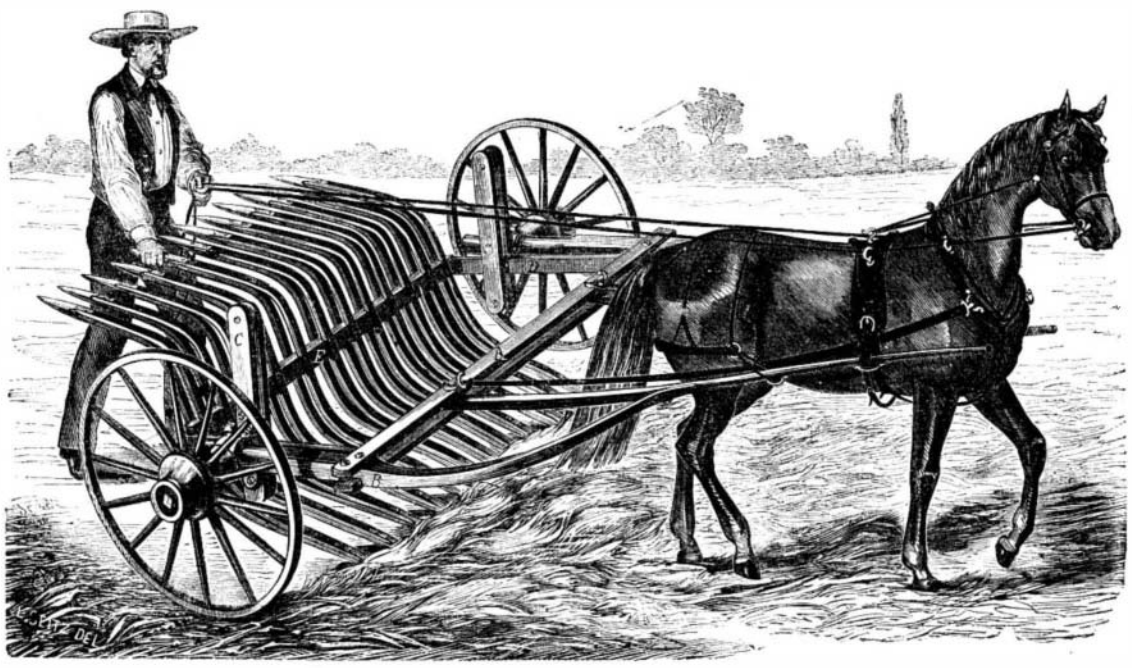
Improved Horse Hay Rake.

The rake represented in the engraving has taken a premium wherever exhibited and tested. In the Indiana State Fair of 1866 it received the first prize over all others, including one which carried off the first premium at the Auburn, N. Y., trial. It is uncommonly light, very strong, and handy in operation. With it there is no necessity of shocking the hay previous to stacking it, as it will carry an ordinary sized shock to any part of the field. It works well on very uneven ground. It was contrived to answer a call for a more perfect rake published in the Scientific American, Vol. XIII., No. 12, page 176.

The thills are bolted to a double cross bar, A, to the ends of which are also bolted the curved hounds, B, the forward ends of which are securely united to the thills, thus strongly bracing the structure. These hounds extend back of the crossbar and have their rear ends made cylindrical and quite large to receive the rings of the short axletrees or journals on which the wheels turn. These axles are of metal and may be adjusted on the hounds to bring the wheels further forward or back, as may be desired, to properly balance the rake, and are held in position by set screws. Firmly secured to flanges on the inner end of the axles are upright guides, C, in which play the draft bars, D, which are pivoted to the hounds just in the rear of the crossbar, A, and at their rear ends support the rake head, E. This is pivoted to the draft bars by headed journals which allow the rake to be revolved.



FREDERICK'S PATENT REVOLVING RAKE.

The rake head is square and the teeth are double or made of two curved pieces of wood, which are seated in mortises on opposite sides of the head and are bolted through. At their ends the two parts of the tooth are brought together and held by rivets or screws, and strengthened and protected by shoes of malleable iron. This method of construction makes a very strong and at the same time a very light tooth.

In operation, the driver guides the horse with one hand and manages the rake with the other, as seen. He can easily, by depressing the rear ends of the teeth, elevate the forward ends to avoid obstructions or to accommodate the rake to unevenness of surface, while the guides, C, permit the draft bars to rise and fall. The rake head may be set higher or lower by means of adjustable blocks in the lower part of the guides, C. The rake will revolve for unloading in the usual way by removing the pressure of the hand.

This rake was patented through the Scientific American Patent Agency, Aug. 6, 1867, by Levi W. Frederick, who may be addressed for rights to vend and manufacture, or for other information, at Gosport, Owen county, Ind.

Improvement in Screw and Ratchet Wrenches.

