Oct. 13, 1964 G. F. LYTLE 3,152,828

VACUUM CUP UNITS FOR LIFTING PADS

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FIG. 1.

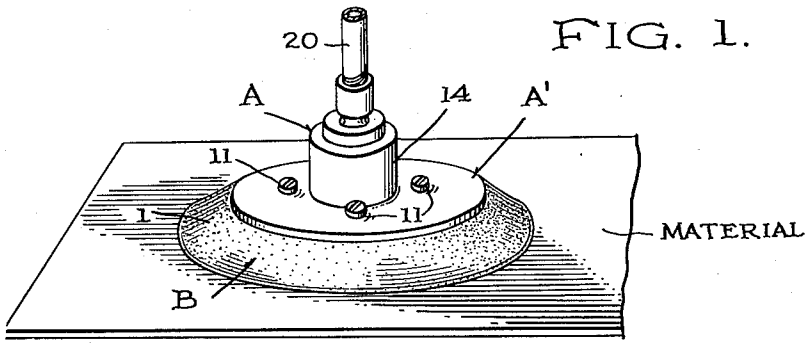


FIG. 2.

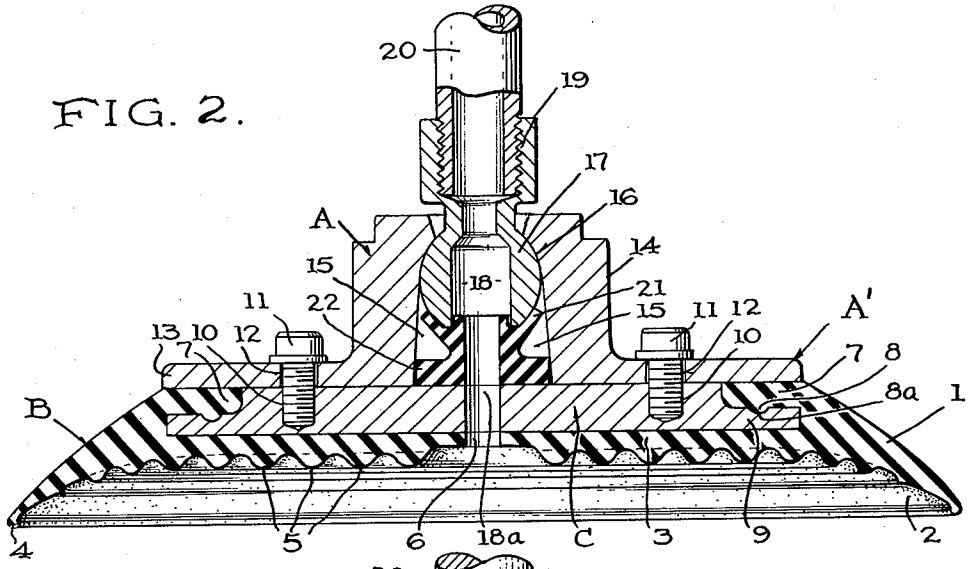
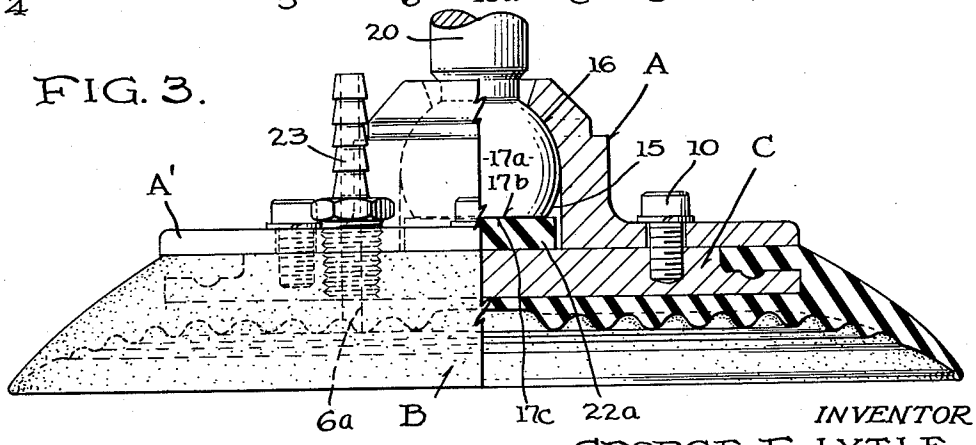


FIG. 3.



