Aug. 9, 1927. 1,638,230

A. ALSAKER

CLAMPING MEANS

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Fig. 1.

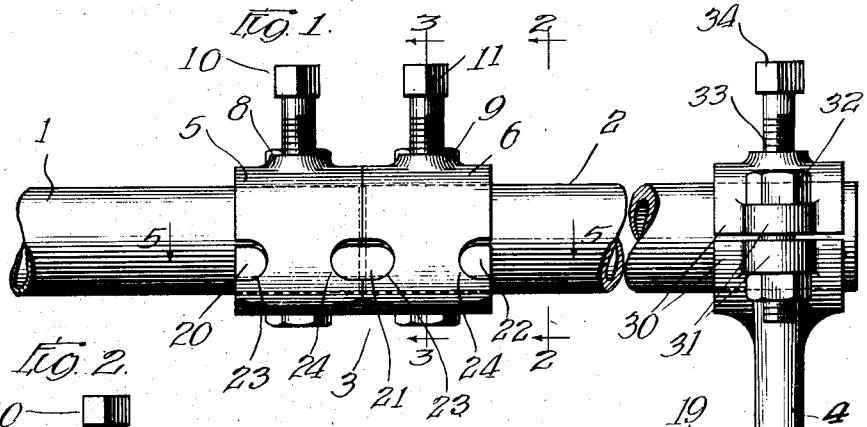
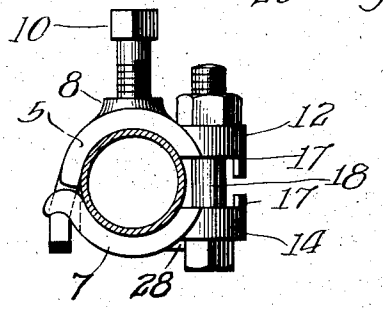


Fig. 2.



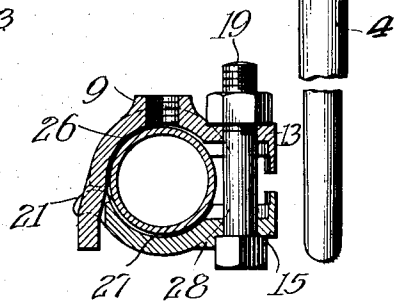


Fig. 4.

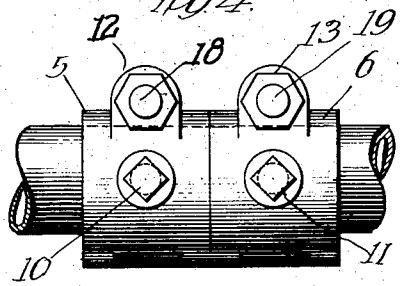


Fig. 5.

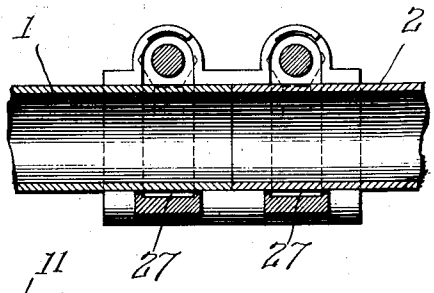


Fig. 6.

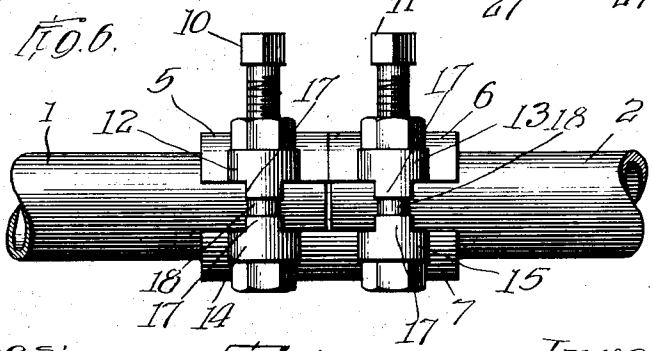


Fig. 3.

Witnesses:
Harry C. White
William P. Kelley

Inventor:
Alfred Alsaker
By Brown Bottcher & Brenner
Attys

Aug. 9, 1927. 1,638,230

A. ALSAKER

CLAMPING MEANS

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Fig. 7.

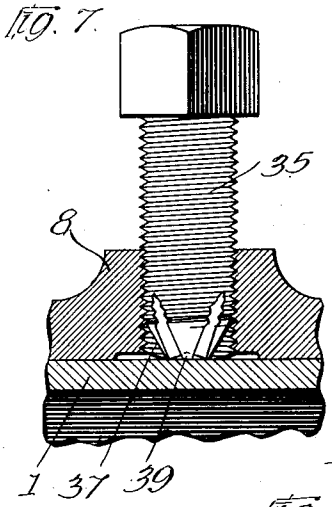


Fig. 7A.

