If we closely examine a flat, square, or half round file, we shall find that the cutting edge of the teeth does not come fully up at the corner; hence neither of them will file a clean corner, but leave it slightly round. To remedy this defect the only plan is to grind away the edge of the flat or one side of the square file, making it smooth, or as least so that the teeth points will meet the corner. Care should be taken to select the worst side of the file to grind away, and this will be the side hollowest in its length. Sometimes a smooth half round file is used to square out a corner, in which case the smoother the file the better.

Safe edge files are those which have one edge left without teeth, so that it will not cut, the object being to enable that edge to be moved against a flange or projection of the work without cutting it. As a rule, however, it will be found that cutting the teeth on one side throws a burr over the edge, and it is necessary, unless in very fine piles, to pass the safe edge over the grindstone to make it absolutely safe.

In using parallel files for keyways, it is often necessary to finish with the end of the file only, so as to take any roundness in the keyway surface. It is to be especially noted that by giving the file a slight lateral motion at each forward stroke, and reversing the direction of that motion, so that the file marks cross, there will be less liability for the file to pin, and the file will cut more freely, but with a lateral motion, from right to left the file cuts cleanest. This is because the deepest serrations forming the file teeth are diagonal and nearest to the end of the file on the left-hand side, hence with a motion from right to left there is a partial draw-filing motion. For finishing, very light strokes should be taken, the cross-filing being done with smooth files before the draw filing is begun, and to prevent pinning, a frequent application of chalk should be given to the file teeth.—*Scientific American.*

AN IMPROVED FLEXIBLE HARROW.

The accompanying engraving represents the improved flexible harrow invented by Mr. James M. Flower, of Malvern, Ark.

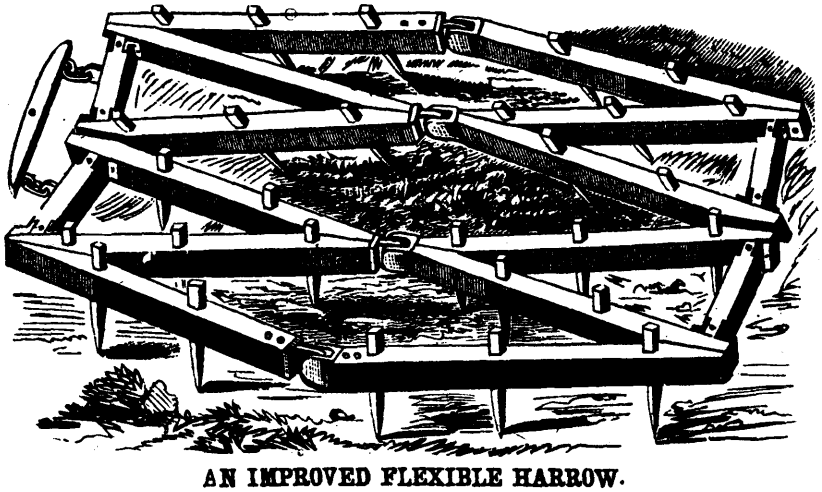
The object of this invention is to furnish an improved harrow which shall be so constructed that the teeth may be wide apart, so that it will not clog with stones, sods, stubble, corn-stalks, &c., and which shall be simple in construction, light, strong, and durable, and effective in operation, pulverizing the soil very finely.

The frame of the harrow is made in four sections, each section being formed by arranging three bars of suitable length and size, in the form of the letter N—that is to say, two of the bars are parallel, and are connected at their alternate ends or diagonally by the third bar. The bars of each section are connected at one end by a cross or brace-bar, the ends of which are secured in cast iron sockets, attached to the ends of the said bars. The sections are connected together in pairs at their open ends by iron hinges.

One pair of the sections are turned over, and the two pairs are then connected together near the outer ends by iron hinges, the cross-bars thus forming the end bars of the harrow.

The teeth are inserted in the bars about eighteen inches apart, so that rubbish may easily find its way between, while, from the peculiar form of the frame, the paths of the teeth will be close together, and the soil will be very finely pulverized. To the cross-bars at either end, is attached a draw-bar, to which the double-tree is attached by a clevis, in the usual way.

By this construction the harrow will be exceedingly flexible, so that it will accommodate itself to any and every inequality of the surface of the ground.—*American Inventor.*



AN IMPROVED FLEXIBLE HARROW.

RETARDED FRACTURE IN TOOL STEEL.

A paper was read before the late meeting of the American Society for the Advancement of Science, by Wm. Kent, describing a peculiar case of fracture in tool steel. From this paper we take the following paragraphs: Mr. John L. Gill, Jr., of the Pittsburgh Car Wheel Works, Alleghany City, had occasion to use in a machine which he is building a cylindrical piece of tool steel, 10 inches long, and two inches in diameter, with a curved groove cut on one side and a rectangular groove on the opposite side, parallel to the axis. The steel was procured from a well-known firm, and stated by them to be the very best tool steel. It was supposed to contain about 0.9% of carbon. That the steel was of excellent quality is shown by the fact that another piece from the same bar was made into a rose reamer, which has been in use for some time in Mr. Gill's shop without showing a flaw. The reamer and the piece which broke were tempered by the same blacksmith, an experienced hand.

After the piece was formed into the required shape, it was tempered by being carefully heated in a wrought-iron muffle, then plunged into water and cooled. It was then oiled, and held close enough to the fire merely to burn off the oil, the object being to have the piece extremely hard. It was then laid away on a shelf, to be used when the machine for which it was made was ready for it. The machine being delayed the piece was not needed as soon as was expected and it lay on the shelf for six weeks. One night, at the end of the six weeks, the watchman of the works heard in the shop a report like a musket shot, and on going towards the shelf on which the steel had been placed and from which the report sounded, he found that the piece had broken in two, one of the broken pieces falling on the brick floor, four feet in front of the shelf, the other having apparently recoiled against the board wall behind the shelf, leaving a deep dent in the board. The fractures are of a peculiar curved or concave and convex form, and the structure shows a fine grained and superior metal.

The various theories of internal strain will at once suggest themselves to those inquiring into the cause of this and similar accidents. It is almost certain that a condition of internal strain existed in the piece of steel during the whole six weeks that it lay on the shelf. It may be possible that the interior portion of the piece during all that time was compressed by the greater contraction of the exterior portion, and that it resisted this compression with a constant and uniform force, while the resistance of the exterior portion to this force gradually diminished, becoming weaker until it "let go" suddenly, and the piece broke with a loud report. Admitting this theory, however, the difficulty arises, "if the exterior portion 'let go,' why did the interior also break, its strain being relieved?" The "shock of rupture" may be the answer to this querry.