July 18, 1967 C. B. KREKELER 3,331,637

CUTTER BITS AND MOUNTING MEANS THEREFOR

Filed May 7, 1965 2 Sheets-Sheet 1

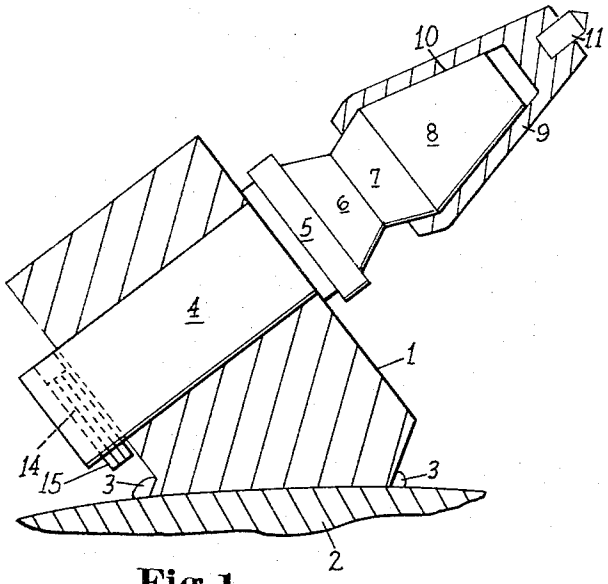


Fig.1

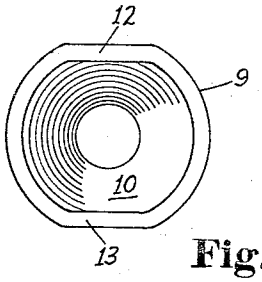
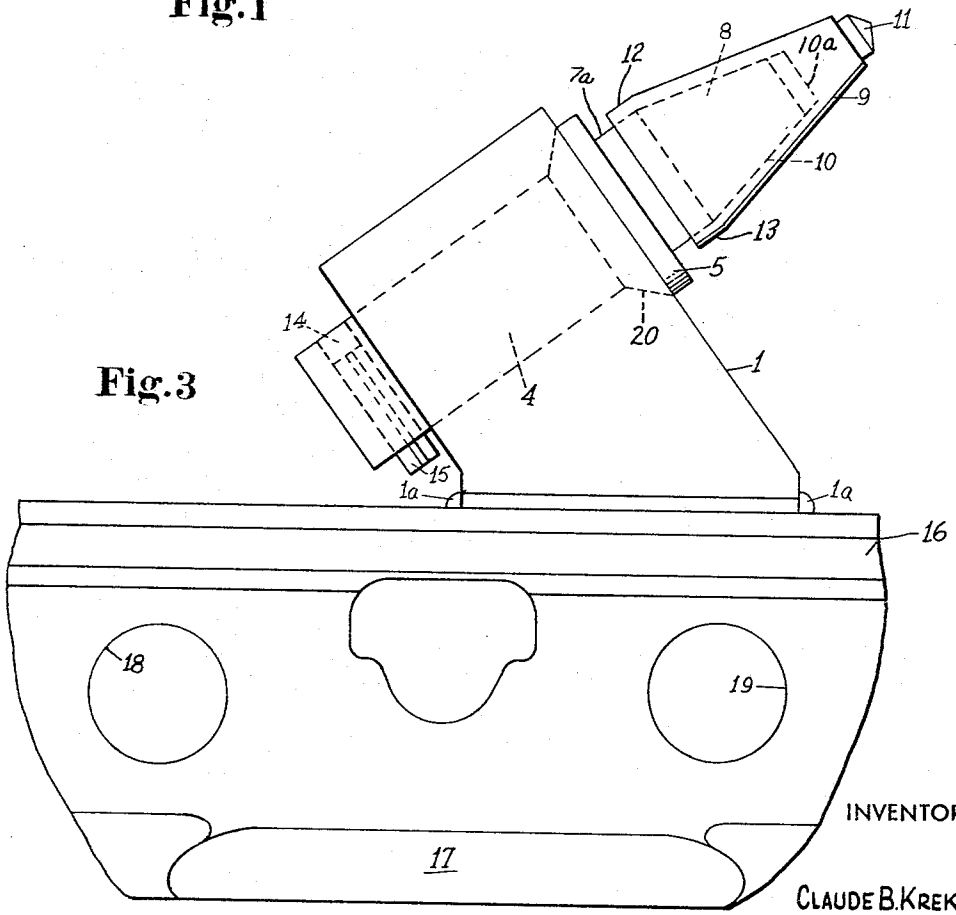