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VACUUM CUP UNITS FOR LIFTING PADS

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This invention relates to vacuum cup units for lifting pads used with apparatus to pick up sheets or other objects by a vacuum, as distinguished from magnetic or other type lifting devices.

A vacuum cup unit essentially includes a support suspended from a dirigible hanger, a scuff pad, and a flexible seal assembled in a manner to lift objects through the utilization of a vacuum. The seal of the assembly is normally made of medium durometer rubber and is attached to the outer perimeter of the metal portion of the pad. In many cases, material being handled can be damaged by the exposed metal face of the support when the vacuum induced by a vacuum pump is supplied to the cup assembly. Heretofore, it has been customary to utilize a soft shield for the exposed metal face of the flanged support and this shield usually takes the form of a scuff pad of rubber bonded to the otherwise exposed metal face of the support to protect the material from being scratched or marred. Extensive experience has shown that, bonding of a scuff pad to the metal support is inefficient and ineffective because, in actual use, the bonded pad readily comes loose and, therefore, soon destroys the usefulness of the unit.

Accordingly, a primary object of the present invention is to provide a vacuum cup assembly which includes a combined seal and scuff pad comprising a clamping plate carried by the combined seal and scuff pad and which may be secured to the support by fastenings which do not pierce either the clamping plate or the pad and are readily accessible for manipulation from the top face of the assembly. It will thus be understood that the present invention is directed to a combined scuff pad and seal fitted with a clamping plate in a manner to provide an effective seal while at the same time protecting the materials upon which the pad operates.

Another object of the invention is to provide a vacuum cup unit which tends to keep the combined scuff pad and seal at right angles to the support or hanger regardless of whether the hanger itself constitutes a vacuum supply pipe or is a ball having substantially universal movement in relation to the support, while the vacuum supply is connected through a separate nipple or pipe fitting.

A further object of the invention is to provide a combination scuff pad and seal wherein a half O-ring is molded in the attaching flange of the combined seal and scuff pad to fit in a complementary groove in which is formed in an annular ledge of the plate which secures the said combined scuff pad and seal to the support.

A still further object of the invention is to provide the seal with peripheral O-ring lip which not only strengthens the contact edge of the seal but has the additional advantages of allowing the lip to slide more readily over the face of the material to be handled to insure positive grip while also preventing the lip from folding under as frequently occurs as the pad touches down on the material at an angle.

An additional object is to provide a vacuum cup assembly carried by a hanger or hollow stem which constitutes the vacuum supply means through a flexible ball joint to the flexible material gripping seal.

With the above and other objects in view which will more readily appear as the nature of the invention is better understood, the invention consists in the novel construction, combination, and arrangement of parts,

hereinafter more fully described, illustrated, and claimed.

Preferred and practical embodiments of the invention are shown in the accompanying drawing, in which:

FIGURE 1 is a perspective view illustrating the application of the invention.

FIGURE 2 is a vertical cross-sectional view of one form of embodiment wherein the vacuum supply tube also constitutes a hanger or support for the pad assembly.

FIGURE 3 is a vertical cross-sectional view of a modification where the hanger and vacuum supply tubes are separate.

Similar reference characters designate corresponding parts throughout the several figures of the drawing.

