A. SMITH.

WELL CASING.

APPLICATION FILED APR. 13, 1909.

1,028,065. Patented May 28, 1912.

5 SHEETS—SHEET 1.

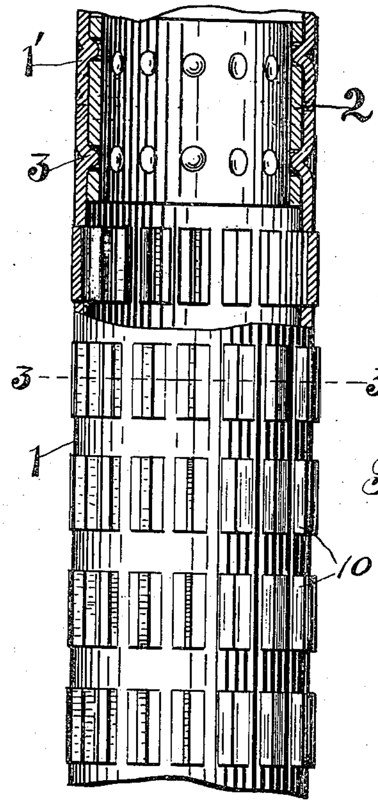

Fig. 1.

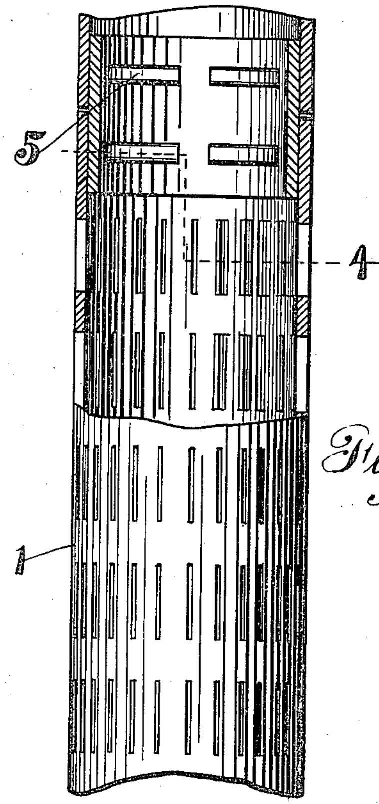

Fig. 2.

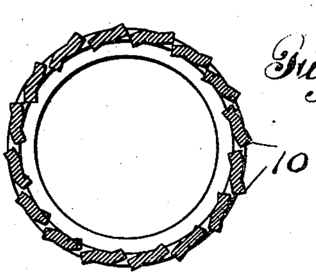

Fig. 3.

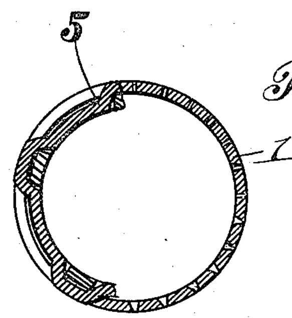

Fig. 4.

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5 SHEETS—SHEET 2.

Fig. 5.

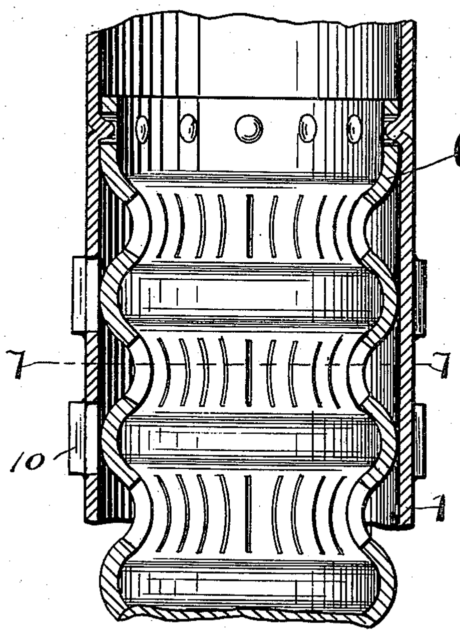


Fig. 6.

