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a part interest

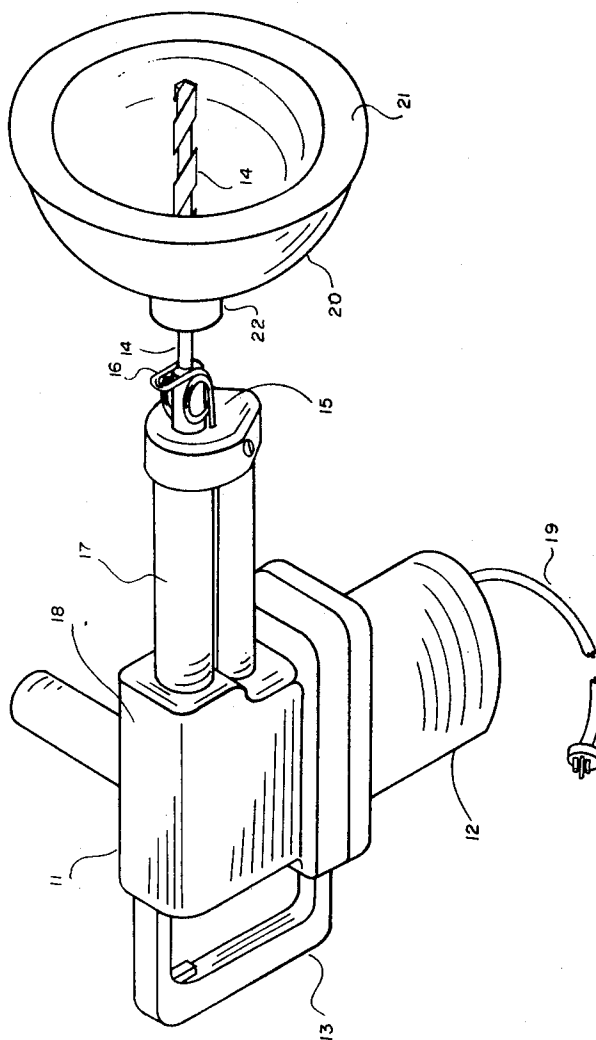
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[54] **APPARATUS FOR SUPPRESSING SOUND AND DUST CREATED BY OPERATION OF ROTARY HAMMERS**
8 Claims, 6 Drawing Figs.

[52] U.S. Cl. **175/209**
 [51] Int. Cl. **I21c 7/00**
 [50] Field of Search **175/209, 211, 213**

ABSTRACT: Apparatus for collecting debris and dust and suppressing noise created by operation of rotary hammers for drilling in concrete and stone, said apparatus involving a flexible cup-shaped body fabricated from a resilient material having poor soundconducting characteristics and adapted to fit around the rotary hammer drill bit and to fit snugly against the stone or concrete surface being drilled.