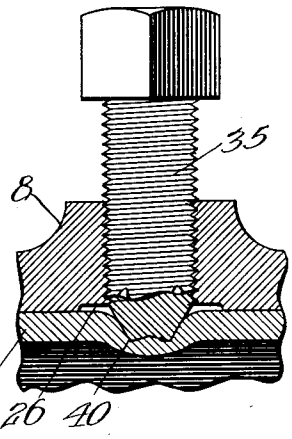


Fig. 7B.

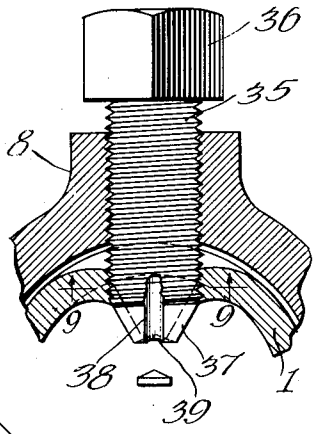


Fig. 8.

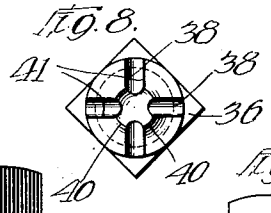


Fig. 9.

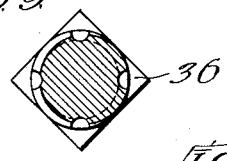


Fig. 10.

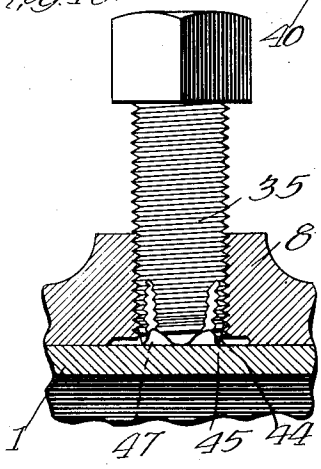


Fig. 10A.

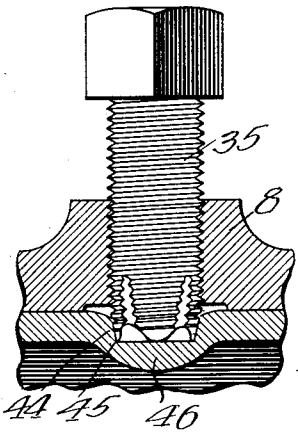


Fig. 10B.

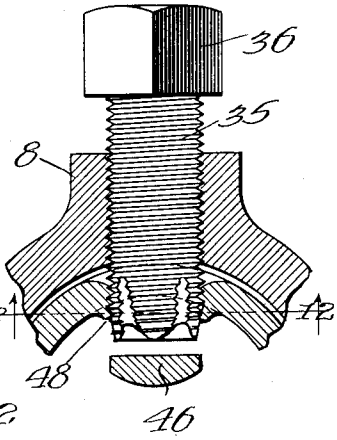


Fig. 22.

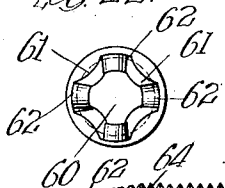


Fig. 11.

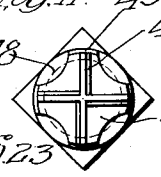


Fig. 12.

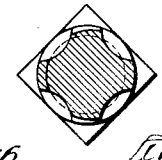


Fig. 23.

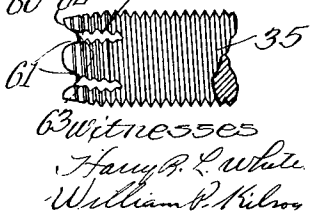


Fig. 20.

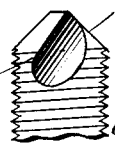


Fig. 21.



Witnesses
Harry B. L. White
William P. Wilson

Inventor:
Alfred Alsaker.

By Brown Borcher Dinner Attys.

Aug. 9, 1927.

1,638,230

A. ALSAKER

CLAMPING MEANS

Filed Dec. 28, 1925

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Fig. 13.

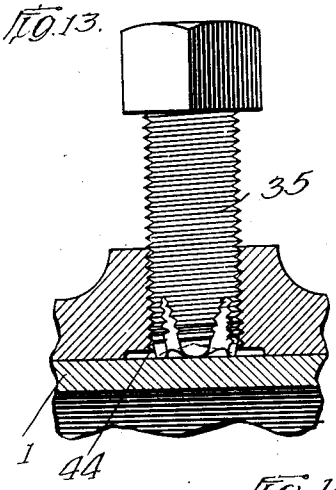


Fig. 13A.