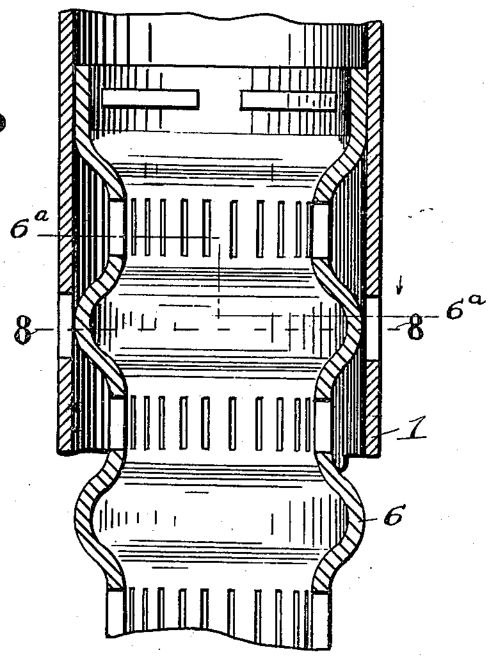


Fig. 7.

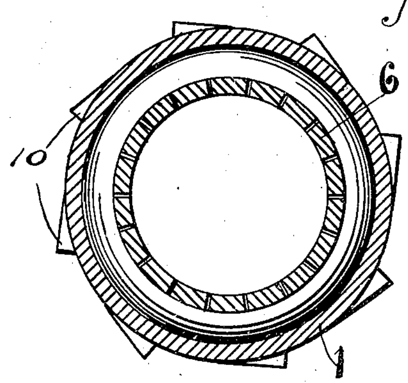
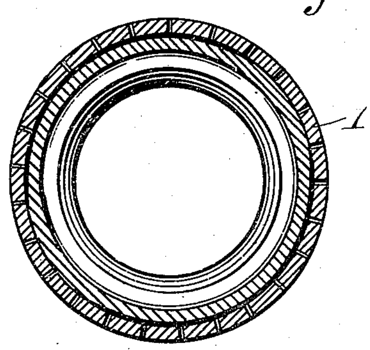


Fig. 8.



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5 SHEETS—SHEET 3.

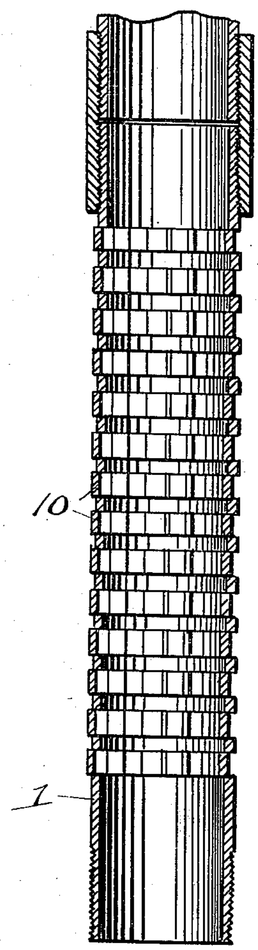

Fig. 9.

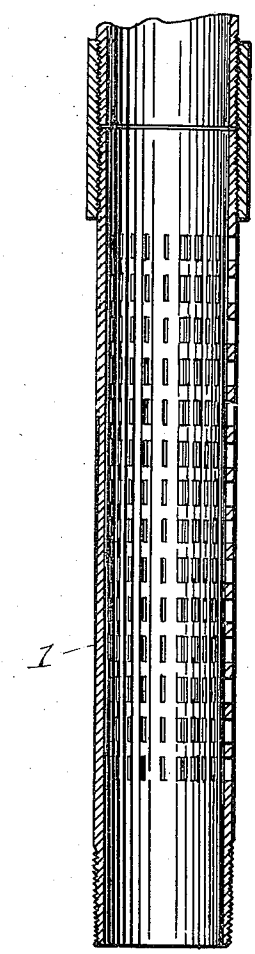

Fig. 10.

