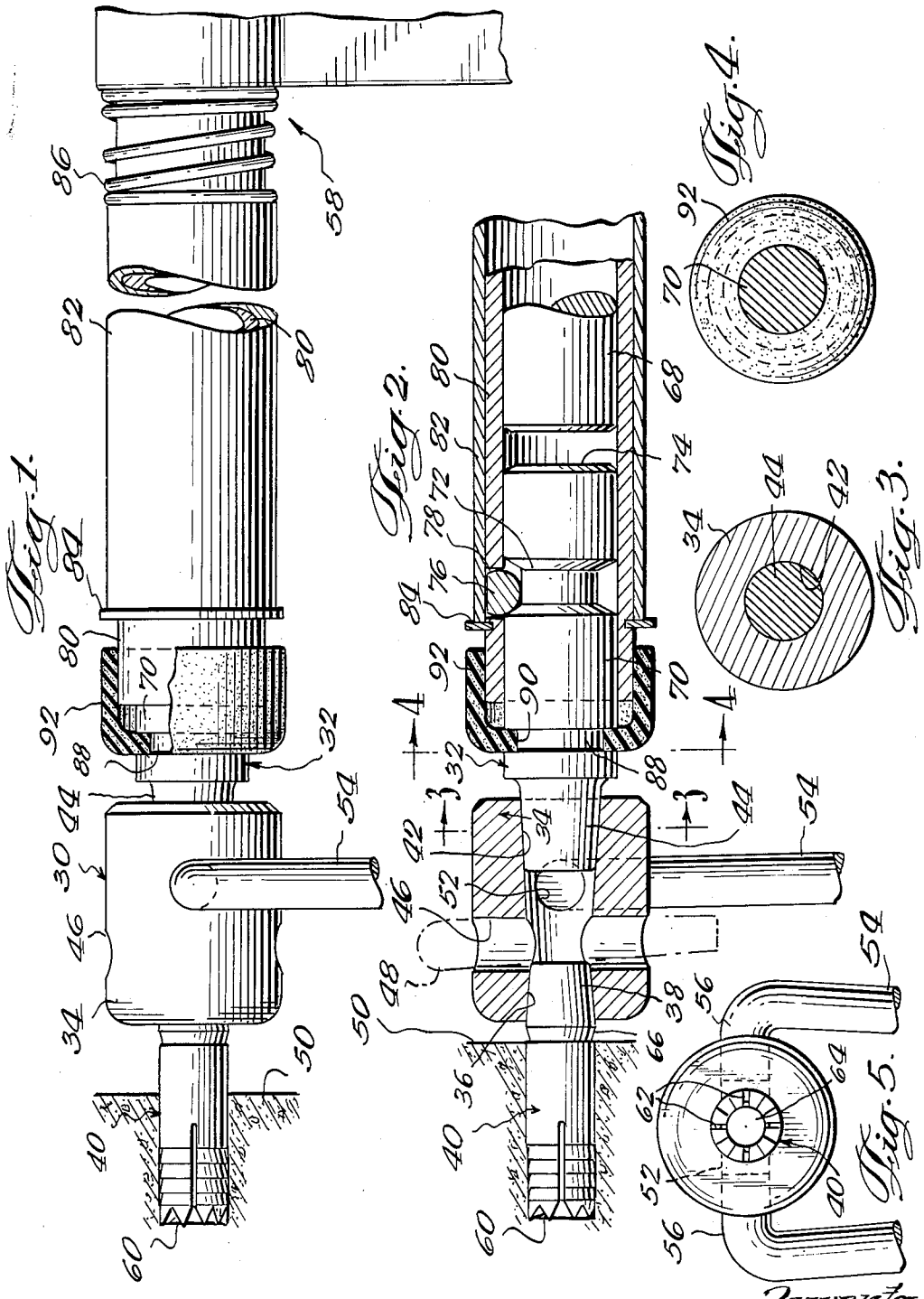
April 3, 1962 F. A. WERSTEIN 3,028,167

ADAPTER OR PERCUSSIVE MEMBER FOR SELF-DRILLING EXPANSION SHELLS

Filed Oct. 15, 1959 3 Sheets-Sheet 1

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Filed Oct. 15, 1959 3 Sheets-Sheet 2

