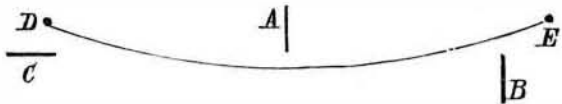


BASE BALL SCIENCE.

We are in receipt of several communications relative to the question of whether a projectile can be thrown so as to describe a horizontal curve during flight. Some of our correspondents favor us with newspaper clippings wherein we are quoted as deciding this problem in the negative. As the only reference to the matter which has appeared in these columns consists in letters from correspondents wherein the writers set forth their individual views—and our reply to a question which gave insufficient data, to the effect that we had never witnessed the conditions specified—it is scarcely necessary to add that we have never expressed the formal opinion imputed to us, especially as the views we do hold are diametrically the reverse.

Several learned professors in various Ohio educational institutions having recently embarked in a newspaper controversy as to whether a skillful base ball pitcher could or could not throw a ball in a horizontal curve—the question

Fig. 1.

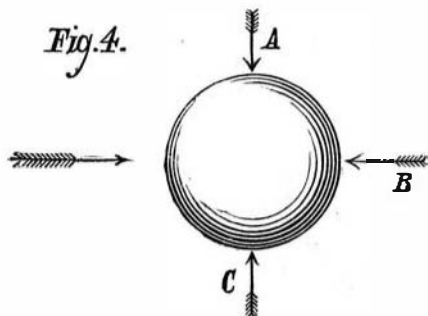


was set at rest by actual experiment. A chalk line was drawn parallel to the plane of the home plate and first base, Fig. 1. Two sections, A B, of picket fence were placed on opposite sides of the line with their posts upon it. A flat board was placed at C, so that the edge of the board and the inner fence posts were in the same line. The ball was delivered from D with a right hand twist. It passed to the right of A and left of B, and struck the ground at E. When the pitcher stood on the opposite side of C, and threw with his left hand (the position of the barriers being relatively changed), the ball described a curve in the opposite direction.

The mode in which a ball is "pitched," in base ball playing, is shown in Figs. 2 and 3. Fig. 2 is the right hand of the pitcher drawn back. Fig. 3 the same purposely thrown forward more than usual to show the hand—the wrist being turned as the arm is swung, and the ball thus given a rotation from right to left. When thus projected the velocity of translation decreases more rapidly than the rotative velocity, which remains nearly constant. This is true of rifle cannon balls, the rotative velocity of which, at the end of their few seconds' flight, is found to be little impaired, although it is not nearly so rapid, the relative velocities of translation being considered, as is that of a base ball. The curve described by the ball, when thrown without twist, is of course in a vertical plane, and in its path it encounters resistance from the air, first, to its forward progression; and, second, to its upward movement during the first part of its flight; while, during the second part of its journey, and while falling

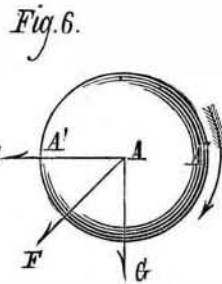
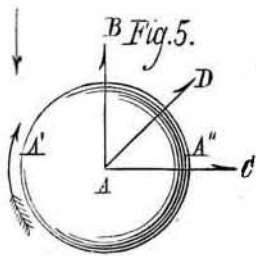
the second resistance of the air is of course opposite to the attraction of gravity. In either case the resultants of these combined resistances act upon the forward portion of either hemisphere, A B, B C, of the projectile approaching A or C, Fig. 4, as the direction of motion more nearly approaches the vertical; or moving toward B as the path of the projectile, traveling in the general direction indicated by the arrow more nearly flattens. It will be evident, however, that over the entire trajectory there will be a vertical component of air resistance, opposing in one case the rising, in the other the falling, of the ball.

Fig. 4.