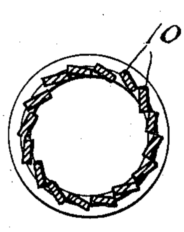

Fig. 9a.

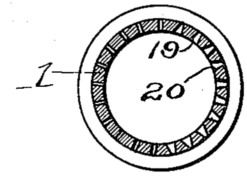

Fig 10a.

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5 SHEETS—SHEET 4.

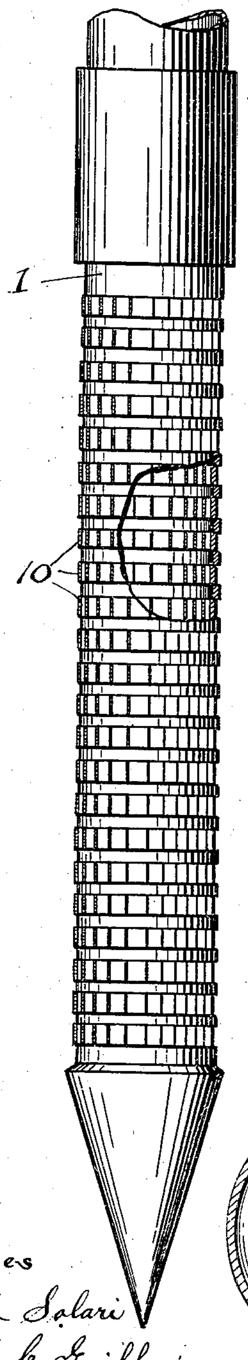


Fig. 11.

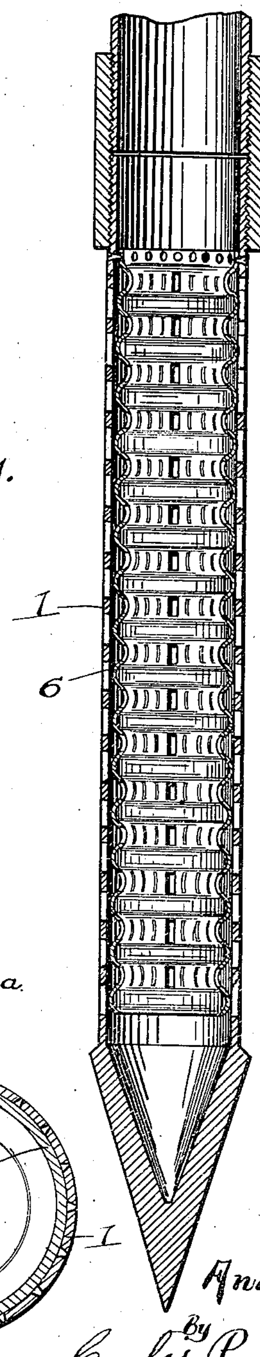
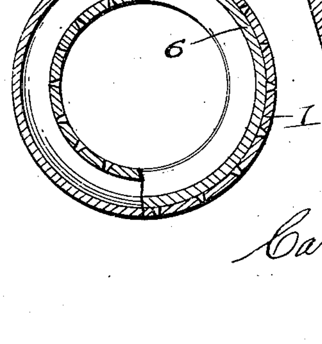


Fig. 12.

Fig. 6.ª



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5 SHEETS—SHEET 5.

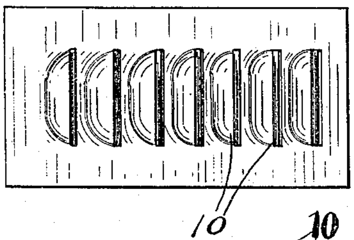

Fig. 13.

Fig. 14.

Fig. 15.

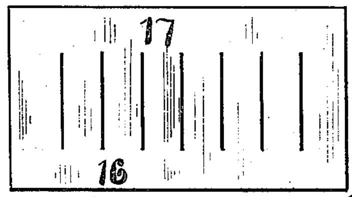

Fig. 19.

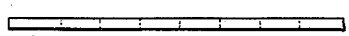

Fig. 20.

Fig. 21.