FIGURE 1 illustrates the application of the new unit to a form or embodiment of the vacuum cup assembly corresponding to FIGURE 2. In all forms, however, the same essential elements of the assembly are embodied in the complete construction. These elements are, for example the lifting unit comprising a metallic support A, having a flange A' including top and bottom faces, and the vacuum cup assembly comprising a combined seal and scuff pad B, and a securing plate C releasably attached to said bottom face.

The combined seal and scuff pad B and its carrier plate C, as shown, may be used with various forms of supports A. Therefore, the vacuum cup assembly including the combined seal and scuff pad will now be described in detail.

In both FIGURES 2 and 3, the seal includes a body 1 molded from suitable flexible air impervious material into an annular or ring-like seal 2 in the form of a substantially frusto-conical skirt, and an integral medial scuff pad portion 3.

It will also be seen that the marginal or peripheral material engaging edge portion of the annular skirt 2 is provided with a full O-ring edge 4 which prevents the skirt from deformation if the cup strikes the material to be lifted at an angle.

The scuff pad portion 3 has its inner face engaging the bottom face of the flange A' and its outer material engaging face provided with a series of annular ribs which not only strengthen the pad but insure augmented gripping capacity. The central area of the scuff pad may be provided with a vacuum inlet 6, FIGURE 2, disposed axially of the seal ring although it may be eccentric thereto as will be pointed out in connection with FIGURE 3, later to be described.

The combined scuff pad and seal B has its central area open as defined by an inwardly extending attaching flange 7 having a half O-ring 8. This ring provides a resilient rib to mate with a groove 8*a* of the annular ledge 9 of the carrier plate C. This plate has an outer face which engages with the back of the scuff pad 3 and an inner face of less diameter than the outer face, thereby to form a recess or pocket in conjunction with said annular ledge. It will thus be seen that the elastic flange 7 of the combined seal and scuff pad may be held in the recess defined by the annular ledge 9 and the bottom face of the flange A'. This half O-ring is important because it insures a positive seal, and at the same time, mechanically holds the seal from being pulled from beneath the peripheral edge portion of the flange A' and the clamping plate C.

As will appear both from FIGURES 2 and 3, the plate C is provided with internally threaded sockets 10 to receive the lower threaded end portions of screws 11 which pass through unthreaded holes 12 in the flange A' of the support A.

The medial or central portion of the upper face of the flange A' of the metal body A has an upstanding boss 14, provided with an internal socket 15 wider at its bottom end than at its upper end which includes a rounded

bearing surface 16. As will be seen from both FIGURES 2 and 3, this socket 16 is intended to receive the ball portion 17 of a hanger.

In FIGURE 2, the ball 17 is hollow as indicated at 18 and is threadedly suspended at 19 from a hollow vacuum supply pipe 20. As shown, the hollow portion or chamber 18 is intended to communicate through passage 18*a* with the opening 6 in the scuff pad portion of the sealing ring.

In order to provide a vacuum tight seal between the ball 17 and the plate C, and at the same time hold the assembly in its intended relation to the pipe 20, a rubber or plastic gasket member is utilized. This gasket includes a cup-like flange 21 to embrace the lower portion of the ball 17 and also includes a relatively flat disc portion 22 which bears flushly on the flat inner face of the clamping plate C. It will also be seen that the chamber 18 of the ball 17 communicates with the opening 6 of the scuff pad through said opening 18*a*.

The purpose of the foregoing arrangement is to permit the vacuum cup assembly to freely adjust itself to the material being handled, and, when the material is released by breaking the vacuum, the vacuum cup assembly will tend to return to the normal horizontal position shown in FIGURE 2.

Referring to FIGURE 3, it will be observed that the combined scuff plate and seal B, clamping plate C, and fastenings 10 are still utilized in connection with a slightly different form of hanger.