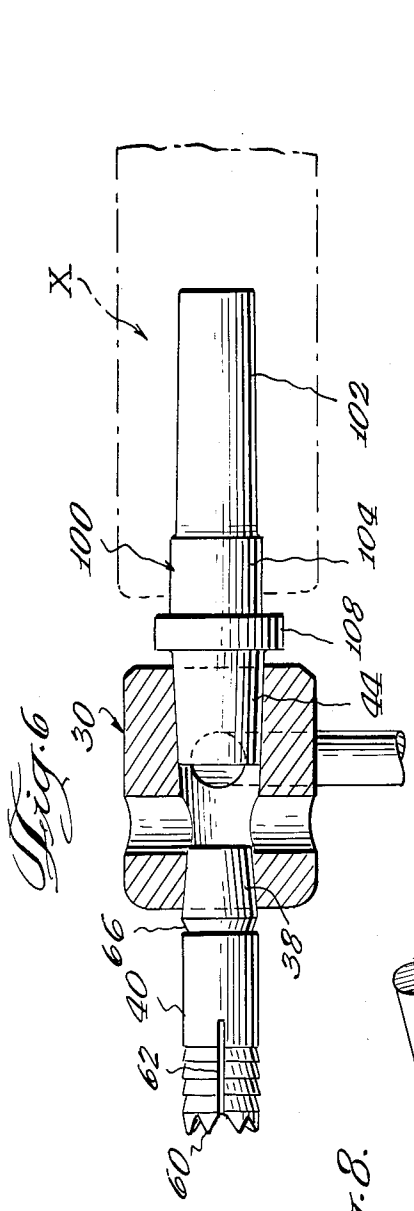


Fig. 6

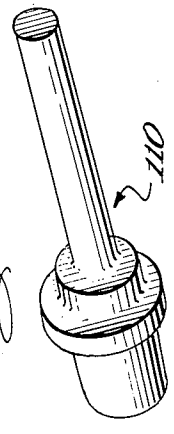


Fig. 8

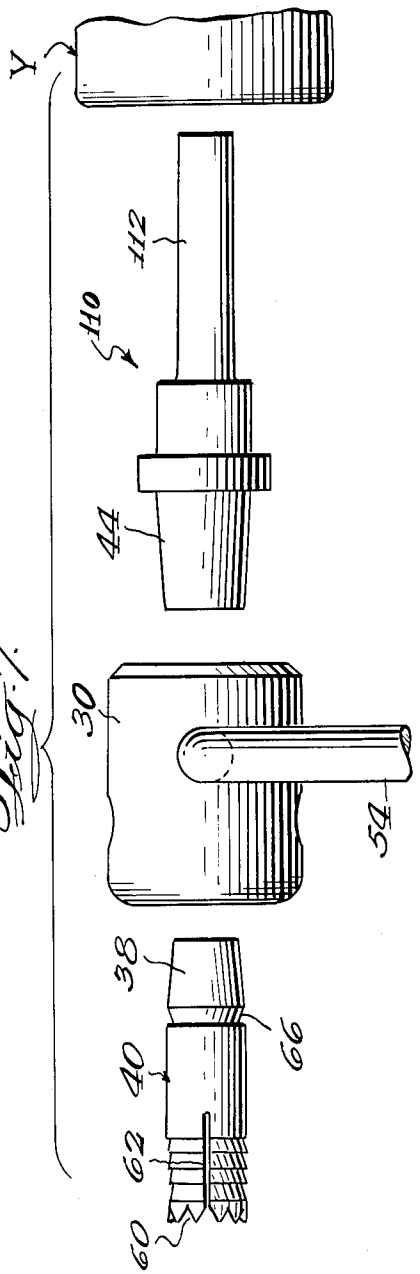


Fig. 7

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ADAPTER OR PERCUSSIVE MEMBER