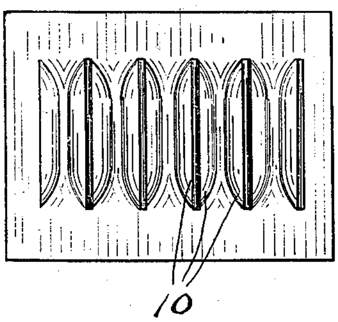

Fig. 16.

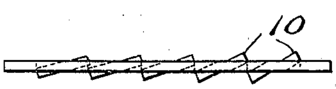

Fig. 17.

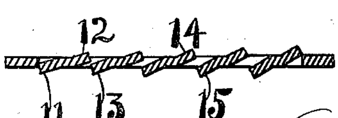

Fig. 18.

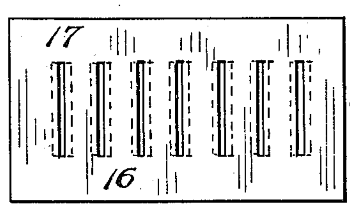

Fig. 22.

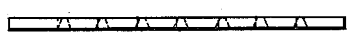

Fig. 23.

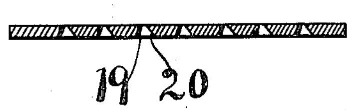

Fig. 24.

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WELL-CASING.

1,028,065. Specification of Letters Patent. Patented May 28, 1912.

Application filed April 13, 1909. Serial No. 489,642.

To all whom it may concern:

Be it known that I, Andrew Smith, a citizen of the United States, residing at San Mateo, in the county of San Mateo and State of California, have invented a new and useful Well-Casing, of which the following is a specification in such full and clear terms as will enable those skilled in the art to construct and use the same.

This invention relates to a metal casing used for the purpose of preventing fine sand from passing into wells of any kind.

While the invention is especially adapted to be used in ground where there is a large amount of fine sand it will be understood that should the nature of the ground permit the slits in the casing may be made larger than is intended as the principal form of the invention.

The especial object of the invention is the production of a multitude of openings which are very narrow in width, whereby a pipe having a large capacity for the admission of fluids is produced, while at the same time preventing the ingress of the finest of sand.

Another object of the invention is the production of a well casing which will close its apertures if undue pressure is placed on it from the outside, as frequently happens in driving or boring wells, when the pipe is forced into the ground.

Another object of the invention is the production of a reinforced pipe, a corrugated pipe being placed within the outer pipe, said corrugated pipe being so placed as to strengthen the outer pipe at the places where it is weakened to permit the ingress of the desired fluid.

Another object of the invention is to produce a pipe which will have its outer surface as smooth as possible considering the fact that it must be provided with a very large number of inlet openings.

Other objects of the invention will appear as the description proceeds.

In the drawings, in which the same numeral of reference is applied to the same portion throughout, Figure 1 is a view partly in elevation and partly in section showing a pipe constructed according to one form of the invention, Fig. 2 is a similar view of another form of the invention, Fig. 3 is a transverse sectional view of the pipe shown in Fig. 1, Fig. 4 is a transverse sectional view of Fig. 2 on the dotted line 4—4, Fig. 5 is a longitudinal sectional view of a reinforced pipe made according to the invention, Fig. 6 is a longitudinal sectional view of a form of the invention having the reinforcement therein, Fig. 6ª is a cross-section on the line 6ª—6ª of Fig. 6, Fig. 7 is a horizontal sectional view of the pipe shown in Fig. 5, Fig. 8 is a transverse sectional view of the pipe shown in Fig. 6, Fig. 9 is a longitudinal sectional view of a screw threaded well casing pipe constructed in a similar manner to Fig. 1, Fig. 9ª is a transverse sectional view of the pipe shown in Fig. 9, Fig. 10 is a longitudinal sectional view of a threaded well casing pipe of the form shown in Fig. 2 the outer surface being substantially smooth, Fig. 10ª is a cross-sectional view of a pipe the same as Fig. 10 showing one form of slits on one half and another form of slits on the other half, Fig. 11 is a longitudinal elevation, partly broken away, of a well point, Fig. 12 is a longitudinal sectional view of a drive well point having the corrugated reinforcing pipe therein, Fig. 13 is a plan view of a small plate showing the openings on a larger scale than in the other figures, Fig. 14 is a side view of the said plate, Fig. 15 is a sectional view of the plate shown in Fig. 13, Fig. 16 is a plan view of a plate punched so the edges of the cut parts are in the relation shown in Fig. 3, Fig. 17 is a side elevation of the plate shown in Fig. 16, Fig. 18 is a sectional view of the same plate, Fig. 19 is a plan view of a plate having very fine slits formed by punching up the plate as in Fig. 13 rolling the punched up parts back in place and then rolling the plate to elongate the same along its edges, and this is the plate used in Figs. 2 and 4, Fig. 20 is a side view of said plate, Fig. 21 is a sectional view of the same plate, Fig. 22 is a plan view of a plate similar to Fig. 19 except that the slits are produced by shearing off a small strip of metal each time an opening is made, Fig. 23 is a side elevation of the plate shown in Fig. 22, and Fig. 24 is a sectional view of the plate shown in Fig. 22.