Fig.2

Fig.3



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CUTTER BITS AND MOUNTING MEANS THEREFOR

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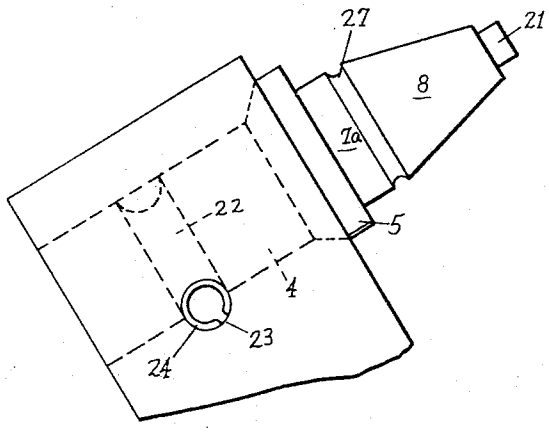

Fig. 4

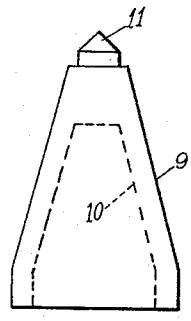

Fig. 5

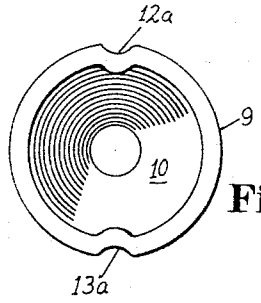

Fig. 8

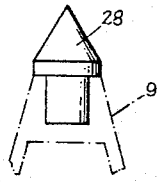

Fig. 7

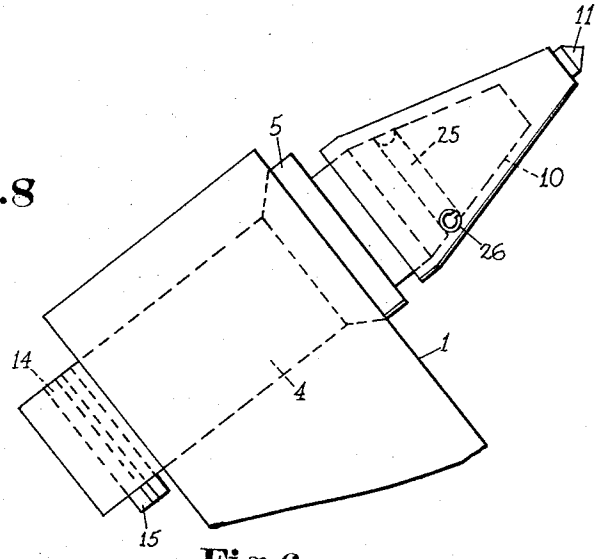

Fig. 6

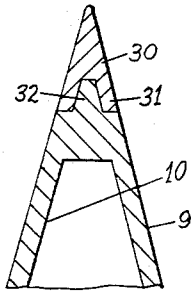

Fig. 9

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CUTTER BITS AND MOUNTING MEANS THEREFOR

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Filed May 7, 1965, Ser. No. 454,002
12 Claims. (Cl. 299—92)

This application is related to the copending cases of the same inventor Ser. No. 432,981, filed Feb. 16, 1965. and entitled, Cutter Bits of Heavy Construction and Means for Mounting Them, and Ser. No. 439,586, filed Mar. 15, 1965 and entitled, Cutting Structures for Mining Machines, and is a continuation-in-part of the said applications.

This case relates to cutter bits for mining machinery and means for mounting the said cutter bits in cutting positions and for driving them against the face of a seam of coal or other mineral to be mined. More especially this case relates to cutter bits having a conical or tapering exterior configuration with a piece of hard cutting alloy mounted at the tip of the bit. There has recently been considerable interest in the mining industry in bits of this general type especially for heavy duty applications where the bits have a greater service life and effect a better usage of the hard alloy tips.

The service life of such bits, moreover, is prolonged if provision is made for the slow automatic rotation or rocking of such bits about their main axis, the movement referred to being a movement generated by the mutual reaction of the bit itself and the mineral being cut.