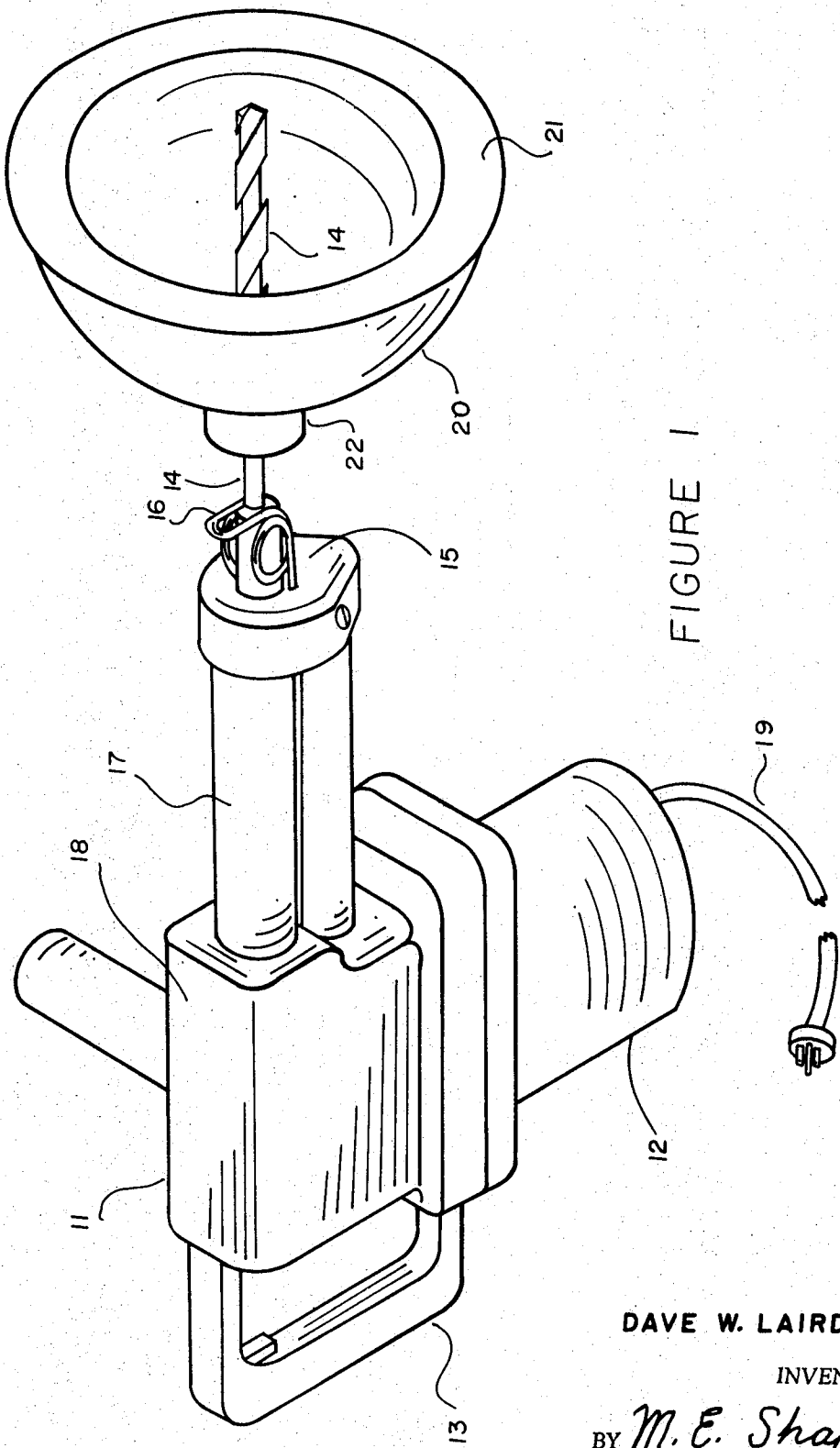


FIGURE 1

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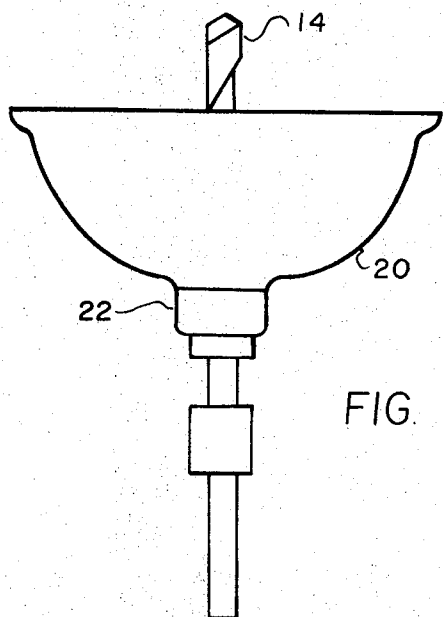