It will be understood by those familiar with the art that well casing must be made of heavy pipe, ranging from $\frac{1}{8}$ to $\frac{3}{8}$ of an inch in thickness, depending on the particular class of work done. It will also be understood that it is necessary to provide the pipe with a multitude of very fine holes which must be large enough to permit the ingress of the liquid, but at the same time they must be small enough to shut off any materials which would be liable to pass into the pipe in such quantities as to be liable to fill the well up. This is accomplished either by using a double tubing having a pair of large registering openings which may be so adjusted as to produce a very fine opening, or by some other adjusting means. Other forms of the same thing are produced by what is called "cracking" the pipe. This consists of driving a wedge shaped cutter against the pipe hard enough to crack a fine line on the outside of the pipe, but stopping short of actually cutting the pipe. The objection to the former method is that the pipe is rather expensive, while the latter is objectionable for the reason that the shape of the openings produced is bad. There is always a ragged edge and the crack may be narrower at the part near the inside of the pipe than at its outside, whereby the silt will pack in the opening and stop it completely. Another disadvantage of the cracked pipe is that the raw edges produced very soon rust and corrode so that they either stop up altogether, or they rust to such an extent that they form large holes in the pipe through which sand and gravel may enter the pipe and fill the well. It is also to be noted that cuttings through a metal sheet of the thickness herein referred to are impossible either with a punch or with a drill for the reason that no punch or drill of from one to ten thousandths of an inch in width or diameter would cut anything save very thin or soft material. The object to be attained is the production of a large number of very fine slits having the sides thereof as smooth as possible thus avoiding the rapid deterioration of the metal and consequent enlargement of the opening due to corrosion since with a large solid surface there is little corrosion while with the so-called "cracked pipe" the edges of the slits are rough and the corrosion proceeds very rapidly.

Figs. 1 and 3 show views of the ordinary well casing in which a pipe 1 is connected to its adjacent pipe by means of a coupling 2, the coupling having a series of openings therein said openings being filled with the material of which the outer pipe is constructed as illustrated at 3. To do this all that is necessary is to have a die which fits the inside of the coupling tightly and then with a conical punch the outer pipe may be rigidly secured to the coupling, and that pipe to another, as illustrated at 1'.

Figs. 2 and 4 show one form of the invention in which the pipe 1 is secured to the coupling by means of loop 5 which is punched into a slot formed in the coupling. There may be a number such slots around the coupling, into each of which the loop from the outer pipe is cut and punched.

Fig. 5 shows a form of the invention in which the outer slitted pipe is secured to an inner corrugated pipe 6 by the same means as that by which the coupling is secured thereto as shown in Fig. 1. This corrugated pipe is provided with slots formed by the projections 10 of considerable width at its points away from the outer pipe, but is left solid at the points in contact with the outer pipe, and the inner pipe is so placed that the uncut portions of the inner pipe are adjacent the slits in the outer pipe, the object being to reinforce the outer pipe at its weakest places, and to provide means to prevent the widening of the slits in the outer pipe, should an uneven pressure be brought on the outer pipe.