Two views of an improved wrench are shown in the accompanying engravings. The object is to relieve the screw (if one is used) from the whole strain exerted in setting up a nut or bolt by introducing a stop-catch with teeth which engages with a rack or ratchet cut on the shank of the wrench. It is, in one form, a combination of the screw wrench and the ratchet wrench, and in another form, is a simple ratchet wrench.

Fig. 1 is the ratchet wrench, *per se*. The movable jaw, A, can be slipped to position by the thumb and finger, and held by the catch, B, which engages, on its under side, with two of the teeth of the ratchet rack, when shut to place, where it is held by the spring, C, that acts like the spring of a pocket knife. The plate, D, is a permanent portion of the jaw and thimble, A, and, of course, moves with it.

Fig. 2 represents the combined screw and ratchet wrench, E, being the screw, and F the spring of the catch-bar, which in this case is connected with the movable sleeve. The jaw may be adjusted by the screw, E, and then held by the catch-bar, or it may be operated by the screw alone by raising the catch-bar.

Fig. 1

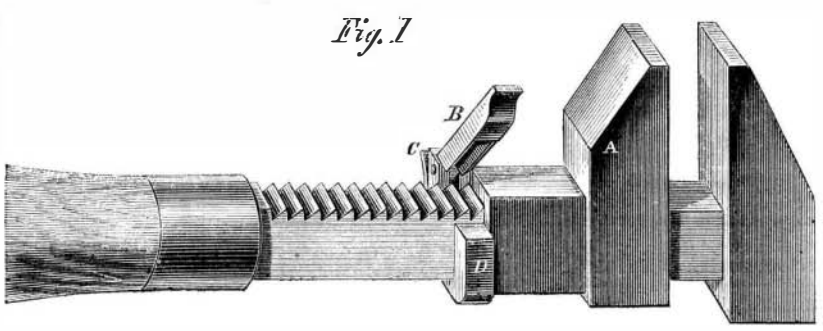
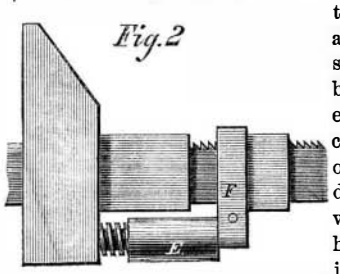


Fig. 2



CHRISTOPHER'S IMPROVED WRENCH.

Letters patent were issued for this invention through the Scientific American Patent Agency, Aug. 27, 1867, to Theodore D. Christopher, who may be addressed at Madison, Ind. The patentee desires to arrange for the manufacture of his wrench on a royalty.

A DEEP COAL MINE, WITH A DESCRIPTION OF ITS PUMPS, WINDING ENGINE, ETC.

A very correct idea may be obtained of the deep English coal mines from the following extracts from a paper read by Mr. Higginbotton before the Manchester Geological Society, on the Astley Deep Pit, said to be the deepest coal mine in England.

The new pit, which has been sunk to the Black Mine on the Dunkenfield estate, near Manchester, is no less than 686½ yards deep from the surface of the ground. The usual diameter of this pit is 12 feet, with the exception of a short distance in the middle of its length, where it is widened to 12 feet and 6 inches to facilitate the passing of the chairs, and also excepting a short distance of the bottom of the pit, where it is gradually increased to 19 feet 20 inches. 320,931 cubic feet of materials have been taken out in sinking this pit, and 10,584 cubic feet in addition for mouthings. Out of the total depth of the pit 211 yards have been sunk through rock; 443½ feet through shale; and the remaining 32 through seam coal.

With respect to the coal seams, there are 26 of more than one foot in thickness, of which 15, with an aggregate thickness of 58½ feet, have been worked at different places in the neighborhood and may, therefore, be considered to have a present commercial value. The shaft with the exception of 42 yards where it is tubed with cast-iron segments, is walled with a nine-inch wall of arch bricks, stiffened at intervals by stone wings, 18 inches thick, of which there are 80. Altogether, 7,308 cubic feet of stone, and 750,000 bricks have been used in the shaft exclusive of those employed in the mouthings, etc.

In sinking, water was met at the following depths: At 481 yards from the surface 40 gallons per minute; at 240 yards, 35 gallons; at 358 yards, 52 gallons; at 413 yards, 33 gallons; at 590 yards, 5 gallons, making a total of 165 gallons per minute.

This water is raised to the surface by seven lifts of plunger pumps; of these, the four upper are 12 inches in diameter, and the three lower 9, 7, and 6 inches diameter; they have all a stroke of eight feet.