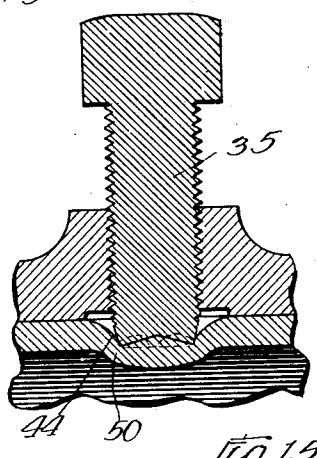


Fig. 13B

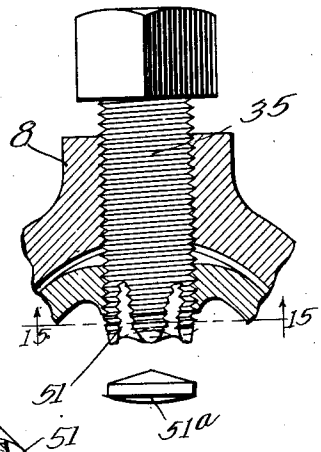


Fig. 14

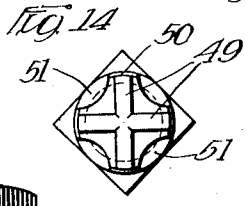


Fig. 15.

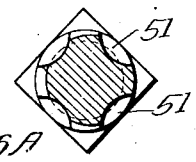


Fig. 16

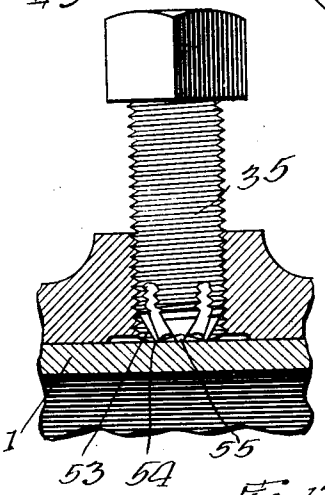


Fig. 16A

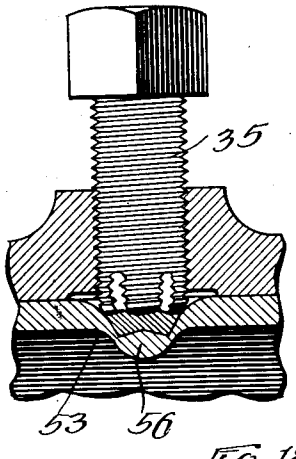


Fig. 16B

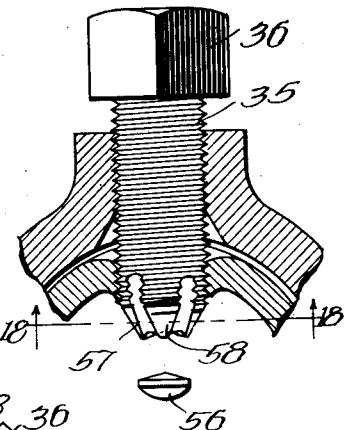


Fig. 17.

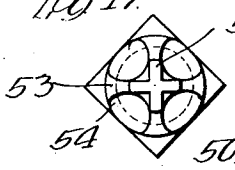


Fig. 18.

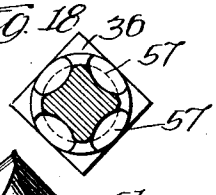
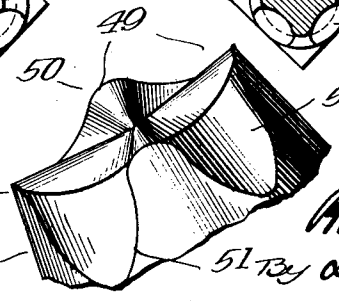


Fig. 19.



Witnesses

Harry B. White

William P. Milroy

Inventor

Alfred Alsaker.

By Brown Borderer & Dinnie. Attys.

Patented Aug. 9, 1927. 1,638,230

UNITED STATES PATENT OFFICE.

ALFRED ALSAKER, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE DELTA-STAR ELECTRIC CO., OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

CLAMPING MEANS.

Application filed December 28, 1925. Serial No. 77,965.

My invention relates to clamping means for fastening an encircling member such as a collar, handle, joint or the like, to a hollow rod or pipe.

The invention also provides a novel tool for perforating the wall of a pipe and for threading the same if desired.

In the construction of operating mechanisms for such devices as electric switches, railroad switches, interlocking mechanisms, etc., it is customary to use hollow rods or pipes serving as push or pull rods or as rotary shafts. One great difficulty which has heretofore been encountered in making connection between sections of pipe or between the pipe and an operating member, such as a lever or the like, is the difficulty of making a positive or locked connection in the field where the mechanism using such pipe is erected.

It is common practice to employ a pipe for the operating mechanism of outdoor electric switches. Such pipe may be drilled at the shop for pinning the co-operating parts together when they are assembled in the field. This is not generally practicable because the parts joined to make up a switch frame are commonly made up of structural steel and exact fits are not feasible. As a result, when the operating mechanism is connected up, it is often found to vary from the measurement determined upon in the shop. It is necessary at present, therefore, to assemble the operating parts by means of bolted clamps or set screws having no positive hold upon the pipe. If pinning is desired, it must be done by drilling in the field, and this is often prohibitive.