The first of the above entitled cases discloses various types of cutter bits having conical heads; but it also discloses cutter bits and holders therefor in which the bit itself is a hollow conical member which is engaged by a bit holder. In some of the disclosed structures, provision was made for rotation of the conical bit element with respect to the bit holder. The second of the cases mentioned above teaches inter alia the combination of a lug or socket member and a bit holder where the bit proper is a solid or hollow conical or tapering element which in either case has a frictional engagement with the bit holder. For rotation or a rocking movement as above described, reliance is had upon the possibility of a turning movement effective between the bit holder and the lug.

One of the objects of the present invention is the provision of a structure and combination in which the bit is not necessarily frictionally engaged with the bit holder in such a way that a turning movement will depend upon the rotation of the bit holder with respect to the lug.

Another object of this invention is to provide a structure in which the inter-engagement between the bit proper and the bit holder is simplified, and in which the bit is more readily removable from the bit holder, it being understood that the removal and renewal of the bit itself with respect to the bit holder is generally a simpler and quicker operation than the removal of a bit holder from the lug preparatory to the removal of the bit from the bit holder.

It is also an object of the invention to provide a structure having a superior mounting for the desirable turning movement which has been mentioned above.

It is an object of the invention to provide for a turning movement of the bit with respect to the bit holder as well as to provide for a turning movement of the bit holder with respect to the lug.

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It is likewise an object to minimize the cost and weight of the bit holders as such and the likelihood of breakage of the holders.

An object of the invention is to simplify the structure of conical bits and to lower their cost of manufacture.

It is an object of the invention to provide simplified but adequate means for the engagement of a conical type bit with a supporting means, whether the supporting means be a bit holder as a separate element, or a configuration formed on a lug.

These and other objects of the invention which will be set forth hereinafter or will be apparent to one skilled in the art upon reading these specifications are accomplished by that construction and arrangement of parts of which certain exemplary embodiments will now be described. Reference is made to the accompanying drawings wherein:

FIG. 1 is a view partly in elevation and partly in section of a structure made in accordance with the present invention and comprising a lug, a bit holder and a conical bit.

FIG. 2 is an end view of the bit from the bottom edge thereof.

FIG. 3 is an elevational view of a lug, a bit holder and the bit of this invention mounted upon a link of a mining machine cutter chain.

FIG. 4 is an elevational view of a lug and a bit holder of a somewhat modified form.

FIG. 5 is an elevational view of a typical bit of the present invention.

FIG. 6 is a partial elevational view of a bit and bit holder showing another means for inter-engagement between the two.

FIG. 7 is an elevational view of another type of a hard cutting tip which may be used with the bits of this invention.

FIGS. 8 and 9 are views of bits with different end configurations.

Referring to FIG. 1, there is shown in section a lug or socket member **1** attached to a cutter head **2** of a mining machine as by welding at **3**. The lug member has a perforation to receive the shank **4** of a bit holder; and the lug is so configured as to present the bit later described in a proper position for cutting. While considerable modifications may be made in the bit holder, gauging means will be provided for the shank **4**. Without limitation, the gauging means may be an enlargement **5** which is preferably undercut as shown to permit the holder to be pried out of the lug, should that be necessary. Beyond the enlargement **5** there is a preferably integral nose piece having a first outwardly tapering portion **7** and a second inwardly tapering conical portion **8**. It may also have a base portion **6** if desired.

The bit itself may be made by forging, by upsetting, by a turning operation, as a screw machine product, by powdered metallurgy and in other ways not constituting a limitation here. It has a generally tapering outer body surface as indicated at **9** and an interior surface **10** which may be cylindrical or of other shape but is preferably conical. The bit itself may be provided wih a tip **11** of hard cutting alloy.

The bit **9** may have a frictional engagement with the conical portion **8** of the bit holder. So long as the sloping faces of the interior hollow **10** of the bit and of the outwardly tapering nose portion **8** of the bit holder correspond, have a correct angularity, and are correctly proportioned, the bit can be retained frictionally on the

bit holder in such a way that it will resist the stresses encountered in cutting or "bursting" the mineral, such as coal, being mined. Normally also there will be a little chance of the bit **9** being dislodged from the bit holder accidentally, as by centrifugal force under such frictional conditions. Nevertheless there are circumstances including a reverse travel of the cutting head **2** which might tend to subject the bit itself to extraordinary forces, perhaps accompanied by impact. As a consequence it is desired to provide some more positive engagement between the bit and the bit holder nose.