Now suppose the ball to be thrown with a twist, as indicated by the arrow in Fig. 5. During the first part of its journey the ball is rising, or moving in direction A B. But the resistance encountered by the side, A', is equal to the sum of the resistances due to translation and that due to the rotation of the ball, while that on the side, A'', is due to

their difference. Hence the ball will be thrown to the right or in the direction A C, and its path, after being impelled in the directions A B, A C, will clearly be somewhere between



the two, or, for instance, on A D. (In the diagrams the ball is supposed to be traveling from the reader.) This continues so long as the ball rises, but as soon as it begins to fall, Fig. 6, then, the resistance of the air being, from down, up along the vertical A G, the side, A'', of the ball meets the greatest opposition, and hence the projectile is thrown in the direction A E, and hence takes some intermediate path, as A F; consequently the ball during the first part of its flight drifts to the right, and during the second part to the

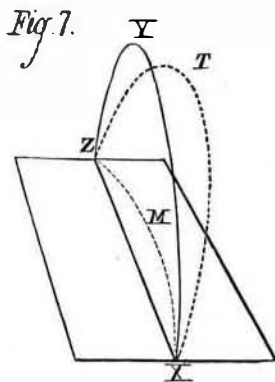
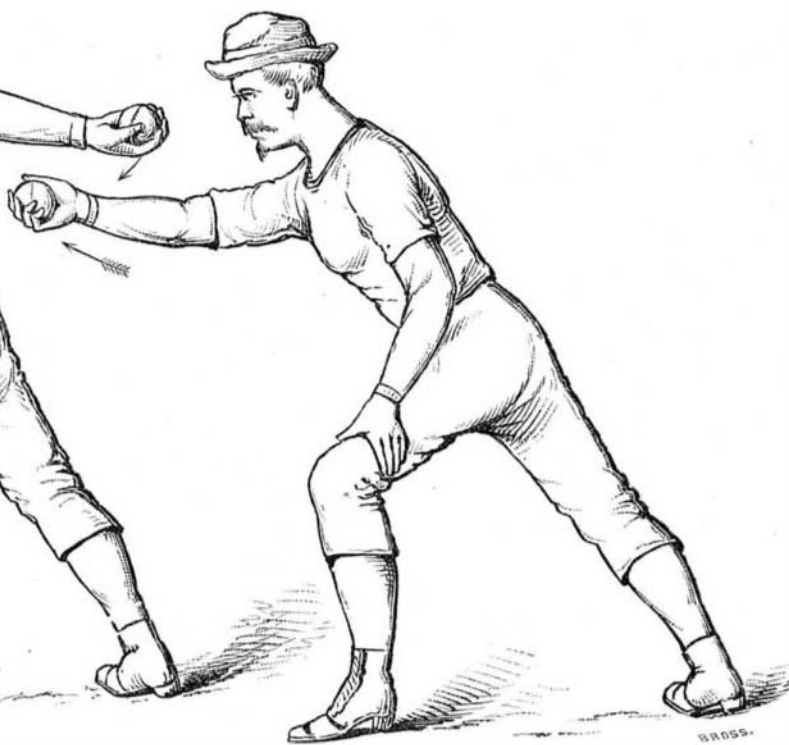


Fig. 2.

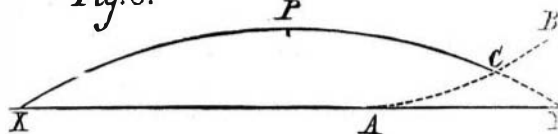


Fig. 3.



left. The curve described, instead of being in a vertical plane, as X Y Z, in Fig. 7, is in an inclined plane, as X T Z,

Fig. 8.

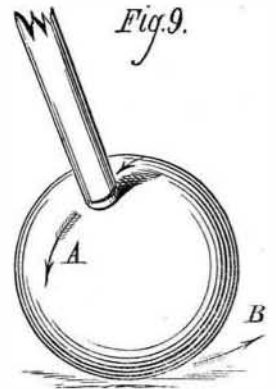


the projection of which is on a horizontal plane, becomes a curved line, X M Z. It may be added that Commander A. P. Cooke, U.S.N., in his "Ordnance and Naval Gunnery," states that in rifle firing it is well known that projectiles "deviate in a curved line either to the right or left, the curve rapidly increasing toward the end of the range. This probably occurs from the velocity of rotation decreasing but slightly compared with the velocity of translation, and the trajectory is therefore a curve of double curvature, its projection on either a horizontal or vertical plane being a curved line."