Set screws as now employed for clamping pipe do not provide a sufficiently strong hold upon the pipe to keep the same from slipping under the stresses which may be imposed by operation of the device.

I provide according to the present invention, a set screw which serves a dual purpose, namely, the usual action of clamping by pressure of its end face against the pipe and, in addition, it serves thereafter to force its way through the wall of the pipe and act as a positive locking pin.

Hence it is possible to set up the operating mechanism of the switch or the like and clamp the parts together and hold them for trial by pressure of the set screws. Trial of the operation of the device may then be made, and if it is satisfactory the set screws without releasing their temporary hold are screwed down and driven home forcing their way through the pipe and positively pinning the parts together.

In forcing its way through the wall of the pipe, the set screw of my invention serves two ends. First, it forms a perforation through the wall of the pipe, and second, it threads itself into the opening.

I have tried a number of different methods of operation in securing the perforating function, to-wit;

1. A pure cutting operation.
2. A combined cutting and punching operation.
3. A spinning operation.
4. A combined spinning and cutting operation.

The aforesaid operations relate to forming the initial perforation which may be of a diameter equal to or smaller than the size of the body of the set screw. If the initial perforation is of a size smaller than the body of the set screw, I enlarge the same by one or more of the above operations in addition.

The final cutting of the thread is, of course, mainly a cutting operation, although it may be combined with spinning.

The preferred form of my set screw preferably operates with an action combining the operation of spinning, that is, making the metal flow, and cutting, to form the perforation. The perforation is preferably made substantially the size of the body of the screw, that is, the diameter of the screw at the base of the threads, and then the hole is threaded by the combined action of cutting and spinning.

The secret of operation to the best advantage is found in limiting the working surface of the set screw which is in engagement with the work, that is, the wall of the pipe, to as small a value as is possible so as to increase the unit pressure which may be brought upon the work to cause it to yield or flow, and also to limit the friction which is involved in the work of forming the perforation.

Now, in order to acquaint those skilled in the art with the manner of constructing and

operating a device embodying my invention, I shall describe in connection with the accompanying drawings a specific embodiment of the same.

In the drawings:—

Figure 1 is a side elevational view of an operating shaft comprising two sections of pipe clamped together and having an operating handle secured to one end;

Fig. 2 is a section taken on the line 2—2 of Fig. 1, showing the clamp in end elevation;

Fig. 3 is a cross section through the clamp taken on the line 3—3 of Fig. 1;

Fig. 4 is a plan view of the clamp shown in Fig. 1;

Fig. 5 is a horizontal section taken on the line 5—5 of Fig. 1;

Fig. 6 is a rear elevational view of the clamp shown in Fig. 1;

Figs. 7, 7^A and 7^B are fragmentary sectional views showing one form of the set screw of my invention in the different stages of perforating and threading the wall of the pipe;

Fig. 8 is an end view of the working face of the screw;

Fig. 9 is a cross sectional view taken on the line 9—9 of Fig. 7^B. Figs. 7 and 7^A are taken longitudinally of the pipe and Fig. 7^B is taken transversely of the pipe;

Figs. 10, 10^A and 10^B are views of successive stages of forming and threading a perforation through the wall of the pipe by a modified form of my invention; Figs. 10 and 10^A being taken longitudinally of the pipe and Fig. 10^B transversely thereof;

Fig. 11 is an end view of the form shown in Fig. 10, showing the working face thereof;

Fig. 12 is a cross section of the end of the screw taken on the line 12—12 of Fig. 10^B;

Figs. 13, 13^A and 13^B are cross sectional views of progressive stages of the action of another form of my invention; Figs. 13 and 13^A being taken longitudinally of the pipe and Fig. 13^B transversely thereof;

Fig. 14 is an end elevational view of the set screw shown in Fig. 13^B.

Fig. 15 is a cross sectional view taken on the line 15—15 of Fig. 13^B;

Figs. 16, 16^A and 16^B are like cross sectional views showing a modified form of set screw of my invention in different stages of perforating and threading the wall of the pipe; Figs. 16 and 16^A being taken longitudinally of the pipe and Fig. 16^B transversely thereof;

Fig. 17 is an end elevational view of the set screw shown in Fig. 16^B;

Fig. 18 is a cross sectional view taken on the line 18—18 of Fig. 16^B;

Fig. 19 is an enlarged isometric view of the end of the set screw shown in Fig. 14;

Figs. 20 and 21 are a side view and an end view, respectively, of the form of set screw which I have provided with cutting faces for cutting the perforation and for cutting the threads in the wall of the pipe; and

Fig. 22 is an end view and Fig. 23 a side view of a further modified form of my invention.

Referring now to Fig. 1, I have shown two lengths of pipe 1 and 2 united by the clamp 3 and having the operating handle 4 connected to the end of pipe section 2.

The clamp 3 is made up of three parts 5, 6 and 7. The part 7 extends across the ends of both sections 1 and 2 and the separate members 5 and 6 are identical castings.