FOR SELF-DRILLING EXPANSION SHELLS

Filed Oct. 15, 1959 3 Sheets-Sheet 3

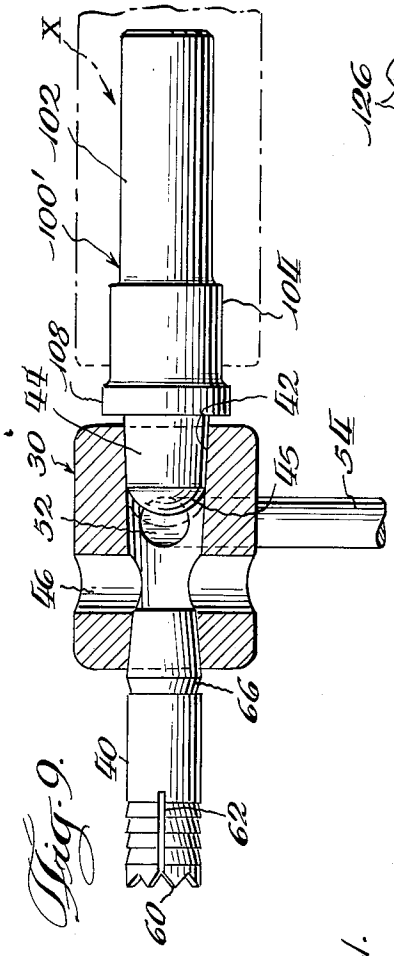


Fig. 9.

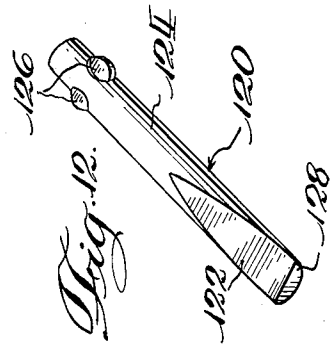


Fig. 12.

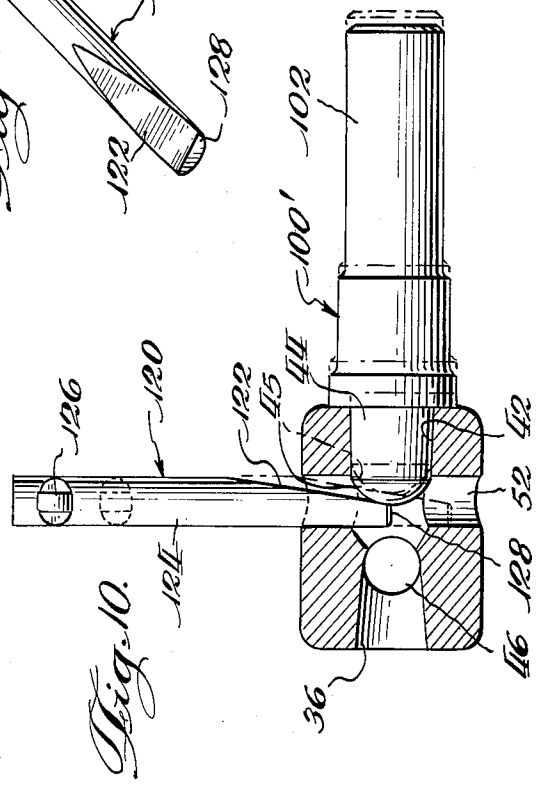


Fig. 10.