A simple experiment in proof of the correctness of the above theory may be made as follows: Let a skillful pitcher, accustomed to allow for the twist he gives the ball when throwing it to a given distance, X Y, on level ground, throw with the same allowance to a point, C, at about the same distance off on a hillside, A B, Fig. 8. Now P being the highest point on the trajectory, the ball, for the reason already given, will deviate to the right from X to P. It would then deviate to the left in traveling from P to Y, on level ground, to compensate for this; but in traversing the distance, P C, less than P Y, there will not be sufficient com-

ensation, and hence the estimate of the pitcher should be found untrue, the ball falling, instead of at the point, C, at some point to the right thereof. The converse result is obtained by pitching down hill.

A good instance of a body being propelled in a curved line is afforded by the well known "perpendicular force shot" in billiards, whereby a ball can be made to travel around a hat or other object placed in the center of the table. This is illustrated in the annexed diagrams, Figs. 9 and 10. The ball is struck, as shown in Fig. 9, with the cue elevated at an angle of at least 45°. To cause it to curve to the right it is struck on the left with a quick impulsive thrust. It thus receives a backward or rather angular twist in the direction of the arrows, and at the same time is given a forward motion or translation toward the right and ahead, as indicated by arrow, B. The composition of these two motions, and the friction of the ball against the table, determine its movement in the curves shown in Fig. 10. The movement of translation to the right is at first the stronger, but eventually the rotating movement, tending leftward, prevails, and the ball at the end of its course inclines towards the latter direction.

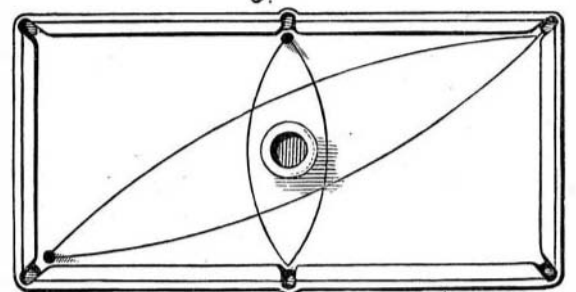


American Products in English Colonies.

We have frequently called the attention of our readers to the magnificent market for products of American invention and industry which is open in Australia. Progress on that continent only finds its parallel in our own past history, and its movement was never so rapid as now. How our manufacturers and inventors are taking advantage of the opportunity offered is shown by the following from the *British Mercantile Gazette*. Beef, cotton cloth, and hardware have hitherto been chief among the productions where-with England has uniformly distanced competition; but what with importation of American beef, the sale of American cottons in Manchester itself, and now our large exports of hardware and machinery to English colonies, it would seem that the condition of affairs, so far as our English rivals are concerned, is very truly, as the *Gazette* states, one of serious importance. "We allude," says our contemporary, "to the ever lengthening list of American-made goods which not only in foreign markets, but in our own colonies, and even in this country, are gradually displacing and superseding English manufactures of the same description. In Australia and

New Zealand, which are now almost the only shipping markets that exhibit any real vitality, the successful growth of this competition is especially alarming. Every month, we are told, on the authority of some of the oldest and largest firms in the trade, adds to the list of American and diminishes the list of English made goods. Sydney, it is stated, swarms with the representatives of American hardware houses, who spare no exertions to wrest the orders from English firms, and in too many cases with success, and the

Fig. 10.



reports from Sydney are echoed from Melbourne, and from the principal towns of New Zealand, Canada, the Cape, and many of the leading States of South America. In Australia and New Zealand the United States houses, we are assured, are carrying all before them, and at the present rate of progress it will evidently not be many years before these

splendid and expanding markets are entirely lost to the manufacturers and merchants of the old country.