The clamp members 5 and 6 have the bosses 8 and 9 for receiving the set screws 10 and 11, the bosses being suitably threaded to receive the threads of the set screws. At one side the clamp members 5 and 6 contain the bolting lugs 12 and 13 adapted to be brought into alignment with the corresponding bolting lugs 14 and 15 on the clamp member 7. The lugs 12, 13, 14 and 15 have projecting stops 17 adapted to contact when the clamp is drawn tight to limit bending of the lugs 12, 13, 14 and 15 towards each other. Standard machine bolts 18 and 19 pass through the registering lugs 12, 14 and 13, 15, respectively, to fasten the clamp sections 5 and 6 to the clamp section 7. At their opposite sides the clamp sections 5 and 6 have interengaging notches co-operating with hooks upon the clamp section 7. The clamp section 7 has projecting fingers or hooks 20, 21 and 22 extending therefrom, as will be apparent from Figs. 1 and 2, and the clamp sections 5 and 6, which are identical, have notches at their sides, as indicated at 23 and 24, to receive the hooks or fingers 20, 21 and 22. The clamp section 7 of the clamp is made sufficiently rigid to provide the necessary strength for uniting the pipe connections 1 and 2 and the clamps 5 and 6 merely hold the clamp section 7 to the sections 1 and 2. Obviously, if desired the sections 5 and 6 may be formed integral or otherwise united, but I find it to be simpler in applying the clamp to have the parts 5 and 6 separate. Both the clamps 5 and 6 and the clamp section or part 7 are provided with a certain amount of clearance in the transverse plane of the set screws and bolts, as indicated at 26 and 27 in Figs. 3 and 5. This insures contact at each side of each clamping bolt 18, 19, and the corresponding set screws 10 and 11.

The lugs 14 and 15 on the clamp section 7 are provided with stop faces as indicated at 28 in Figs. 2 and 3 for engaging the head of the corresponding bolt to prevent the same from turning. Hence, it is not necessary to hold the bolt against turning when

the corresponding nut is drawn up to fasten the clamp and the frame member against the corresponding pipe section.

The construction of the set screws 10 and 11 and their mode of operation will be more fully set forth in connection with Figs. 7 to 23, inclusive.

Suffice it to say at this time that the set screws 10 and 11 may be threaded down in the corresponding bosses 8 and 9 until the end faces of the set screws engage the outer surface of the pipe section for holding the same temporarily in place, while a trial is made of the operation of the device involving the pipe sections 1 and 2. If the operation of the device on trial is found to be satisfactory, the set screws 10 and 11 are then driven down by turning the same until the heads 10 and 11 are in engagement or substantially in engagement with the bosses 8 and 9, whereupon it will be found that the corresponding set screws will have formed perforations through the pipe sections and threaded their way through said perforations to hold the parts firmly in place.

At the right of Fig. 1, I have shown an operating lever 4 having a split clamp 30 formed at one side of the same, this split clamp being in the shape of an integral hub on the end of lever 4 and the split clamp encircling the end of pipe section 2.

The split clamp 30 has the two bolting lugs 31 with a suitable bolt 32 for tightening the same upon the end of the pipe section 2. A threaded boss 33 is provided for a set screw 34, which like the set screws 10 and 11 is first set against the outer surface of the pipe for trial and, upon final adjustment of the same, this set screw is driven home, pushing its way through the side walls of the pipe and threading the corresponding opening to pin the lever 4 to the pipe section 2.

Referring now to the specific embodiment of the set screw shown in Figs. 7, 7A, 7B, 8 and 9, the threaded shank 35 of the set screw has the head 36 at its upper end, and has a working end thereof formed into a frusto conical shape, as will be clear from Fig. 7B and Fig. 8. The tapered or conical surface 37 of the set screw is provided with a series of grooves 38 in this case four in number, which extend from the concaved or cupped end face 39 up to the threaded shank intersecting a part of the thread of the shank, as is apparent from Fig. 7B and Fig. 9.

The intersection of the cup 39 with the cone 37 forms a circumferential circular cutting edge, which however is interrupted by the grooves 38, so that instead of a continuous circular edge there are provided in the set screw under consideration four short cutting edges having relatively sharp corners on both the advanced and on the trailing edge. The grooves 38 are preferably cut deep enough to provide relatively sharp corners along the conical surface 37.

This set screw operates primarily upon the theory of cutting its way through the metal. In Fig. 7 I have shown the set screw as threaded in the boss 8 and having its end face 39 engaging with the surface of the pipe section 1 for holding the clamp and the pipe together in the present known manner of using a set screw, namely, by setting the end face of the set screw against the surface of the wall of the pipe. Trial of the connections involving the pipe section 1 and the clamp 8 may be made while the set screw is in this position. The trial being found to be successful or adjustment being made to make it successful, the set screw is then threaded down to the boss 8 in the manner indicated in Fig. 7A, the sharp cutting edges 40 formed by the meeting of the conical surface 37 and the cup or depression 39 and as interrupted by the grooves 38 tend to cut the metal at said surfaces 40, and the sharp edges 41 on the trailing side of the grooves 38 also tend to cut away the metal at the sides of the depression as the set screw is forced through the wall of the pipe. The cuttings or chips are free to dispose themselves in the clearance space 26 and also in the clearance space provided by the depression which is formed by the set screw itself forcing the wall of the pipe away from the boss, as will be apparent from Fig. 7B.