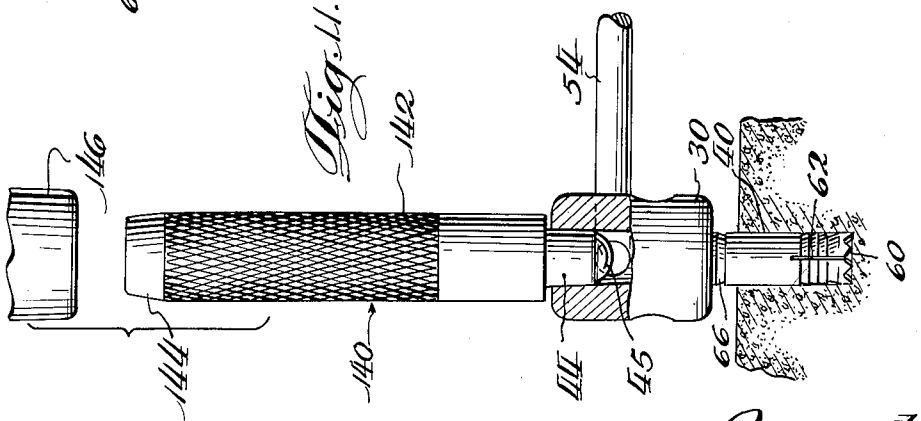


Fig. 11.

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3,028,167

# ADAPTER OR PERCUSSIVE MEMBER FOR SELF-DRILLING EXPANSION SHELLS

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6 Claims. (Cl. 279—19)

This invention relates generally to the art of installing self-drilling expansion shells but more particularly is concerned with a novel adapter or percussive member which is adapted to be used with a tool holder or chuck for installing the shells either with percussive hammers or manually.

The application herein is a continuation-in-part of a co-pending application entitled "Chuck and Adapter for Self-Drilling Expansion Shells," Serial No. 681,689, filed September 3, 1957, now Patent No. 2,918,290.

The so-called self-drilling expansion shell with which the invention herein is concerned principally comprises a hollow cylindrical member having sharp axially directed teeth at one end and having its opposite end tapered to enable the member to be mounted in a socket provided in a chuck. Axially extending grooves are provided on the shell body at the toothed end to enable the expansion of the shell in the installation of the same. The tapered portion may have a circumferential groove spaced from its end so that the tapered portion may be broken off by lateral strain after installation, to enable the shell to remain flush in the masonry. Shells of this construction are shown and described in U.S. Patent 1,996,121. Tapered end shells are shown and described also in U.S. Patents 1,746,050 and 1,621,598.

The shells are installed in masonry, concrete or stone by percussion. The chuck is mounted on the operative end of a pneumatic, electric or mechanical hammer, the shell inserted in the chuck and the shell is engaged against the masonry while the hammer delivers its blows. The shell teeth drill a hole in the masonry and the debris and cuttings pass through the hollow center of the shell and out of a passageway provided in the chuck. The passageway is for ejection of the shell by means of a suitable tool in a manner shown in U.S. Patent 1,786,029. While the hole is being drilled, the entire chuck is rocked or oscillated back and forth about the axis of the shell through the use of a bail or handle which is rotatively journalled in the chuck. A chuck such as described is illustrated in U.S. Patent 2,767,988 and in U.S. Patent 1,968,055, both of the latter two patents illustrating one type of electric hammer which may be used to install these self-drilling shells.

After the hole has been drilled, the shell is withdrawn and the hole cleaned. Thereafter a tapered plug is inserted in the toothed end, the shell re-inserted in the hole and hammered home. The tapered plug spreads the toothed end by splitting same along the fracture grooves, expanding the shell within the hole, causing the teeth to bite laterally into the walls of the hole, and permanently securing the shell within the hole. Thereafter, the shell is ejected from the chuck by some suitable tool, or its tapered end may be broken off and the broken off end later forced out of the chuck.