In Figs. 6 and 8 there is shown another form of reinforced pipe, this form being the smooth form to be described later, while the inner pipe is corrugated with the slots in the corrugated pipe in the parts away from the outer pipe and the uncut portions in contact with the lines of slits in the outer pipe. In the several figures illustrating different forms of slotted casings, I have shown the openings or slots extending longitudinally and arranged in annular sets around the casing, but it is obvious that the slots or openings may extend in any other direction relatively to the casing and may be staggered or arranged in groups extending angularly or in other directions in any manner desired. This inner pipe is held in its position in the outer pipe by means of a series of loops such as are shown in section in Fig. 4. It is important that the particles which pass through the slits in the outer pipe should pass on into the inner casing, and I, therefore, prefer to make the openings in the inner casing somewhat wider than those of the outer casing, as illustrated in Figs. 6, 6[a], and 8. While the inner corrugated pipe is shown in contact with the outer pipe at the slitted portions, it is obvious that it may be arranged in contact therewith at intermediate points between the slitted portions.

In Figs. 9 and 9[a] there is shown a pipe having screw threads at each end, for the purpose of securing the coupling members, the pipe being slitted with the edges of the material half on the outside and half on the inside of the general line of the material. This pipe is especially adapted to use in a soil which is not very hard, and which permits the use of pipe having rather large openings, the outside of the pipe being as smooth as is possible for this type of slit.

In Fig. 10 is shown a pipe the slits of which are of very small dimensions on one side and of rather larger dimensions on the other side, thus forming V-shaped slits.

This pipe is of the smoothest possible type the punched up portions having been rolled back into the same plane as the remainder of the material of which the pipe is made. It will be observed that Fig. 10ª shows one half the pipe with the V shaped cuts and the other half with very narrow slits.

Fig. 11 shows a well point used when a drive well is to be sunk in shallow ground. This point is made of a slitted pipe such as the cross section shown in Fig. 3, and it is provided with a driving point and a screw coupling.

Fig. 12 shows a longitudinal sectional view of a drive well point which is adapted to be used where deep wells are sunk in hard ground or large gravel. This form of well point is provided with the slitted tubing which has its surface in the same plane as the body of the tubing, the slitted portion of the pipe being reinforced by means of a slotted corrugated pipe which touches the outer pipe near the center of each series of slits, the slots in the corrugated pipe being in the parts of said pipe which are out of contact with the outer pipe, the holes in the corrugated pipe being large enough to insure the passage therethrough of any material which may pass the outer pipe.

In Fig. 13 is shown a plan view of the material of which the pipe is to be constructed. Now it is to be noted that the openings through the pipe must be very small, and in order that the pipe may not rust out very quickly, a disadvantage of the so-called "cracked pipe", the sides of the cuts should be as nearly 90 degrees with the edges of the cut and as smooth as possible. This object is accomplished in the form of the invention shown in Fig. 13 by having a die which will push the material of which the sheet is made up as shown at 10, the distance of the pushed up lip or projection from the body of the material determining the precise size of the opening through the plate. In the drawing, note Fig. 15, the openings vary in amount from one end of the plate to the other, but it will be understood by those skilled in the art that for any given conditions it is necessary to provide the plates with openings all of the same size. If this plate is used with the punched out side outwardly, the result of pressure on the outside of the pipe does not enlarge the opening, but tends to make the openings smaller since the lip tends to be pushed back into the place from which it has been punched.

It will next be observed that it is possible to produce a plate with less of a projecting lip if both sides of the slit are moved, note Fig. 16. It will be noted that the lip 11 has been moved only one half the thickness of the plate, but at this point no opening is produced, however if both sides of the slit are moved, as shown at the lips 12 and 13 an opening is produced which may be as small as it is desired to make, for the amount of the opening is determined by the way the punches are set in their vertical movement. In the same way openings of a greater width may be produced as at the lips 14 and 15 by setting the punches to push the lips farther through than one half the thickness of the plate.

