed with keyhole slots 36 for receiving enlarged beads 37 at the inner ends of the arms 31, the latter in their outer end portions 34 being curved to lie alongside the peripheral band 32 to which they

are joined at their extremities, integrally or otherwise. An abrasive sleeve S may be fitted around the band, as shown. In this construction, the inner ends of the arms may be slipped out of the keyhole slots, lengthwise thereof, so that the bend may be disassembled from the hub. The performance of this holder is the same as the others already described.

According to Fig. 5, the hub 40 is provided with a plurality of resilient arms 41 which initially may extend radially as indicated by the dot and dash lines. In use, however, these arms are bent around to lie all in the same direction to provide curved outer end portions 44. Over the curved ends of these arms may be fitted an endless abrasive sleeve S which is supported thereby over an extended area, perhaps even the major part, of its inner surface. In this construction I dispense with the peripheral band, relying instead upon the curved arm portions in engagement with the surrounding sleeve, to provide an adequate driving support therefor. Viewed one way, the sleeve is itself a band which may not always require for its support an inner band which is joined to the arms; consequently, this form of holder may be found entirely satisfactory for many purposes.

In all forms, the holder may be molded as one piece of rubber, being molded, except in Fig. 4, to a metallic shaft or spindle which may be nurlled or ribbed. It should be observed that the form of Fig. 5 is exceedingly simple to manufacture since the holders may be formed to the final shape with relatively simple molds.

All of the forms of the invention may be driven in either direction. Ordinarily, it will be preferred to drive the holders in the direction in which the arms extend from the more radial portions thereof. With this direction of rotation the drag on the sleeve resulting from the abrasive use thereof will tend to flex the arms in such a manner as to increase the force they exert against the sleeve. When a very soft action is desired, rotation in the opposite direction may be preferred.

It is important to have at least three and preferably four or more arms. With only two arms, very little pressure is required to push the sleeve off center with respect to the axis of the hub.

A salient characteristic of the present holder is its capacity to expand evenly under rotation so as to bear with pressure against the surrounding sleeve. A condition of expansion is normally attained when the holder is in operation, and a condition of relaxation when the holder is still. This makes for security in the connection between the abrasive sleeve and the holder when the device is operated, and for ease in removal of the sleeve and replacement of a substitute sleeve, whenever desired. In addition, the expanded peripheral band of the holder is susceptible of yielding when the sleeve is pressed against the work, so as to enlarge the area of its surface contact therewith. Accordingly, in many cases the time required for performing a given task may be materially reduced or the quality improved.

Successful performance of the present sleeve holder is also attributable to another factor, viz. the form and arrangement of the arms which transmit the rotary force to the surrounding sleeve. These arms, while resilient, are stiff or self-sustaining enough to move the band through its circular path, and not inwardly, the arms for

a large part of their length being concentric therewith and adjacent thereto so that centrifugal force works on the arms. The connection between each arm and the band, when a band is provided, is confined to a relatively small area at the arm extremity, leaving the arms and band elsewhere in freely separable relation. This is important in facilitating a uniform and even expansion or outward movement of the band at every point in its periphery when rotation takes place. The band is accordingly free to expand at every peripheral point, even at the arm extremities where connection is made with the band. In general these observations apply also to the bandless construction of Fig. 5 in which frictional engagement between the arms and sleeve is relied upon to transmit rotation to the latter. In every case the holder furnishes a rotatable, floating, yieldable, driving and concentric support for the abrasive sleeve such that it may be easily slipped on and off when motionless, and be flattened somewhat at the point of its engagement with the work whereby to enlarge its area of contact therewith.

The holder may, of course, be made of synthetic rubber, such as the buna rubbers, including Buna S, and neoprene as well as compounds of natural rubber. Any such materials may be deemed to be included in the term "rubber-like" used in the claims, provided that they are flexible, compressible, elastic, and stable at slightly elevated operating temperatures, thus resembling ordinary soft vulcanized rubber.

This application is a continuation in part of application Serial No. 530,501, filed April 11, 1944, now abandoned.

I claim:

1. A rotary one-piece expansible abrasive sleeve holder of rubber-like material comprising a rotatable hub, a thin peripheral band concentric therewith and spaced therefrom adapted to support a surrounding abrasive sleeve, and thin resilient arms fast to the band and extended outwardly from the hub, and circularly adjacent the band in freely separable contact therewith for distention thereof in connection with both the hub and band to transmit rotary motion from the hub to the band while permitting expansive movement of the band against the surrounding sleeve in response to centrifugal force, the entire flexibility of the resilient arms from the hub to the outer ends of the arms being freely available for radial expansion by centrifugal force, said arms extending predominantly in one circular direction so that with rotation in one direction reaction of the work will tend to reduce the outward thrust of the arms, while with rotation in the opposite direction the reaction will tend to increase said thrust, and said arms being also movable inwardly from the band to compensate for relative rotary movement of the hub and the band.