It is to be noted that this form of set screw, while it is effective presents a relatively large frictional engaging surface along the conical surface 37 and on the cup shaped end face 39, with the result that the friction and hence resistance to turning rises to a relatively high value. This may be observed by the degree to which the wall of the pipe 1 is depressed in forming the opening through the same. The set screw shown in Fig. 7 finally cuts its way through the wall of the pipe and by the combined action of cutting and pressing or forcing its way through, it presents the threaded part of the shank 35 to the walls of the pipe and, due to the fact that the grooves 38 extend along the threaded part of the shank, as is plainly shown in Fig. 7B, the threads of the set screw cut corresponding threads in the opening in the wall of the pipe 1. It is to be understood that the set screw is hardened, particularly as to the lower end in order to permit the aforesaid action to occur.

In Figs. 10, 10A, 10B, 11 and 12, I have shown a set screw in which the perforating action is secured, mainly, through a spinning operation. In this case the lower end or working face of the set screw is provided with a plurality of radial ridges 43, in the present instance shown as formed in the

shape of a cross (see Fig. 11). These ridges are rounded to provide smooth spinning surfaces for engaging the wall of the pipe 1. The shank 35 at the end adjacent the working face is tapered off, as by cutting away the metal to form a conical surface, as indicated at 44, the coning of the end of the set screw being sufficient to bring the diameter of the end face within the base of the threads so that the corners 45 formed by the ridges 43 and the conical surface 44 may be relatively sharp. These corners play an important part in the operation of the set screw and their function is to cut the metal to sever the slug 46 from the wall of the pipe. Between the ridges 43 the metal of the end face is cut away, as indicated at 47, to insure ample clearance between the ridges. It is not necessary that the clearance be as great as I have shown, but the clearance should be sufficient to give these ridges 43 a sharp definition. It is also desirable that sufficient clearance be provided that if any chips or scales should be formed there would be room for the disposal of the same without compelling it to come under the ridges and perhaps cut or mar said ridges 43.

In operation the set screw is set against the wall 1 of the pipe, as would be the case with the ordinary set screw, then after trial of the device, the set screw is screwed home, the operation of depressing the slug 46 being shown in Fig. 10^A. The corners 45 actuately cut the metal while the ridges 43 being limited to a very small contacting area bring an exceedingly high unit pressure upon the metal of the slug 46, and since the forward travel of the shank 35 must be at the rate determined by the pitch of the threads, the operation of depressing and cutting away the slug 46 is performed relatively rapidly, and the resistance to turning of the set screw drops off quite sharply after the slug 46 is depressed to the extent shown in Fig. 10^A, and shortly thereafter the slug 46 drops off free, as indicated in Fig. 10^B, and the operating of threading is carried on by the tap-like portion back of the end face. The tap-like portion which is formed by the clearance grooves 48, cuts the threads in the wall of the pipe and the set screw may then be screwed down until the head 36 strikes the boss 8.

In the samples which I have employed the thread is an automobile thread, that is, for the half inch set screws which I have employed a pitch of 20 threads to the inch. Obviously the threads may be made finer or coarser as may be desired within operating limits, but I find that a relatively fine thread, that is, having a relatively large number of threads per inch is preferable, since the resistance to turning may be decreased thereby.

In Figs. 13, 13^A, 13^B, 14 and 15, I have shown a form of set screw which is substantially identical with the form shown in Figs. 10 to 12, inclusive, with the important difference, however, that the end face has the spinning ridges 49, corresponding to the ridges 43 in the previous modification, disposed at an angle such that the end face presents a concavity, with the result that the angle formed between the conical end face 44 and the ridges 49 is an acute angle and, therefore, the cutting corners 50 formed between the conical side walls 44 and the ridges 49 are able to cut their way into the wall of the pipe 1 before the full area of contact is secured between the ridges 49 and the face of the pipe. The result is that there is a cutting into the wall of the pipe and forcing down of the slug 51^a around its edges in advance of pressure upon the center of the same. After the operation of cutting or shearing the slug 51^a from the walls of the pipe has been well begun, then the forcing of the entire area of said slug may take place, as is shown in Fig. 13^A with the result that the slug is very easily pushed out of the wall of the pipe. The tapping or threading operation which is carried on by the interrupted threads above the working face proceeds easily. The tapping portion is formed as previously explained in connection with the other modification by grooves 51 extending a short way along the shank 35 above the working face, so that cutting corners or cutting threads are provided at the trailing edges of the grooves 51.