"The competition is not confined, as formerly, to those articles for the production of which the Americans enjoy natural advantages, such as wool work, but extended to leather goods, tinware, machinery, every description of implement and edge tool, carriage axles, force pumps, spades, shovels, axes, forks, files, locks, scales, tacks, rivets, pulleys, sewing machines, stove grates, guns, pistols, and other products too numerous to mention. In all these branches of manufacture the Americans are rapidly increasing their Australian business, whilst the English makers are losing ground. Australian commerce, as a whole, is certainly expanding, yet the returns of many well known English firms who supply the markets of Sydney and Melbourne are not now one tenth of what they were a few years ago. If we ask for an explanation of this extraordinary falling off, from those who are in a position to answer us, we are told that it is due to the successful competition of the Americans, who beat our manufacturers sometimes in price, always in quality, and not unfrequently in both. English manufacturers are slow to adopt new patterns or to accommodate themselves to the wants of their customers, but their American competitors spare themselves no pains or expense in this way. They are constantly on the look-out for novelty and improvement, and by good trade organization and close intercommunication they are always kept well posted up in what is being done by their rivals in other parts of the world. Their illustrated pattern books, which are distributed with lavish hand among their customers, are marvels of engraving and typography, and no amount of canvassing or advertising is spared to bring the merits of their productions before the world. Above all, the Americans take care that their goods shall correspond to sample, and be turned out in a finished and workmanlike manner, unlike those of many English makers, who never trouble themselves to inspect the work they send away."

#### Are Ants Civilized?

The October number of the *Quarterly Journal of Science* contains an article on "Our Six-footed Rivals," the ants, which may well cause us to believe that we are not the only rational and civilized beings on this globe.

Let us suppose that we were suddenly informed, on good authority, that there existed a race of beings who lived in domed habitations, aggregated together so as to form vast and populous cities, that they exercised jurisdiction over the adjoining territory, laid out regular roads, executed tunnels underneath the beds of river, stationed guards at the entrance of their towns, carefully removed any offensive matter, maintained a rural police, organized extensive hunting expeditions, at times even waged war upon neighboring communities, took prisoners and reduced them to a state of slavery; that they not merely stored up provisions with due care, but that they kept cattle and even cultivated the soil and gathered in the harvest. We should unquestionably regard these creatures as human beings who had made no small progress in civilization, and should ascribe their actions to reason.

Among the *hymenoptera* the lead is undoubtedly taken by the ants, which, like man, have a brain much more highly developed than that of the neighboring inferior groups. Perhaps the most elevated of the formicidæ family is the agricultural ant of western Texas. This species is, save man, the only creature which does not depend for its sustenance on the products of the chase or the spontaneous fruits of the earth. A colony of these ants will clear a tract of ground, some four feet in width, around their city, and remove all plants, stone, and rubbish. A species of minute grain, resembling rice, is sown therein and the field is carefully tended, kept free from weeds, and guarded against marauding insects. When mature, the crop is reaped and the seeds dried and carried into the nest. If this is done near a larger city the latter regard it as an intrusion, and a fierce warfare results, which ends in the total destruction of one or the other side. The queens are treated with great attention and installed in royal apartments.

The ant government is communistic. In a formicary there is no trace of private property; the territory, the buildings, the stores, the booty, exist equally for the benefit of all. The family among them scarcely exists. Rarely is the union of the male and female extended beyond the actual intercourse, all provision for the future young devolving upon the latter alone, the former being speedily killed, as he is no longer of any use. The females are the larger, stronger, and more long lived. The workers and fighters are sexless; to them belongs the real government of the ant-hill, and they provide for its enlargement, well being, and defence.

Ants are sometimes very stupid in regard to small things, but in many instances they display remarkable sagacity. Mr. Belt, in his "Naturalist in Nicaragua," tells of a column of ants who were crossing a watercourse by a small branch not thicker than a goose quill. They widened this natural bridge to three times its width by a number of ants clinging to it and to each other on each side, over which the column passed four deep, thus effecting a great saving of time. Again, the *ecton legionis*, when attacking the hill of another species, digs mines and passes the pellets of earth from ant to ant until placed at a sufficient distance outside to prevent it rolling back into the hole. Their errors and stupidity are not more conspicuous, however, than among the human beings.

These tiny creatures have a language by which they can impart to each other information of a very definite character,

and not merely general signals, such as those of alarm. It has been found that ants fetched by a messenger seem, when they arrive at the spot, to have some knowledge of the task which is awaiting them. Their principal organs of speech are doubtless the antennæ; with these, when seeking to communicate intelligence, they touch each other in a variety of ways. There is a possibility that they may have a language of odors, for the various scents given off by them are easily perceptible. Under the influence of anger it becomes very intense. In battles how, save by scent, can they distinguish friend from foe? After a lapse of several months a former companion will be received kindly into the nest, but a stranger is killed.