2. A rotary one-piece expansible abrasive sleeve holder of rubber-like material comprising a rotatable hub, a thin peripheral band concentric therewith and spaced therefrom adapted to support a surrounding abrasive sleeve, and thin resilient arms fast to the band and the hub and extended outwardly from the hub, forwardly with respect to its direction of rotation, and circularly adjacent the band in freely separable contact therewith for distention thereof, in connection with both the hub and band to transmit rotary motion from the hub to the band while permitting expansive movement of the band against the surrounding sleeve

in response to centrifugal force, the entire flexibility of the resilient arms from the hub to the outer ends of the arms being freely available for the expansion by centrifugal force, said arms having approximately the same cross sectional area as that of the band and being movable inwardly therefrom to compensate for relative rotary movement of the hub and the band.

3. A rotary one-piece expansible abrasive sleeve holder of rubber-like material comprising a rotatable hub, a thin peripheral band concentric therewith and spaced therefrom adapted to support a surrounding abrasive sleeve, and thin resilient arms having approximately the same cross sectional area as that of the band and fast to the band and the hub and extended outwardly from the hub, rearwardly with respect to its direction of rotation, and circularly adjacent the band in freely separable contact therewith for distention thereof, in connection with both the hub and band to transmit rotary motion from the hub to the band while permitting expansive movement of the band against the surrounding sleeve in response to centrifugal force, the entire flexibility of the resilient arms from the hub to the outer ends of the arms being freely available for the expansion by centrifugal force, and said arms being also movable inwardly from the band to compensate for relative rotary movement of the hub and the band.

4. A rotary one-piece expansible abrasive sleeve holder comprising a rotatable hub, a thin band concentric therewith and spaced therefrom, and thin arms having approximately the same cross sectional area as that of the band and joined at one end to the hub and elsewhere being curved to extend along and adjacent the band and in connection therewith at the proximate arm ends, the hub, arms, and band being formed of one piece of resilient material adapted to permit uniform expansion of the band in response to centrifugal force, the band, when in a condition of rest, having a normal diameter such as to receive thereon a relatively non-stretchable abrasive sleeve, and when subjected to rotation, being expanded uniformly with pressure against the inner face of the sleeve, and said arms being also movable inwardly from the band to compensate for relative rotary movement of the hub and the band.

5. A rotary expanding member including a hub, a thin resilient stretchable band concentric therewith and spaced therefrom, and thin arms inseparably attached to the hub and band for driving the band from the hub, the disposition and flexibility of the connecting means being such as to allow the band to expand by centrifugal force substantially without restraint from said connecting means, said arms having outer portions located at spaced points around the band and extending

circumferentially thereof and movable inwardly therefrom to compensate for relative rotary movement of the hub and the band.

6. A rotary one-piece expansible abrasive sleeve holder of molded resilient rubber-like material comprising a band having a cylindrical outer contour, a hub, spaced from the band, and at least three arms integral with the band and the hub and supporting the band in its spaced relation with the hub and having arcuate circumferentially disposed outer portions normally arranged contiguous to the band and disposed at spaced points around the same and movable inwardly from the band to compensate for relative rotary movement of the hub and the band.

7. A rotary one-piece expansible abrasive sleeve holder of molded resilient rubber-like material comprising a thin band having a cylindrical outer contour, a hub, spaced from the band, and at least three thin arms integral with the band and the hub and supporting the band in its spaced relation with the hub and having substantially the same cross sectional area as the band, said arms having curved outer portions normally in contact with the band and spaced at intervals around the same and movable inwardly from the band to compensate for relative rotary movement of the hub and the band.

8. A rotary expansible abrasive sleeve holder comprising a hub, a thin band having a cylindrical outer contour and spaced from the hub, and at least three thin arms extending from the hub to the band and supporting the latter in its spaced relation with the hub, said band and arms being formed of one-piece of molded resilient rubber-like material and said arms having substantially the same cross sectional area as the band and having outer arcuate portions normally arranged contiguous to the band and spaced from one another and movable inwardly from the band to compensate for relative rotary movement of the band and the hub.

GEORGE A. LARSON.

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