As pointed out in the said co-pending application, there are many constructions for percussive hammers and as well numerous sizes of shells. The prior structures for driving the shells comprised integral members each having a socket at one end for receiving the shell and a shank at the opposite end to fit the particular hammer that the workman was using. The invention of said copending application was directed to a structure in which the number of pieces needed to accommodate all sizes of shells



and all types of hammers was reduced very materially through the construction of a tool holder that had a first socket at one end for receiving the shell, a transverse passageway to permit debris to pass from the center of the hollow shell and through said first socket, and a second socket at the other end which was of universal size and hence would fit any of a large number of adapters each of which had a tapered male portion at one end thereof, all male portions being identical. The other ends of the adapters were constructed differently to fit any one of a large group of different percussive hammers.

The structure claimed in said co-pending application was not limited to any particular connection between the tool holder and adapter. There was particularly described and illustrated, however, an adapter that had a frusto-conical male end adapted to be engaged in the tool holder, and the invention herein is concerned primarily with this type of adapter or percussive member. The invention herein, as in the said co-pending application, is not limited to percussive hammers, but is also applicable to structures in which the installation is manual, by the use of a bar held in the band, struck with a hammer and having a male portion at the end thereof engaging in the tool holder.

Certain objects of this invention are common with the objects of the invention of the said co-pending application. In addition, this invention has as other objects: the provision of an adapter for use with a tool holder and having a tapered male end adapted to be engaged in the tool holder and a formation at the opposite end adapted to be engaged in a percussive hammer; the provision of an adapter for engagement in a tool holder with means for limiting the axial entry of the end of the adapter into the tool holder; the provision of an adapter or the like with a cam-like end formation enabling the same to be readily ejected from the tool holder as desired; and the provision of a special ejector tool for use with the last-mentioned adapter and tool holder.

Other objects will occur to those skilled in this field as the invention is described in connection with the drawings, in which preferred embodiments are illustrated.

In the said drawings:

FIG. 1 is a side elevational view of a chuck and adapter constructed in accordance with the invention of the said co-pending application and that herein, associated with a percussive hammer and having a self-drilling expansion shell seized therein, portions being shown in section.

FIG. 2 is a similar view but illustrating the same in section, and in this view the shell has been fully driven into the masonry. In this as well as the previous view, only a fragmentary portion of the hammer is shown.

FIGS. 3 and 4 are transverse sectional views taken along the lines 3—3 and 4—4 respectively of FIG. 2 and in the indicated direction.

FIG. 5 is an end-on elevational view of the chuck and adapter taken from the left-hand end of FIG. 1.

FIG. 6 is a sectional view taken through a tool holder of the same structure as that of FIGS. 1 and 2 but illustrating the same associated with a different form of adapter.

FIG. 7 is an exploded elevational view of the parts similar to those shown assembled in FIG. 6, but with a somewhat different form of adapter.

FIG. 8 is a perspective view of the adapter of FIG. 7.

FIG. 9 is a view similar to that of FIG. 6 but showing a form of the adapter in which the end has been modified in accordance with one phase of the invention.

FIG. 10 is a view similar to that of FIG. 9, but in this case the self-drilling shell is not shown, and the structure has been rotated axially through approximately 90°. In addition, the bail or handle has been removed from its

transverse passageway and a special ejector tool has been inserted and is shown in the process of separating the tool holder and adapter.

FIG. 11 is an elevational view, partly in section, illustrating the modification of the end of the adapter of FIGS. 9 and 10 applied to a manual driving bar for installation of shells with a hammer.

FIG. 12 is a perspective view of the special ejector tool used in connection with the structures of FIGS. 10 to 12.

The prior art structures were formed of integral metal members having a chuck formed at one end, and means for inserting the chuck into a percussive hammer at the other end. No means were ever provided for driving the shells manually by using a structure like that of the chuck itself.

FIGS. 1 and 2 best illustrate one phase of the invention. Instead of an integral chuck as in the prior art, there are formed two parts, namely, a tool holder 30 and an adapter 32. The tool holder comprises a cylindrical member 34 having one end, the left in the figures, provided with an axial socket 36 of such dimensions to receive the tapered end 38 of a self-drilling shell 40 of a predetermined size. The right-hand end of the cylindrical member has another socket 42 of tapered formation, so dimensioned to receive the male tapered end 44 of the adapter 32.