In Fig. 19 I have shown in somewhat enlarged isometric elevation the end face of the set screw shown in Fig. 13. It will be seen that the ridges 49 in this form are tapered in and down towards the center, leaving rounded working faces or lands terminating in sharp edges 50 at the outer ends for the purpose of cutting the slug partially free of the wall of the pipe before the forcing operation over the full area of the same is begun.

This form of set screw has proven to be the easiest to drive through the walls of the pipe of any with which I have experimented.

In Figs. 16, 16^A, 16^B, 17 and 18, I have shown a further modification which is an embodiment of the same principle shown in the set screw of Fig. 13, but it is modified to the extent that the end working face is made smaller in diameter by a greater degree of taper of the conical face 53. The beginning of operation is substantially as shown in connection with the modification of Fig. 13, namely, that the sharp corners 54 formed by the intersection of the conical side walls 53 and the ridges 55 first cut into the pipe and tend to sever the slug 56 to some degree before full pressure is brought upon the slug. Since the slug 56 is of a diameter smaller than the final diameter of the shank 35 of the set screw, I provide the conical

surface 53 with a series of grooves 57 forming between them the rounded ridges 58 for spinning outwardly the edges of the hole in the pipe 1. The upper part of the grooves 57 extends up into the threaded part of the shank 35 and, at this point, the edges of the grooves 57 with respect to their threads may be left relatively sharp, so that the threads may be formed more by cutting than by spinning, although this is optional. That is to say, the edges of the grooves 57 may be rounded off along their full length, or may be rounded only to form rounded ridges at 58, as may be desired. With a relatively large set screw and a thin wall pipe this form of working face may be found more advantageous, since there is a tendency to spin outwardly the edges of the hole after the slug 56 is cut therefrom, so that threads may be cut in a greater depth of metal.

In Figs. 22 and 23 I have shown a modified form of set screw in which I have cut away the central part of the end face by drilling into the same to form a rounded pocket, as indicated at 60 in Fig. 22, leaving an annular flange or ring which in turn is cut away at the grooves 61 to leave rounded ridges 62, the outer ends of which form in conjunction with the tapered side walls 63 sharp cutting edges for cutting a slug clear of the wall of the pipe. Grooves 64 in line with the grooves 61 are then extended up into the threads of the shank 35, so as to form the tap or threading portion of the set screw. In this form no pressure is brought upon the central part of the slug and the area of contact is thereby greatly decreased. The sharp corners formed at the ends of the ridges 62 may be made acute by inclining the ridges 62 inwardly towards the cup 60.

The operation of this form of the device is substantially as previously indicated with the exception that the ridges 62 carry the entire endwise pressure upon the slug for forcing the same out of the wall of the pipe. Threading is thereafter accomplished by the tap-like portion immediately above the end face.

In Figs. 20 and 21 I have shown a form of set screw which I have employed in this connection in which I form the end of a twist drill upon the end of the shank of the set screw. This form of cutting face is formed by giving the end of the set screw a generally tapered contour, then cutting the two grooves 65 upon opposite sides of the same, and relieving the conical face 66 in order to bring the edges 67 into cutting engagement with the metal.

The form shown in Figs. 20 and 21 has not proven as advantageous as the forms previously described, since the work of shearing or punching out a plug from a relatively thin walled tube is a simpler operation and requires less power than the cutting of the same into chips, as is required by a drilling operation. Furthermore, the chips tend to clog up the point and it is difficult to provide sufficient room for their disposal without making the device too bulky and inconvenient.

I have tried the effect of a sharp piercing tool, but find that the difficulty with the same is the relatively large friction which is entailed by the large contact surface and the difficulty of maintaining a point which will stand up while the same is turned and forced through the metal.

The samples which I have successfully employed as above described were merely case hardened at their lower ends and they stood up in satisfactory service to punch and thread several holes a piece.

It is to be observed that in the preferred form of the invention there are a plurality of circumferential cutting edges tending to cut or shear a plug out of the walls of the pipe. While I have shown four such cutting edges, obviously a less or greater number might be employed without departing from the invention. The secret of successful operation is to sever the slug at its edges from the walls of the pipe, and simultaneously bring pressure upon the same with as small an area of contact between the end face of the set screw and the slug as it is possible to secure within practical operating limits. While I prefer carefully rounded ridges or lands on the end and side working faces, it is to be understood that failure to round these edges carefully is not to be considered a departure from my invention, as the foregoing explanation is illustrative and not limiting.

Now it will be apparent that the clamp of my invention instead of serving as a fastening for an element to a pipe, may be employed as a tool for perforating a pipe or for perforating and threading. It will at once be apparent that while I have shown the punching and threading operations as being carried on in the same tool, the same need not be the case. I may employ the device as a perforating tool only for general use.

I do not intend to be limited to the details shown and described.