FIG. 2

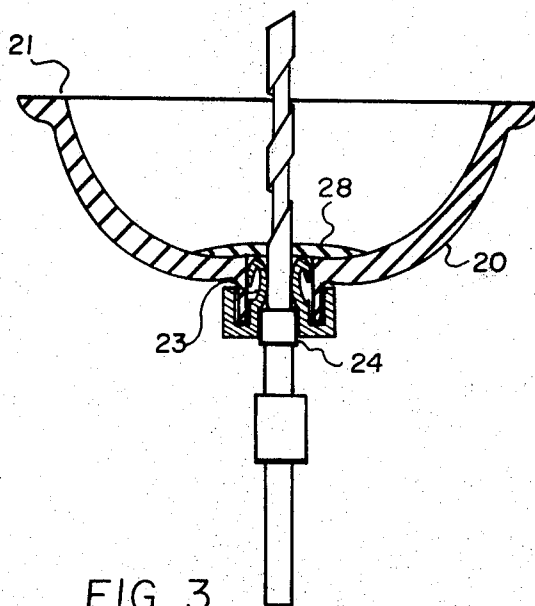


FIG. 3

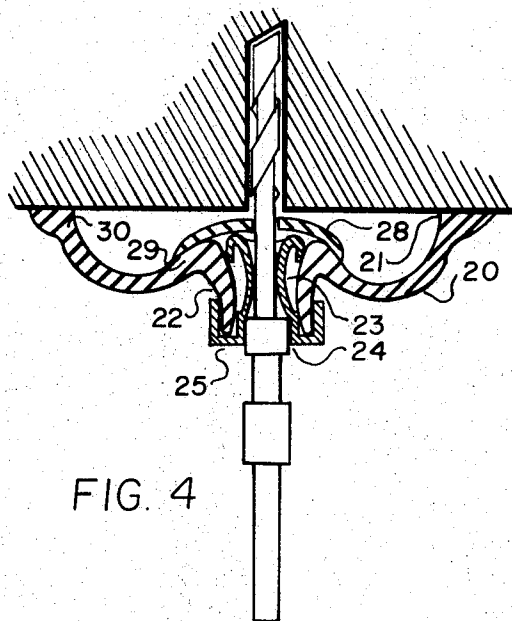


FIG. 4

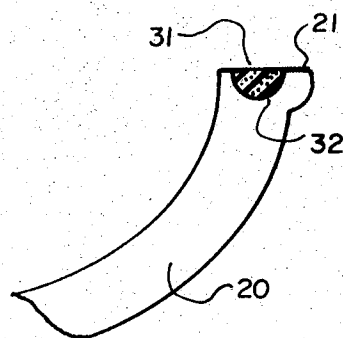


FIG. 6

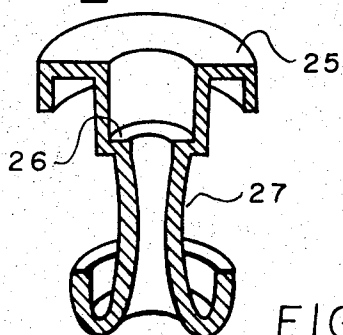


FIG. 5

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APPARATUS FOR SUPPRESSING SOUND AND DUST CREATED BY OPERATION OF ROTARY HAMMERS

SUBJECT MATTER OF INVENTION

This invention relates generally to the use of rotary hammer apparatus for drilling, boring, and abrading operations in stone and more particularly to improvements in protective devices for suppressing the noise and collecting the falling dust and debris involved in such operations.

Heretofore a simple guard or shield has been the usual means of preventing dust and debris from falling back into the equipment in overhead drilling operations. The limitations of such simple shields are obvious. For example, most small shields are designed to prevent abrasive material from getting into the rotary hammer and deflect only the debris falling straight back into the drill. This does little in the way of protecting the eyes, face, and body of the individual operating the drill. In addition, since such guards are generally from metal plates or stiff plastic materials and not enclosed or airtight, they provide little or no help in reducing the irritating noise involved in drilling operations.

OBJECTS OF THE INVENTION

The process of drilling holes in cement or stone in interior locations can create so much dust and noise in a few minutes as to render the room or area where the work is being done untenable. The noise may well drive office workers out of the building and a cloud of stone dust can so pollute the atmosphere in a room as to force interruption of all work for an hour or more at a time. It is, therefore, a prime object of this invention to surround the immediate work area where the rotary hammer drill bit comes into cutting contact with a concrete or stone surface with a small flexible housing that will both confine the dust and debris from the drill bit and will muffle the noise produced by the operation of said tool.