After the plates have been cut as shown in Figs. 13 to 18 it will be clear that it would be possible to close the slits completely by passing the plates through a set of rolls, which would produce a smooth plate again, of the cross section shown in Fig. 21, but this would not permit the passage of any material at all, since the lips would be distorted enough to completely fill the opening on the rolling. If when the lips have been rolled back into place, the plates be passed through a set of rolls which will elongate the plates along the areas 16 and 17, which lie between the series of slits, it will be clear that the plate may be elongated any desired amount, the elongation producing a movement of the edges without producing a movement of the cut portion of the plate. This elongation may be great or small as desired, but in any event the resulting plate has a large number of very fine slits through it, and the plate is as smooth as when it was uncut, a very desirable feature when a deep casing is to be driven. It will be clear that the same effect would be produced by shortening the lip when it is cut, and then rolling it back into the plate.

Where a casing having quite large openings is to be used, openings, say of 1/16 of an inch at their narrowest part, the form of the invention shown in Fig. 22 may be used. In this form the tool used to punch up the lips is set so that its cut will be at an acute angle to the material, and a second cut is made at a different angle. The plate is then in the form shown in Fig. 13, after which it is passed through a set of rollers which bring the lips down into the same plane as the body of the plate, as shown in side elevation in Fig. 23, and forming tapering or V-shaped slots, as shown at 19, 20, Fig. 24, which makes a perfectly smooth plate adapted for use in deep wells and hard ground. This opening is of great advantage as well for the reason that when it is placed with the narrow part out the sand will either stay out, or if small enough to pass the outer part of the opening it will pass through and leave the opening clear. It is to be understood that it is intended to slit the material in this manner even when the thickness thereof is as great as $\frac{3}{8}$ of an inch, a thickness of metal through which it would be impossible to produce such small holes by direct punching. The advantages gained lie in the smooth cut produced, the simplicity of production of minute openings of perfectly determinate size, and in the smoothness of the resultant plate or pipe.

It will be noted that while the so-called cracked tubing has a very small opening produced in its sides, owing to the ragged edges produced in the cracking it is not possible to cover the metal with galvanizing without danger of closing the exertmely small openings through the tube, but with this tube it is possible to galvanize after the cuts have been made for the reason that the slots are cleanly cut and no ragged edges are left projecting from the tubing. This galvanizing may be done electrically or by the sherardizing or other process and is of great advantage where the solutions which pass through the pipe contain large amounts of salts which would otherwise be liable to corrode the tubing badly. It is also to be noted that this tubing when complete presents a very smooth surface to the ground into which it is to be forced there being no rivets projecting from the couplings at all, thus doing away with one very serious objection to a tubing which has riveted joints. Since should a rivet become loosened or pulled out in forcing the tubing into place there will be a hole left in the tube which will be liable to allow the ingress of such amounts of silt and sand as to fill the well in a short time. It is also to be noted that such tubing as the above may be used in the place of the common form of tiling, such as is used to drain water from the soil or from embankments when serving as a draining-culvert, or to conduct water from place to place. The advantages derived from the use of metal tiling instead of the usual earthenware tiling are due not only to the greater strength of the casing but mainly to the fact that the slots or openings can be made narrower to thereby prevent the entrance of sand and other particles, which fill up and clog the tiling. The real reason for the previous non-use of metal tiling lies in the fact that it was very difficult to produce a metal pipe having small enough openings and in sufficient number, but with this method of manufacture the number of openings may be increased at will and the cost of manufacture is very small since all that is necessary is to run the plates through a set of rollers or punches having the necessary shearing surfaces to produce the slits.