I claim:—

1. A set screw for forcing its way through the wall of a pipe comprising a head, a threaded shank, and a working face, said working face having discontinuous circumferentially extending cutting edges at the junction of the lateral surface and the end surface.

2. In combination, a yoke having a threaded hole, a screw having a threaded shank co-operating with the threads in said hole, said screw having a concave end face, and discontinuous arcuate cutting edges at the

junction of the lateral walls and concave face.

3. In combination, a yoke having a threaded hole, a screw having a threaded shank co-operating with the threads in said hole, said screw having a concave end face, and a tap-like portion above said concave end face forming a part of the threads on the shank.

4. In combination, a yoke having a threaded hole, a screw having a threaded shank co-operating with the threads in said hole, said screw having at its lower end peripheral cutting edges for defining a line of cleavage in the wall of a pipe and being forced through said wall by the advance of the threaded shank in said yoke.

5. In combination, a yoke having a threaded hole, a screw having a threaded shank co-operating with the threads in said hole, said screw having at its lower end peripheral cutting edges for defining a line of cleavage in the wall of a pipe, and a tap-like thread forming portion above said lower end forming a part of the threaded shank.

6. A screw including a threaded shank and having one end provided with a plurality of slanting radial ridges tapered in and toward the center of the screw, said ridges leaving substantially rounded working faces terminating in sharp edges substantially at the outer periphery of the screw shank.

7. A screw having an end face provided with a sharp arcuate cutting edge adapted to be rotated to define a line of severance of a plug in a piece of metallic material, and means for enabling the cutting edge to be advanced axially to progressively shear the plug from the piece of metallic material.

8. A screw having an arcuate cutting edge for defining the line of severance of a plug in a metallic strip, and means adapted upon the rotation of the screw with its cutting edge in contact with the metallic piece to contemporaneously bring sufficient pressure upon the plug defined by the cutting edge to shear the same from the said piece along the line of severance.

9. A screw having a substantially cylindrical threaded shank and having a relatively sharp peripheral hole forming edge about its end, said edge being discontinuous and grooves extending axially along the threaded portion above said peripheral edge.

10. A screw including a threaded shank and having a plurality of substantially rounded shoulders upon its end face, said shoulders terminating in peripheral arcuate edges.

11. The method of mounting a screw in a piece of metallic material which consists in providing the lower end face of the screw with a sharp peripheral cutting edge, rotating the screw with the cutting edge in contact with the metallic piece to define a line of severance of a blank, contemporaneously advancing said cutting axially to progressively shear the blank from the metallic piece and thereafter advancing the shank of the screw into the hole formed by the removal of the blank.

12. The method of mounting a screw in a piece of metallic material which consists in rotating it to cause its edge to cut and define a line of severance of a plug, contemporaneously exerting pressure upon the plug by the end of the screw within the line of severance to shear the edge of the plug from the metallic piece, and thereafter threading the shank of the screw into the hole formed by the removal of the plug.

13. A screw for forcing its way through the wall of a pipe comprising a head for turning the screw and a threaded shank terminating in a working face on its end, said working face having one or more short circumferentially extending cutting edges.

14. A screw for forcing its way through the wall of a pipe comprising a head for turning the screw and a threaded shank terminating in a working face on its end, said working face having one or more short circumferentially extending cutting edges to define a line of severance, and raised lands for pressing upon the part of the wall lying within the line of severance.

15. The method of forming a tapped or threaded hole in the side wall of a pipe which comprises depressing a slug from the side wall by a rotating punch which is advanced the pitch distance of the threads for each rotation thereof and cutting threads in the side walls of the hole thus formed by the continued movement of the punch.

16. A screw for forcing its way through the wall of a pipe comprising a substantially cylindrical threaded shank terminating in a working end face, said working end face being cupped and having circumferentially extending cutting edges.

17. A screw for forcing its way through the wall of a pipe comprising a substantially cylindrical threaded shank terminating in a working end face, said working end face comprising radially extending ribs or lands for engaging the surface of the pipe wall and for punching out a slug by endwise and rotary movement.

18. A device of the class described for punching a hole through the side wall of a pipe comprising a cylindrical threaded shank having an end face adapted to engage the side wall of said pipe, said end face being of a diameter less than the diameter of the shank, and having radial lands terminating in arcuate cutting edges for defining a line of severance, said end face having its lands forced against the said side wall by rotation of the shank on its threads.

19. A device of the class described comprising a cylindrical shank having a rela-

tively fine thread, said shank terminating in an end working and blank perforating face of a diameter not substantially less than the diameter of the shank at the base of the threads, and grooves extending radially across the working face and longitudinally from the working face across the lowermost threads of the shank.

20. The method of mounting a set screw in a member which consists in rotating the screw on its own threads with the end face of the screw in contact with the member to punch out of said member a blank severed by a cutting edge of the end face and advancing said screw axially on its own threads to thread the shank of said screw into the hole.

In witness whereof, I hereunto subscribe my name this 22nd day of December, 1925.

ALFRED ALSAKER.