Another object of the invention is to create a protective device that will permit the operator to drill into overhead stone without having the dust and debris fall back in his eyes.

A further object of this invention is to provide a device that is adaptable to various sizes of drill bits. A flexible collar located along the inner edge of the neck aperture enables the opening to expand or contract as necessary to fit the size of the bit being used. Since the device attaches to and operates with the drill bit instead of being attached directly to the drill or rotary hammer, the device can be used with a number of items of commercial stone drilling apparatus without requiring modification of the drill or rotary hammer.

A further object of the invention is to devise a means of attaching said protective device to the associated drill or rotary hammer by a means that will not require any material change in the existing structure of the pot hammer or drill thereby making it possible to attach the device to existing commercial drills and rotary hammers.

Another objective of the invention is to devise a noise-suppressing and debris-confining device that will fit on and around the drill bit, that will not turn with the drill bit but that will also prevent the debris collected in the cup from working back along the drill where it can leak into the motor housing of the drill or rotary hammer. This is accomplished in part by use of a flexible diaphragm across the interopening of the tubular opening through the neck of the device.

These and other objects and advantages of this invention will become apparent through consideration of the following description and appended claims in conjunction with the attached drawings in which:

DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. 1 is a perspective view of the invention described herein attached to a commercial rotary hammer;

FIG. 2 is a side view of the exterior of the body of the invention with a rotary hammer drill bit in place;

FIG. 3 is a section view of the invention showing how the cup-shaped body of the invention fits around the drill bit;

FIG. 4 is a section view of the invention showing how the body of the device fits snugly against the surface being drilled and showing how the body of the device flexes as the drill bit penetrates the surface;

FIG. 5 is partial perspective and cross-sectional view of an insertable, removable shank coupling and bearing sleeve; and

FIG. 6 is a partial section view of the broadened lip area along the perimeter of an alternate version of the invention.

In describing one selected form or preferred embodiment of this invention as shown in the drawings and described in this specification, specific terms and components are used for clarity. However, it is not intended to limit the claimed invention to the specific form, components or construction shown and it is to be understood that the specific terms used in this illustration of the invention are intended to include all technical equivalents which operate in a similar manner to accomplish a similar purpose.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT OF INVENTION

Referring to the specific embodiment of the invention selected for illustration in the accompanying drawings, the number 11 refers to a roto hammer or power drill driven by a motor 12 and equipped with a handle 13 for hand operation. An interchangeable rotary hammer drill bit 14 is mounted firmly in the drill chuck 15 and held securely in place by a retainer clip 16. Bit 14 is turned by means of the drive shaft 17 which is powered by the motor 12. Said parts of a standard, commercially available rotary hammer are mounted in housing assembly 18 and said rotary hammer is powered by means of any standard motive power source such as power cord 19 which connects to said source of power.

The central item of the invention is a bowl or cup-shaped body 20 which is fabricated from a resilient, flexible material having poor sound-conducting characteristics and adapted to surround an operating rotary hammer drill bit as shown in FIG. 1. It will be readily apparent that such a cup or bowl-shaped structure surrounding the drill will be useful in collecting dust or debris from the drilling operation, especially when the operator has to drill into overhead stone structures, but the efficiency of the device as a dust and debris collector can be substantially improved by adapting lips 21 of said cup-shaped body 20 to maintain secure contact with the surface of the material being drilled throughout the operation. By a further choice of materials, design and adapting the structure to fit snugly to the surface being drilled into, a substantial part of the grinding and impact noise of the drill against the stone surface during the drilling operation can be muffled. The shape and size of cup-shaped body 20 may be varied over a modest range to accommodate various sizes or lengths of drills and to fit over or around special structures to be drilled into although the embodiment of the invention illustrated herein is primarily adapted to surrounding said rotary hammer drill bits while being drilled into flat surfaces.