The tool holder is also provided with a transverse passageway 46 which passes completely through the cylindrical member 34 and is intended to receive the ejector tool shown in fragmentary broken outline 48 in FIG. 2. Note that the tapered end 38 extends partially into the passageway 46 so that if the ejector tool 48 has a thickness approximately that of the passageway 46 but is provided with a flat portion disposed opposite the end 38, rotation of the ejector tool will wedgingly disengage and force the end 38 out of its socket 36. Since the self-drilling shell is hollow, as it is hammered and drilled into the masonry 50 the stone dust and debris will work its way through the center of the shell 40 and out of the rear thereof through the passageway 46.

Another transverse passageway 52 is formed in the cylindrical member 34 preferably at right angle to the passageway 46. A bail or handle 54 is journalled in this transverse passageway. The passageway 52, in function, is the same as attributable to aligned sockets formed on opposite sides of the cylindrical member 34. This is because, as shown in FIG. 5, the handle 54 is in the form of a loop having a pair of opposed short inwardly bent facing ends 56 which engage in the ends of the passageway 52. Thus, in this case, it is not necessary that the passageway 52 extend all the way through the cylindrical member 34. The handle 54 may swing about the axis defined by the ends 56, and is used to steady and support the percussive hammer 58 when the drilling is commenced. It is used also to oscillate the chuck and adapter with the shell 40 during the drilling process.

The shell 40 which is illustrated has hardened teeth 60 on its forward end and several fracture grooves 62 adjacent that end so that the shell may be expanded in its own hole for securement. Its hollow center can best be seen at 64 in FIG. 5. The particular shell 40 illustrated is intended to be driven into the masonry 50 and to have its tapered end 38 broken off by sudden lateral strain. This is normally done by merely forcing the hammer 58 downward as viewed in FIG. 2 after the shell 40 has been driven home. The annular fracture groove 66 provides a weakened area at which the fracture occurs.

According to the invention, all of the tool holders 30 are identical, regardless of the kind of percussive device with which the same are to be used, except for the size of the tapered socket 36. Every tool holder illustrated, therefore, may have identical construction, including those in FIGS. 1, 2, 3, 6, 7, 9, 10 and 11. All of the tool holders 30 has the identical rear tapered socket 42 regardless of the size of the front socket 36, and this rear socket 42 is chosen of some standard and easily formed construction, fully capable of transmitting the desired impacts for any size of shell with which the tool holder may be used.

It will become apparent from the description of another phase of the invention, as set forth below, that it is preferred that the passageway 52 extend completely through the tool holder 30 so that the tool holder 30 and adapter 32 may be separated by means of a special ejector tool. This requires the removal of the handle 54 from the passageway 52, which may be accomplished simply by pulling the ends 56 out of the ends of the passageway 52. The handle 54 is usually formed of heavy, but resilient wire.

As previously explained, the adapter 32 is of a particular construction intended to be used with an electric hammer 58 of cooperative construction. The hammer as illustrated includes a structure for mounting the adapter which is described in considerable detail and claimed in said U.S. Patent 2,767,988, which is owned by the assignee of this application. There is a reciprocating plunger 68 which rapidly and repeatedly transmits blows to the impact end 74 of the shank 70 of the adapter 32. The shank 70 has an annular groove 72 spaced from the impact end 74, the axial length of which controls the stroke of the hammer, being confined in its reciprocating movement by the key 76. This key 76 is confined in a slot 78 formed in the tube 80 of the hammer and locked in place by telescopically slidable sleeve 82 which covers the same and is pressed against a stop ring 84 by the spring 86.

Adjacent its forward end the shank 70 has an annular groove 88 formed therein and said groove seats the annular lip 90 of a cup-shaped member 92 which serves as a dust cap for this particular adapter.