The four heavy lifts average above 90 yards in length each, and are arranged alternately on opposites of the pump rods; each stroke of the pump raises 39 gallons, and consequently the engine has to run at an average speed of four and a quarter strokes per minute for twenty-four hours. At full speed the engine would make from eight to nine strokes per minute. The pump trees are thirteen inches internal diameter, and are for the most part of wrought iron, the plates of which they are made to increase somewhat in strength toward the bottom of the lifts. The total weight of the pumping rods, joint plates, clamps, bolts, plunger poles, etc., is 85 tuns; of this weight, 40 tuns are balanced at the pit top, leaving 45 tuns to overcome the weight of the column of water and the friction of the plunger poles, etc. The pumping apparatus occupies in the pit an area of twenty-nine square feet, leaving eighty-four square feet for winding.

The conducting rods are of pitch pine, attached to beams of the same wood, which are supported on cast-iron boxes set into the walling of the pit.

The horse trees are also for the most part of pitch pine, as are the pump rods, which are fifteen inches square at the top and diminish gradually downward to ten inches. The total amount of timber used in the pit is 5,882 feet.

The pumps are worked by a side lever Cornish engine, with a seventy inch cylinder eight feet stroke. The steam is supplied by three boilers, thirty-four feet long six feet 6 inches in diameter, with an ordinary working pressure of twelve lbs. to the square inch. The winding-engine cylinder is sixty inches diameter by seven feet stroke. The winding drums are twenty four feet two and a half inches in diameter, and the whole weight of crank, crank axle, and drums, is fifty-three tuns.

To one of the winding drums a brake drum is attached which is acted on by a steam brake of great power. Beside the winding drums, there is on the main shaft a balance weight drum 6 ft. 8 in. in diameter, to which is attached a balance weight of 5 tuns. The engine is capable of making 25 strokes per minute, thus raising the load in the pit about 21 miles an hour. Allowing for the time lost in hooking on and taking off, the engine is able to raise 600 tun of coal in 10 hours.

The winding ropes are of wire 4½ inches broad by 1⅛ inches thick at the top tapering down to 3¼ inches broad by ⅞ inch thick. They weigh 4½ tuns each, and the breaking strain at the thin end is 30 tuns; the actual working load is 3¼ tuns, which is made up as follows: The chair, which is constructed to carry four double tubs, weighs 16 cwt., four tubs which weigh 17 cwt., and the coal weighing 32 cwt., making in all 65 cwt. The winding ropes pass over pulleys 15 feet in diameter, which are supported by the head gear at a hight of 50 feet above the landing stage. Besides the engines described, which were erected by Messrs. Fairbrain of Manchester, there is on the ground a high-pressure capstan engine of 30-horse power by Messrs. Garforth, of Dunkenfield. There are now eleven boilers actually in use, and room in the boiler house for two more.

There are seven lifts in the pit, all being rams, the largest lift being 158 yards. There is also a small low-pressure engine which drives a circular saw and drilling and punching machines, and supplies generally the power required in the workshops. The workings are aired by the assistance of a dumb drift, which is driven up from a counter level to No. 2 shaft, rising two feet to the yard. The dumb drift is ten feet diameter, which forms an area of 78½ square feet, and enters the upcast shaft at 600 yards from the surface; the furnace drift is 25 yards from the pit bottom, being 61½ yards below the dumb drift.

Careful observations made during the sinking of the pit have shown that the temperature of the strata, increases with tolerable regularity from 57° at a depth of six yards to 75½° at a depth of 686½ yards. The temperature on the pit top, May 28, 1867, at 11 A. M., was 58°; at the pit bottom 64°; variation 6°: in the return air roads, when the air passes round the workings, and has done all its work previous to making its exit into the dumb drift, is 71°; variation from pit bottom 7°. There is now an incline at work at the bottom of the Astley pit, which is 250 yards down, lying at an angle of one foot to the yard, making the total perpendicular depth from the surface to the lowest point 770 yards.

FAIR OF THE AMERICAN INSTITUTE.

This exhibition, which is of a national character, has entered upon its second week, and is now in a presentable shape. We had hoped that before the issue of this present number of our paper we could have begun a report of the exhibition, taking the departments and their individual divisions *seriatim*. This has, however, been rendered impossible from the great extent and comprehensiveness of the exhibition, and from the fact that in one of the prominent departments—that of machinery—the power for its propulsion has been inadequate. This trouble will, however, be immediately remedied. Additional steam boilers are being daily added, and before our next issue the machinery department will be a hive of humming industry.

We might, even now, make some notice of particular portions of the exhibition, but we wait until we can give a view which shall not only be agreeable to our readers, but just to the exhibitors. In the meantime we advise all who can, to make a visit to this exposition of art and industry, and they will not fail to be greatly interested and benefited. One of the novelties which will attract attention is the pneumatic tube, in actual operation, by which passengers are shot through space as is a cannon ball; and another the letter delivery tube, by which letters and parcels are sent almost instantly from one point to another.

Music every evening and the brilliancy of the gas lights make the scene one of unusual beauty. The pictures and statuettes in the art department are seen to as good advantage in the evening as during the day, and the machinery performs its evolutions as satisfactorily. This is the period which seems to be the favorite one with the mass of visitors.