Said cup-shaped body 20 terminates at its apex in a neck portion 22 which should be approximately one-third the overall height of the body and neck together and the outside diameter of said cup-shaped body 20 should be at least twice as great as the depth of said body in order to allow the structure to flex during the drilling operation and to still serve as a container for the debris collected. Said neck portion 22 is provided with a longitudinal tubular opening 23 through the length of the neck and of sufficient diameter to permit the passage of a variety of sizes of rotary hammer drill bits.

Rotary hammer drill bits 14 are usually provided with a shank stop structure 24 at an intermediate point along the shank of said drill bit and the combined height of cup-shaped body 20 and neck 22 should be approximately equal to the distance between the tip of said drill bit 14 and the forward end of said drill bit shank stop 24 for the longest drill to be used with the particular device. The invention described herein is designed to accommodate several sizes of interchangeable drill bits but the reader will appreciate that it

may require an assortment of two to four sizes of the protective device described to accommodate the entire range of sizes of rotary hammer drill bits. Fig. 2 of the drawings herein show drill bit 14 extending slightly beyond the forward edge of body 20 but this is for illustration purposes only. Under proper operating conditions the neck of the device should ride against the bit shank stop and the forward lip 21 of the device should press firmly against the surface to be drilled in as the drill is started. Engagement between forward lip 21 of body 20 is necessary to both muffle the sound from the drill and to prevent stone dust and debris from escaping into the work area. The device must also press against the work surface sufficiently to prevent it from turning with the drill. If the device spins with the drill, debris will be spun out and the utility of the device nullified.

In order for body 20 to stay secured to the work surface and not be drug with the drill bit during operation a slidable bearing surface must be provided between the inside walls of tubular opening 23 and drill bit 14. This slidable bearing surface is provided by an insertable, removable, adaptable shank coupling 25 which is illustrated in FIG. 5. Part of said shank coupling fits over neck 22 and is provided with a shoulder bearing surface 26 which is adapted to ride on the forward surface of shank stop 24 of a commercial rotary hammer drill bit. Extending from said shoulder 26 of shank coupling 25 is a flexible sleeve 27 bearing surface designed to extend a substantial distance into the tubular opening 23 of neck 22. Said shank coupling 25 is fabricated from metal or other suitable bearing material and is constructed in such manner as to keep the side walls of tubular opening 23 parallel to the shank of drill bit 14. The flexibility of said shank coupling 25 and associated bearing sleeve 27 will permit the device described herein to fit and operate with a range of sizes of drill bits. By removing a particular shank coupling and inserting a substitute shank coupling 25 with a larger or smaller sleeve 27 the device can be adapted to accommodate and operate with a further range of sizes of drill bits. It should be appreciated that shoulder 26 of said shank coupling must absorb part of the up and down blows of the rotary hammer and both shoulder 26 and sleeve 27 must permit drill bit 14 to rotate without hindrance.

Since the accumulation of loose stone dust and debris in the vacant space between shank coupling 25 and the walls of tubular opening 23 in neck 22 would cause binding and excessive wear on said shank coupling, a diaphragm 28 is provided across the interior opening of the tubular passage through neck 22. This diaphragm 28 can be fabricated from flexible rubber, plastic or a thin section of the same material from which body 20 is constructed. A small hole through the center of said diaphragm 28 permits the passage of drill bit 14 through neck opening 23 and diaphragm 28 without permitting stone debris to work back into the neck opening.

The reader's attention is called to FIG. 4 to note that the structure of body 20 is thickened in the area of points 29 and 30 and is relatively thin at point 21. This facilitates the flexing of said cup-shaped body at a point 21 as shown in FIG. 4. This flexing permits body lip 21 to maintain constant contact with the work surface and the flexible material from which body 20 is fabricated is even more resistant to sound conduction when in said flexed position.

Under most circumstances where the device described herein is fabricated from a medium-hard rubber or comparable material, the broadened surface of lip 21 will be sufficient to seal or secure contact between the forward surface of body 20 and the work surface. In other instances where a more effective seal or a more effective sound barrier is needed the lip area may be modified as shown in the alternate version of lip 21 in FIG. 6 by adding an insert ring of very soft sound absorbant material 31 in recessed groove 32 within said lip 21.