As explained in the said co-pending application, the invention therein primarily related to a structure in which one adapter such as 32 would enable the user of the percussive hammer 58 to install any size of shell 40 merely by having a tool holder 30 for each size of shell instead of being required to have a complete chuck structure which includes the shank portion. Further, the same identical tool holders are suitable for use with any one of a large number of adapters each designed to fit into the working end of a different kind of percussive drill, the only requirement being that all tool holders having the same socket formation 42, and all adapters having the same frusto-conical male formation 44 at their ends.

In FIG. 6 there is illustrated a chuck and adapter which comprises the identical tool holder 30 suitable for mounting the shell 40. The adapter in this case is different from the adapter 32 because it is intended to be used with a different construction of hammer. Thus, the adapter 100 has a rear shank portion 102 of elongate cylindrical structure with a short section 104 of greater diameter separated from the tapered male end part 44 by an annular collar portion 108. It is desired to emphasize that the surface dimensions of the tapered part 44 are identical to those of the tapered part 44 of the adapter 32 (and of all other adapters illustrated and described therein). This being so, obviously the adapter 100 will also fit into all of the tool holders illustrated.

FIG. 8 illustrates still another construction for an adapter 110 which differs somewhat from the adapter 100 in several dimensions. This adapter is to be installed on a still different type of hammer Y which requires, say, a smaller diameter shank 112 than the hammer X. The tapered end 44 is again identical to all others, and the tool holder 32 is also the same as those previously described.

In the same manner, other adapters are constructed to fit other hammers but all will fit the same tool holders and any others that may be made to receive different sizes of shells. In the event a new hammer comes on the mar-

ket, the manufacturer merely makes a new adapter with the identical tapered end **44** and his problem is solved. This tapered end **44** may be described as a frusto-conical formation.

In FIG. 11 there is illustrated a tool holder **30** identical to those described being used to manually install a shell **40** in concrete **50**. In place of an adapter and hammer, there is provided a bar **140** of substantial weight which may have a roughened gripping area **142** and a relatively malleable impact end **144** intended to receive the blows of a hammer head, partially illustrated at **146**. The bottom end of the bar **140** is provided with a tapered male end **44** which is similar in surface configuration to the tapered ends **44** heretofore described. This construction enables the bar and hammer to perform substantially all of the functions performed by an adapter and pneumatic or electric hammer, but without the convenience of a power drive, of course. Since the identical tool holders are used, and the engagement of the end **44** in the socket **42** is tight, the bar **140** can be twisted back and forth while hammering its end to cause the formed hole to be smooth and true. The debris and cuttings come up the center of the shell and work out through the ejector passageway.

The tapered end **44** as thus far described is formed as a frusto-conical formation, but with a planar axial end in the structures of FIGS. 2, 6, 7 and 8. This tapered configuration is in every case tightly engaged in a suitable socket **42** in tool holder **30** enabling the necessary blows to be applied, either with the percussive hammer or through a suitable bar similar to that of FIG. 11 to drive the shell **40**. The tool holder **30** is not deformed or peened in any way due to this arrangement, although the male formation **44** of the adapter is in every case tightly driven into the socket **42**. In order to prevent the adapter end **44** from being driven too far into the tool holder **30**, a situation which conceivably could result in deformation of the end of the tool holder or splitting of the same, the limiting annular collar formation **108** is provided which will engage against the tool holder as for example in FIG. 10.

The tight engagement of the tapered configuration **44** in the socket **42** might require the driving of a tool of some kind up the hollow bore of the tool holder **32** to separate the same, but a preferred expedient is shown in FIGS. 9, 10, 11 and 12. In these figures there are illustrated tool holders such as **100'** and the manual bar **140**, which have a rounded extension **45** at the free ends of the frusto-conical formation **44**. This extension will be referred to as "spherical" although its surface configuration may not conform to spherical. The spherical formation enables the frusto-conical end portions **44** of the adapter **100'** and the bar **140** (or any other adapter or percussive member which may be so constructed) to have as great surface-to-surface contact as any of those which have planar ends. The spherical formation is an extended portion of the adapter **100'**.