It has been found that this can easily be attained in a simple and inexpensive fashion by subjecting the end of the skirt of the bit to forces which result in a slight distortion of the end of the bit skirt (as shown in FIG. 2) at one or more places such as those indicated at **12** and **13**. The formation of these detents (which are shown as flats in the figure) does not require any great distortion of the metal, and may be accomplished by compressing the bit between the platens of a press or by swaging or hammering the lower end of the skirt portion of the bit. The operation may be done while the metal is cold; and it may be done either before or after any heat treating of the bit body.

The object is to distort the metal of the end of the bit skirt in such a way that the diameter of the bit skirt at the detent or detents will be slightly less than the diameter of the line of juncture between the reversed conical portions **7** and **8** of the bit holder nose. The end of the bit skirt will require to be expandable in order to pass over the line of juncture aforesaid. This is most conveniently accomplished by placing a bit over the conical portion **8** of the bit holder nose and driving the bit home by a hammer blow on the end of the bit nose, exerted through the use of a tool having an operating face softer than the substance of the hard cutting tip **11**. The driving portion of the tool may be faced, for example, with babbitt, brass, bronze or the like.

Since the distortion of the lower end of the bit skirt is a resilient distortion, the detents **12** and **13** having passed over the line of juncture between the conical portions **7** and **8** of the bit holder nose will reform below it, and will cause a section or sections of the end of the bit skirt to contract against the downwardly tapering conical section **7** of the bit holder, as shown in a somewhat exaggerated fashion in FIG. 1.

The detent or detents formed at the end of the bit skirt may vary as to number and kind. By way of example, FIG. 8 shows the end of a bit **9** having detent portions indicated at **12***a* and **13***a*, which are not in the form of flats, although they are inward depressions of the bit skirt. The detents may have other shapes; but it constitutes a cost advantage to be able to make them by a depressing operation performed on the bit skirt after the bit has otherwise its final shape.

The term "conical" has been used throughout this specification without limitative intent. While a true conical shape is easy and relatively inexpensive to make, the invention may be practiced with bits and bit holders having noses of other shapes including those which are non-circular in cross section (e.g. oval) or those which in cross section have the shapes of polygonal geometrical figures.

The bits of this invention may be made rotatable with respect to the bit holder nose. This generally implies a conical configuration of the nose portion **8** and the interior surface **10** of the bit, but it does not necessarily imply a conformation of these surfaces to each other. They may have different angularities, or they may be held apart as later described. The surfaces **8** and **10** do not have to be machined so as to provide a strong frictional inter-engagement, but on the contrary may be relatively rough forged surfaces. The engagement of the detent portions with the reverse conical surface **7** may be a relatively loose engagement, and yet may be sufficient to prevent loss of the bit.

If the bit **9** has, however, a strong frictional engagement with the bit holder nose, it may be essentially non-rotatable with respect to the bit holder. Where this is the case, it has been found preferable to pass the bit holder shank **4** entirely through the perforation in the lug member **1** in such fashion that the shank itself is rotatable in the lug, and to prevent outward axial movement of the shank **4** through the use of a suitable fastening means. There are a number of fastening means which may be employed. For example, it is possible to thread the protruding end of the bit shank and to provide that end with a nut and a lock nut beyond the body of the lug **1**. A simpler expedient is to provide the protruding end of the shank **4** with a transverse hole **14** and to use a pin member **15** which can be tightly engaged in the hole and which will extend beyond the shank at at least one end. The use of what is known as a "roll pin" constitutes a satisfactory and inexpensive expedient. As is known in the art, a roll pin consists of a piece of resilient sheet metal rolled in such a way as to have a slightly larger diameter than the hole into which it is driven. The roll pin will contract to permit driving into the hole **14**, and the resiliency of the metal of the roll pin will be such as to cause it to retain its position therein.