OPERATION

In operation, device 20 is mounted on the bit of a rotary hammer and the lip 21 of the cup-shaped body 20 is placed firmly against the ceiling or wall. This provides an airtight compartment for the collection of the debris which otherwise would fall on the operator and into the equipment. The motor 12 is then turned on and the bit 14 thereby activated. As the bit 14 advances cup-shaped body 20 being flexible gives inwardly and dust and debris is collected in the bowl of body 20. Since said body 20 is made of a flexible and resilient material and the compartment created is virtually airtight and the sound of the drilling operation is absorbed and greatly reduced.

ADVANTAGES

A major advantage of this invention is that it greatly reduces the noise and dust which result from the process of drilling holes in cement or stone. Such operations carried out in interior locations can create so much noise and dust in a few minutes as to render the room or area where the work is being done untenable. The noise may be so great as to drive office workers entirely out of the building and a cloud of stone dust can so pollute the atmosphere in a room as to force interruption of work for lengthy periods of time. This invention eliminates much of this problem by surrounding the immediate work area where the rotary hammer drill comes into cutting contact with the concrete or stone with a small flexible housing that will both confine the dust and debris from the drill bit and muffle the noise produced by the operation of said tool.

Another advantage of the invention is that it provides a protective device that will permit the operator to drill into overhead stone without having the dust and debris fall back in his eyes and face.

A further advantage of this invention is that the device is adaptable to various sizes of drill bits. A flexible collar located along the inner edge of the neck aperture enables the opening to expand or contract as necessary to fit the size of the bit being used. Since the device attaches to and operates with the drill bit instead of being attached directly to the drill or rotary hammer, the device can be used with a number of items of commercial stone-drilling apparatus without requiring modification of the drill or rotary hammer.

Another advantage of the invention is that the device is attached to the associated drill or rotary hammer by a means that does not require any material change in the existing structure of the hammer or drill thereby making it possible to attach the device to existing commercial drills and rotary hammers.

Although this specification describes but a single embodiment of the invention with certain applications thereof, it should be understood that structural or material rearrangements of adequate or equivalent parts, substitutions of equivalent functional elements and other modifications in structure can be made and other applications devised without departing from the spirit and scope of my invention. I therefore desire that the description and drawings herein be regarded as only an illustration of my invention and the invention be regarded as limited only as set forth in the following claims, or as required by the prior art.

I claim:

1. An improved dust-collecting and sound-suppressing protective device for use with rotary hammers, said improved device comprising:

A. a cup-shaped, dust-collecting body adapted to surround an operating rotary hammer drill bit to collect dust and debris thrown out by the drill bit and to muffle part of the noise produced by operation of the bit, said cup-shaped body being

1. fabricated from a resilient, flexible material having poor sound-conducting characteristics;

2. the outside diameter of said cup-shaped body being at least twice as great as the depth of said body; and