The normal position of the portion **44** of the adapter **100'** in the socket **42** is such that the spherical extension **45** protrudes slightly into a projection of the passageway **52**, for example, like the solid line illustration of FIG. 9. If any difficulty is experienced in removing the tool holder from the adapter, as for example, when it is desired to use a tool holder **30** for a different size shell, the handle **54** is removed by springing the ends **56** apart. Thereafter, the tapered wedge-like end **122** of a special ejector tool **120** is inserted in the passageway **52** and driven into the passageway with a hammer. The tapered end **122** cooperates with the spherical extension **45**, camming same to move axially, to the right as in FIGS. 9 and 10. The diameter of the body **124** of the tool **120** is slightly less than that of the passageway **52** and there may be projections **126** to prevent the tool from being driven completely through the passageway **52** and flying out the other side.



The broken lines of FIG. 9 show how the spherical end **45** may be driven further into the socket **42** after a long period of hard usage, for example, and the solid lines of FIG. 10 show the special ejector tool being used to eject the adapter from the tool holder in alleviation of this condition. The broken lines of FIG. 10 comprise a second position of the parts during ejection. The spherical end **45** enables the ejector tool **120** to be used, even where the spherical extension **45** has practically completely closed off the passageway, because only the engagement of the tip **128** of the tool **120** against any part of the surface of the spherical portion will start the camming action.

The bar **140** and its tool holder **30** are separated in the same manner.

It will be appreciated that variations of the details of the invention are capable of being made without departing materially from the spirit or scope of the invention as defined in the appended claims.

What it is desired to secure by Letters Patent of the United States is:

1. An adapter for mounting an expansion shell holder upon a percussive drill and comprising a shank portion adapted to be drivingly engaged in said drill, and a frusto-conical projection on the end of said adapter opposite said shank adapted to be engaged with said shell holder, said projection having a spherical extension at the free extremity thereof.

2. An adapter as claimed in claim 1 in which an annular collar is provided rearwardly of said projection having a diameter substantially greater than the maximum diameter of said projection.

3. Means for drivingly mounting a tapered end, hollow, self-drilling expansion shell upon a percussive drill which has a cavity for receiving and securing a particular tool formation therein, which comprises a pair of separable members, one being a shell holder and the other being an adapter, the shell holder having a tapered socket at one end for tightly receiving the tapered end of said shell therein and a second tapered socket at its second end, a transverse discharge outlet for cuttings intersecting said first mentioned socket, said adapter having a shank of said particular tool formation at one end thereof and a frusto-conical formation at the opposite end of said adapter tightly engageable with said second tapered socket, a transverse passageway in said shell holder intersecting said second tapered socket, at least a portion of the said opposite end protruding into said transverse passageway and having a spherical axial extremity in the passageway whereby a camming tool may be driven into said passageway to eject said adapter from said second tapered socket.

4. A structure as claimed in claim 3 in which said adapter has an annular collar formed rearward of said frusto-conical formation to limit the extent to which said formation may be axially driven into said second tapered socket.

5. A structure as claimed in claim 3 in which there is provided a handle having a pair of resilient aligned trunnions respectively engaged in the ends of said transverse passageway and being removable by spreading said trunnions to permit entry of said camming tool.

6. In combination, a tool holder having a first tapered axial socket at one end for receiving therein a hollow, self-drilling expansion shell and a first transverse passageway intersecting the first axial socket to enable discharge of cuttings therethrough, a second tapered axial socket at the second end and a second transverse passageway intersecting said second socket, a percussive member having a frusto-conical male formation and a spherical protrusion on the end thereof tightly engaged in said second socket with at least a portion of said protrusion extending into said second transverse passageway, and an ejector member having a wedge-like planar surface

with a thin tip, the ejector member adapted to be driven into said second passageway to bring one of either said tip or surface into engagement with said spherical protrusion to forcibly eject said member axially from said second socket in a camming action.



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