In the structure of FIG. 1, the shank **4** should have a reasonably accurate fit within the perforation in the lug member **1**; but it is not necessary that the fit be tight or frictional in characteristics. Thus the entire bit holder will be free to turn or rotate with respect to the lug **1** under the forces encountered in cutting. When it becomes necessary to remove a worn bit from the bit holder this may easily be accomplished by engaging a prying tool between the enlargement **5** and the skirt of the bit. The detents **12** and **13** of the bit re-expand so as to pass the line of juncture between the oppositely tapering conical portions **7** and **8** of the bit holder nose.

In the way above described there is provided a positive engagement between the bit and the bit holder over and above any frictional engagement which may exist. Accidental dislodgement of the bit from the bit holder is prevented during the cutting operations. Moreover, adequate provision has been made for the rotation or turning movement of the bit with respect to the surface of the mineral being cut. As set forth in the above mentioned copending cases such a turning or rotating movement equalizes wear on the cutter bit and makes for a longer service life.

In FIG. 3 where like parts have been given like index numerals, the lug **1** is shown as welded at **1***a* to a link element **16** of a cutter chain for a mining machine. The link element may have guide means **17** for coaction with a track about which the chain will be driven; and as readily understood by those skilled in the art, the link element will be pivoted to adjacent link elements by means of pintles passing through holes **18** and **19**.

In FIG. 3 the shank **4** of the bit holder is provided with a gauge shoulder **5** which has a tapering underside **20**. This taper engages in a corresponding countersink at the forward end of the shank receiving perforation in the lug member. One object of this structure is to provide a tighter engagement between the tool holder and the lug member so as to minimize chatter.

Where the bit holder is more tightly engaged in the lug member, it becomes of increasing importance to have the bit rotatable or turnable with respect to the bit holder. The bit **9** of FIG. 3 is engaged with the bit holder nose, the nose having a cylindrical portion **7***a* and an upwardly tapering portion **8**. The engagement of the detents **12** and **13** against the cylindrical portion **7***a* of the bit holder nose will be sufficient to retain the bit in position. The engagement does not have to be a tight engagement, so that the bit may be readily rotatable upon the bit holder nose.

As indicated in FIG. 4, the upwardly tapering portion **8** of the bit holder nose may be provided with an exten-

sion **21**. The extension **21** is adapted to bottom on the end portion **10***a* of the hollow **10** in the conical bit (see FIG. 3) and will prevent undue frictional engagement between the bit and the upwardly tapering portion **8** of the bit holder.

In FIG. 3 the shank of the bit holder extends through the lug **1** and is again held by a roll pin **15** or other suitable holding means. Removal of the roll pins in any of the figures of this application can be readily accomplished in the field by the use of a drift pin driven through the perforation **14** from the opposite end.

In certain instances it may be desired to terminate the shank of the bit holder at or within the perforation of the lug. In such instances, as shown in FIG. 4, the shank of the bit holder may be provided with a peripheral groove **22**. A hole **23** may be bored in the lug transversely to the shank receiving perforation and intersecting it as shown. A roll pin **24** or other means inserted or driven into the hole **23** will serve to maintain the shank **4** in the lug perforation. A similar construction may be employed where it is desired to mount the bit holder directly in a perforation on a cutting arm or cutting head without the intermediary of a lug member.

Another way of fastening a grooved shank in the perforation of a lug or other driving member is by the use of a resilient retaining means such as is described in United States Letters Patent No. 2,965,365 issued Dec. 20, 1960 in the name of the present inventor.

While the portion **7** of the nose of the bit holder of FIG. 1 has been described as a reverse cone, it may, as shown in FIGS. 3 and 4, have other shapes. For the engagement of the detent members the part **7***a* may be provided with a shallow groove **27** adjacent the part **8**, as shown in FIG. 4.

The metal of which the bit bodies are made is not a limitation on the invention. The bit bodies may be made from any of a large number of carbon or alloy steels.

Where a roll pin or the resilient retaining means last described is employed with th shank of a bit holder having a peripheral groove such as that illustrated at **22** in FIG. 4, the rocking or turning movement of the bit holder may be impeded by the collection and compacting of fine mine cuttings in the annular groove. This makes it all the more desirable to mount the cutter bit rotatably upon the nose of the bit holder as above described.