First, it may be noted that the hole 6 of FIGURE 2 is moved to a position eccentric to the axis of the assembly as shown at 6*a* in FIGURE 3 so that the vacuum supply is effected through the inlet nipple 23. Also, it will be seen that the ball 17*a* is solid and the hanger stem 20*a* is also of solid cross section. However, the lower edge 17*b* of the ball 17*a* is flat to engage the flat surface 17*c* of the rubber disc 22*a*. Here again, provision is made for the vacuum cup assembly to assume the proper and intended angular relationship to the hanger 20*a* as the surface of the material dictates, but, when the vacuum is broken, the vacuum cup assembly will return to its normal plane, namely, substantially at right angles to the axis of the support 28.

It will now be seen that in both forms of the invention, the combined vacuum seal and scuff pad B, together with the supporting plate C are adaptable to different types of flanged supports A. The features described herein may be used in a variety of sizes of pads from two inches in diameter to as much as twelve inches. Material from which the combination seal and scuff pad is made will vary somewhat with the application usage. Rubber or neoprene being the common material used, the seal can be made of silicone where high or low temperature prevails. An elastomeric material such as polyurethene is also adaptable for use, and aids in preventing undue marking of the material being handled as is prevalent where rubber is used due to certain additives required. Material of the type described has high resistance to tearing and greater life expectancy.

In both forms of the invention, the rubber disc 22 or 22*a* performs two functions, the most important being to hold the pad in a level position at all times when not in contact with material. The flat surfaces of the ball 17 or 17*a* resting on the rubber bumper disc will hold the pad level and yet permit it to flex if the material with which the pad comes in contact is out of plane for any reason. The second function of the rubber bumper is to hold the ball hanger snugly against the metal pad itself.

It will also be understood that the half O-ring 8 and the full O-ring 4 contribute materially to the usefulness and longevity of the seal for the reasons previously given.

I claim:

1. In a vacuum cup for lifting pads, the combination comprising,
   a support (A) provided with a flange (A') and a medial boss (14), said boss having a central opening and an interior socket (16),
   a carrier plate (C) having a vacuum inlet (18*a*),
   a combined seal and scuff pad (1, 2, 3) also having a vacuum inlet opening (6) registering with said opening of the boss (14) and the opening of the carrier plate (C),
   a hanger (20) for the vacuum cup unit including a ball (17) movable in said socket, and resilient means (22-22*a*) confined between the lower end of the ball (17) and the clamping plate (C) against which said ball (17) bears and tending to maintain the unit at substantially right angles to the axis of the hanger,
   and fastening means (11) for releasably connecting the carrier plate (C) to said flange (A') to hold the seal and scuff pad in operative position.

2. A vacuum cup unit according to claim 1, wherein the ball (17) is hollow (18) and the hanger is a pipe (20) communicating with the source of vacuum supply,
   and the resilient means (21-22) embraces the bottom of the ball and is also provided with a passage (18*a*) connecting with the vacuum inlet opening (6) in the scuff pad.

3. A vacuum cup unit according to claim 1, wherein the hanger is a solid rod (20*a*) and the ball (17*a*) fitting in the socket has a flat bottom face (17*b*) resting upon the flat upper surface of a resilient disc (22*a*) and the vacuum inlet opening in the suction area of the seal is eccentric to the axis of the hanger,
   and a vacuum supply nipple (23) carried by the flange on the support and in communication with said eccentric opening.

4. Vacuum lifting apparatus, comprising, in combination,
   a vacuum cup including,
   a carrier plate (C) recessed along its upper edge to provide a pocket,
   a one-piece resilient vacuum cup (B) having a medial portion coextensive with the lower material engaging face of said carrier plate (C) and also having an elastic flange (7) fitted in said pocket,
   a support (A), including a central medial boss (14) and a flange (A') coextensive with and overlying said carrier plate (C) to cover and hold said elastic flange (7) in said pocket,
   hanger means (18-20) having its lowermost portion retained within said boss,
   and resilient means (22 or 22*a*) within said support disposed beneath the lowermost portion of the hanger means (18-20) on the one hand and bearing flushly on the other hand with the upper face of the carrier plate (C) to maintain the plate substantially at right angles to the said hanger means.

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