When used as a tiling for drainage purposes, in which the pipe or casing is usually laid horizontally, any of the different forms which I have shown in the several figures of the drawing may be used, the particular form employed depending upon the special conditions encountered. In tiling, it is sometimes desirable to use larger openings than the thickness of the metal of the casing. When the pressures to be sustained are very great, as when passing under or through embankments which must be subjected to enormous strains, as for instance, under the trackways of railroads, the duplex or double casing may be necessary. In ordinary drainage work, however, a single-walled casing is sufficient, and for this purpose I prefer to employ a single casing of the corrugated form illustrated at 6, in Fig. 5, which presents the maximum strength for the weight of material used. By constructing this casing in the manner shown, the convex corrugations alternate with and protect the slotted concave portions and produce an exceedingly rigid casing or tiling.

When the double casing is employed as a tiling, the walls of the corrugated members brace the cylindrical walls of the plain tubular member and greatly strengthen the duplex casing. Inasmuch as the tiling is usually laid horizontal, the function of the corrugated members in strengthening the casing will be just as efficient when used upon the outside and the plain tubular members when used upon the interior will furnish an unobstructed interior channel or conduit.

Having thus described my invention what I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. A drainage casing comprising a metal sheet having a series of smooth walled sheared slits therein of less width than the thickness of the sheet.

2. A drainage casing comprising a tubular metal member provided in its side walls with a series of smooth-walled sheared slits, substantially parallel and alined with each other, the strips of the metal between the slits being inclined with the edge of the metal upon one side of each slit lying in the plane of the walls and the edge of the adjacent metal upon the other side of the slit lying out of the plane of the walls, and with the inner corner of the last mentioned edge opposite the outer corner of said first-mentioned edge, whereby the size of the passages increases from the mouth or opening inwardly.

3. A tubular drainage casing comprising an outer casing having slots therein, and an inner slotted corrugated casing within the first casing and constituting a support for the outer casing.

4. A tubular drainage casing comprising a corrugated metal sheet having alternate portions provided with smooth walled sheared slits therein of less width than the thickness of the sheet.

5. A well casing comprising an outer casing having a series of slits therein of less width than the thickness of said casing, and

an inner transversely corrugated casing within the first casing, having slits distant from the outer casing, substantially as set forth.

6. A well casing comprising an outer casing having a series of slits therein arranged in annular series, and an inner transversely corrugated casing having slits therein distant from the outer casing, said inner casing touching the outer casing near the middle of the series of slits in said outer casing, substantially as set forth.

7. A well casing comprising an outer casing having a series of slits therein arranged in annular sets, and an inner casing having a series of slits therein, said inner casing touching the outer casing only near the middle of the slits in said outer casing, substantially as set forth.

8. A well casing comprising a casing having a series of slits therein arranged in annular sets, and an inner corrugated casing having a series of slits therein distant from the outer casing, said slits being larger than the slits in said outer casing, substantially as set forth.

9. A casing for wells comprising an outer casing having a plurality of series of slits therein, said slits being arranged in annular sets, and an inner corrugated casing having a plurality of sets of slits arranged in annular series distant from the outer casing, said inner casing being substantially solid at its outer portion and touching the outer casing near the middle of each set of slits therein, substantially as set forth.

10. A drainage casing comprising a tubular metal member provided in its sides with a series of adjacent slits substantially parallel and alined with each other, with the strips of metal between the slits inclined so that the inner corner of the edge of the metal upon one side of each slit lies opposite and adjacent the outer corner of the edge upon the other side of the slit, whereby the size of the passages increases from the mouth or opening inwardly.

11. A drainage casing comprising a tubular metal member provided in its sides with a series of slits, with the edge of the adjacent metal upon one side of the slit lying to the inside of the edge of the adjacent metal upon the other side of the slit, and with the inner corner of the last mentioned edge opposite the outer corner of the first-mentioned edge.

12. A drainage casing comprising a tubular metal member provided in its sides with a series of adjacent slits substantially parallel with each other, with the strips of metal between the slits inclined so that the inner corner of the edge of the metal upon one side of each slit lies opposite and adjacent the outer corner of the edge upon the other side of the slit.

In testimony whereof I have set my hand this 6th day of April A. D. 1909, in the presence of two subscribed witnesses.

ANDREW SMITH.

Witnesses:

JOHN R. TYRRELL,

C. P. GRIFFIN.