However, as shown in FIG. 6, where the shank **4** of the bit holder is rotatably mounted in the lug **1**, it is practicable to mount the bit non-rotatably on the bit holder nose by providing an annular groove **25** in the conical nose **8**, forming a perforation through the skirt of the bit **9** and using a drift pin **26** in the hole. While this provides in effect for the rotation of the bit **9** with respect to the bit holder, again the collection and compacting of fine cuttings within the annular groove **25** may impede rotation. But if the shank of the bit holder is rotatable with respect to the lug, the desired effect will be attained irrespective of whether the bit can rotate on the nose of the bit holder.

FIG. 7 illustrates a hard cutting alloy tip of slightly different configuration but usable with the bits of this invention. The tip has an enlarged head portion **28** preferably as large in diameter as the small end of the bit body. It also has a shank portion **29** which is recessed into the end of the bit body. It will be understood that the hard cutting alloy tips mentioned herein may be brazed, welded, or otherwise attached to the bit bodies.

FIG. 9 shows a type of bit having a conical or other tapering body **9**. The hard alloy tip **30** is a conical element having a skirt portion **31** and an interior hollow which fits over a nose portion **32** of the bit body. This type of hard cutting bit has certain advantages in that a greater length of the tip is exposed for cutting, while the extension of the nose **32** within the central hollow of the tip anchors the tip firmly and at the same time minimizes the amount of hard alloy required to form the tip.

Modifications may be made in the invention without departing from the spirit of it.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A cutter bit for a mining machine having a tapering body portion with a hollow formed therein so as to provide a skirt, said body portion having at least one configuration formed in the end portion of said skirt effectively diminishing the inside transverse dimension of the said skirt at the point of formation of said configuration, said end portion of said skirt being resiliently distortable.

2. A cutter bit as claimed in claim **1** in which the said tapering body portion of the bit is provided with a hard cutting alloy tip, the tip having a head portion of tapering configuration with a base at least equal to the adjacent end portion of the body of the said bit and a shank extending into a recess in the said body portion.

3. A cutter bit as claimed in claim **1** wherein a hard cutting alloy tip is affixed to the said body portion of the bit, the said tip being itself of tapering external configuration and having a tapering hollow within it, a portion of the said body of the bit having an extension fitting within and affixed to the said tip.

4. A cutter bit for a mining machine having a tapering body portion with a hollow formed therein so as to provide a skirt, said body portion having a skirt having a pair of detents formed in the end portion thereof, said detents acting effectively to decrease the inside diameter of said end portion, the end portion of said skirt being resiliently distortable.

5. In combination, a bit holder having a shank adapted to be received in a perforation in a socket member, and a nose portion having an outwardly tapering portion extending beyond a portion having effectively a diminishing diameter adjacent the juncture of the two portions, and a cutter bit having a tapering body with a tapering hollow formed therein so as to provide a skirt portion, the said tapering hollow being configured to correspond substantially to the shape of the outwardly tapering portion of the nose of the said bit holder, the said skirt of the bit being resilient and having at least one detent portion extending inwardly, requiring expansion of said skirt in one direction to pass the end of the said outwardly tapering portion of the bit holder nose.

6. The structure claimed in claim **5** wherein the skirt of the said bit is flattened to provide said detent means.

7. The structure claimed in claim **5** wherein when said bit is placed upon the nose of said tool holder there will be frictional engagement between the inner tapering surface of the said bit and the outwardly tapering surface of the nose of the said bit holder.

8. The structure claimed in claim **5** wherein there is a non-tapering extension upon the outer end of the outwardly tapering portion of the tool holder nose, said extension acting upon the hollow interior surface of said bit to minimize frictional engagement between the said bit and the said nose.

9. The structure claimed in claim **8** wherein the shank of said bit holder extends entirely through the said socket member and is held beyond said socket member by a means resisting axial movement of said shank.

10. The structure claimed in claim **8** wherein the shank of said bit holder extends entirely through the said socket member and is held beyond said socket member by a means resisting axial movement of said shank, and in which said shank has on its opposite end a gauge-determining abutment so related to the skirt of the said bit as to permit removal of the bit from the bit holder by the insertion of a prying tool.

11. The structure claimed in claim **8** wherein the shank of said bit holder has a peripheral groove formed therein and wherein said shank is held in the socket member by an engaging device extending through a hole transverse to and intersecting a shank receiving perforation in said socket member.

12. The structure claimed in claim 8 wherein said bit is pinned to the nose of said bit holder by a pin extending into a perforation in the skirt of said bit and engaging in a recess in the nose portion of said bit holder.

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