3. having a neck portion situated at the apex center of said cup-shaped body, said neck
 - a. having a length equal to at least two-thirds of the depth of the cup-shaped body;
 - b. being provided with a longitudinal tubular opening through the neck; and
 - c. said tubular opening through the length of the neck being of sufficient diameter to permit the passage of a rotary hammer drill bit;
- B. a broadened lip area along the periphery of the cup-shaped body with said lip area being adapted to fit snugly against a wall or a reasonably flat surface; and
- C. an insertable, removable adaptable shank coupling adapted to fit over said neck structure and extend into the tubular opening through said neck, said shank coupling having:
 1. a bearing shoulder shaped to ride on the surface of the shank stop of a commercial rotary hammer drill bit;
 2. a sleeve bearing surface adapted to extend into the tubular opening in the neck and to provide resilient engagement with the side walls of said rotary hammer drill bit.
2. The improved dust-collecting and sound-suppressing protective device described in claim 1 with a flexible diaphragm extending across the interend of the tubular neck opening of said device and an appature in said diaphragm through which the drill stem of a rotary hammer drill bit may pass.
3. The improved dust-collecting and sound-suppressing protective device described in claim 1 except that part of the broadened lip area along the periphery of the cup-shaped body of said device is fabricated from a soft, highly plyable material adapted to conform to and fit snugly against granular surfaces such as unfinished cement.
4. An improved dust-collecting and sound-suppressing protective attachment for use with rotary hammers, said improved device comprising:
 - A. a cup-shaped, dust-collecting body adapted to surround an operating rotary hammer drill bit to collect dust and debris thrown out by the drill bit and to muffle part of the noise produced by operation of the bit, said cup-shaped body being
 1. fabricated from a resilient, flexible material having poor sound-conducting characteristics; and
 2. having a neck portion situated at the apex center of said cup-shaped body, said neck
 - a. being provided with a longitudinal tubular opening through the neck;
 - b. said tubular opening through the length of the neck being of sufficient diameter to permit the passage of a rotary hammer drill bit;
 - B. a broadened lip area along the periphery of the cup-shaped body with said lip area being adapted to fit snugly against a wall or a reasonably flat surface; and
 - C. an insertable, removable adaptable shank coupling adapted to fit over said neck structure and extend into the tubular opening through said neck, said shank coupling having:
 1. a bearing shoulder shaped to ride on the surface of the shank stop of a commercial rotary hammer drill bit; and
 2. a sleeve bearing surface adapted to extend into the tu-

- bular opening in the neck and to provide resilient engagement with the side walls of said rotary hammer drill bit.
5. The improved dust-collecting and sound-suppressing protective device described in claim 1 with a flexible diaphragm extending across the interend of the tubular neck opening of said device and an appature in said diaphragm through which the drill stem of a rotary hammer drill bit may pass.
6. In rotary hammer-type apparatus for drilling holes in cement and stone surfaces, said apparatus comprising:
 - A. a conventional rotary hammer tool including,
 1. a tool housing assembly,
 2. a motor to drive said tool,
 3. means for connecting said motor to a source of motive power,
 4. a drive shaft driven by said motor, and
 5. a chuck adapted to receive and hold interchangeable rotary hammer drill bits including shank stops on said drill bits;
 - B. A cup-shaped, dust-collecting and sound-suppressing protective body adopted to surround an operating rotary hammer drill bit to collect dust and debris thrown out by the drill bit and to muffle part of the noise produced by operation of the bit, said cup-shaped body being,
 1. fabricated from a resilient, flexible material, having poor sound-conducting characteristics;
 2. the outside diameter of said cup-shaped body being at least twice as great as the depth of said body; and
 3. having a neck portion situated at the apex center of said cup-shaped body, said neck
 - a. having a length equal to at least two-thirds of the depth of the cup-shaped body;
 - b. being provided with longitudinal tubular opening through the neck; and
 - c. said tubular opening through the length of the neck being of sufficient diameter to permit the passage of a rotary hammer drill bit;
 - C. a broadened lip area along the periphery of the cup-shaped body with said lip area being adapted to fit snugly against a wall or a reasonably flat surface; and
 - D. an insertable, removable adaptable shank coupling adapted to fit over said neck structure and extend into the tubular opening through said neck, said shank coupling having:
 1. a bearing shoulder shaped to ride on the surface of the shank stop of a commercial rotary hammer drill bit;
 2. a sleeve bearing surface adapted to extend into the tubular opening in the neck and to provide resilient engagement with the side walls of said rotary hammer drill bit.
7. The improved dust-collecting and sound-suppressing protective device described in claim 1 with a flexible diaphragm extending across the interend of the tubular neck opening of said device and an appature in said diaphragm through which the drill stem of a rotary hammer drill bit may pass.
8. The improved dust-collecting and sound-suppressing protective device described in claim 1 except that part of the broadened lip area along the periphery of the cup-shaped body of said device is fabricated from a soft, highly plyable material adapted to conform to and fit snugly against granular surfaces such as unfinished cement.