More wonderful than their intelligence is their organization. If separate they would be helpless, and probably soon become extinct. Mr. Belt observed a marching column of *ectons* in the primeval forests of Nicaragua. A dense body of ants, four yards wide, moved rapidly in one direction, examining every cranny and fallen leaf. At intervals larger and lighter colored individuals would often stop and run a little backward, apparently giving orders. On the flanks and in advance of the main body, smaller columns would push out, which pursued the cockroaches, grasshoppers, and spiders in the neighborhood. A grasshopper seeking to escape would often leap into the midst of the ants. After a few ineffectual jumps, with ants clinging to its body, it would soon be torn to pieces. Spiders and bugs which climbed to the tops of trees were followed and shared a like fate. In Nicaragua the vegetarian ants eat up trees and carry off the leaves, to use as a manure, in which grows a minute species of fungus, on which they feed. They evince a mutual sympathy and helpfulness, which to an equal extent can be traced in man alone. Mr. Belt placed a little stone on one to secure it. The next ant that approached ran back in an agitated manner and communicated the intelligence to others. They rushed to the rescue: some bit at the stone, and tried to move it, others seized the prisoners by the legs and pulled. They persevered until they got the captive free.

In Australia they have been known to bury their dead with some degree of formality. The Texan ant removes any offensive matter placed near its city and carries it away. Ants who refuse to work are put to death. Prisoners are brought in by a fellow citizen, handed over in a very rough manner to the guards, who carry off the offenders into the underground passages.

The slave-making propensity and the reliance upon slaves occur in several species, but not to the same degree. The *polyergus rufescens* is absolutely dependent on its slaves, and would rather die than work. *Formica sanguinea*, on the other hand, has much fewer slaves, being itself capable of working as well as fighting. No less variation may be traced in the habits of the cattle-keeping ants. Of the honey-secreting *aphides* and *cocci* that serve them as milch kine, some have large herds, whilst others have none at all, and if they encounter an *aphis* straightway kill and eat it. These *aphides* are extremely destructive to fruits and trees, as they live by sucking the sap. The ants watch them with wonderful care, and defend them from all enemies.

Instances of sagacity and design might be easily multiplied. Careful observation has shown that the ants are evolving as fast as their short terms of life will permit them. They are becoming more wise and more civilized yearly. Each century marks an advance. Who knows but that perhaps in the dim future they may assert rights which human beings shall be bound to respect?

#### Mushroom Ketchup.

Place agarics of as large a size as you can procure (not worm eaten), layer by layer in a deep pan, sprinkling each layer as it is put in with a little salt; the next day stir them up several times so as to mash and extract their juice. On the third day strain off the liquor, measure, and boil for ten minutes, and then to every pint bottle of the liquor add  $\frac{1}{2}$  oz. of black pepper,  $\frac{1}{2}$  oz. of bruised ginger root, a blade of mace, a clove or two, and a teaspoonful of mustard seed; boil again for half an hour, put in two or three bay leaves, and set aside until quite cold; pass through a strainer and bottle, cork well, and dip the ends in resin. A very little Chili vinegar is an improvement, and some add a glass of port wine or a glass of strong ale to every bottle. Care should be taken that the spice is not added so abundantly as to overpower the true flavor of the mushrooms.

#### Asparagus Paper.

According to the *British Mercantile Gazette*, an excellent paper can be made out of the white ends of asparagus, which consist entirely of tough vegetable fibers. The material is adapted to the production of the finer kinds of writing paper.

#### NEW BOOKS AND PUBLICATIONS.

OUR COMMON INSECTS. By A. S. Packard, Jr. Illustrated. Estes & Lauriat, Publishers, 301 Washington street, Boston.

This is mainly a reprint of a series of popular papers on insects which appeared in the *American Naturalist*, from 1867 to 1871. Mr. Packard has devoted considerable attention to popularize entomological knowledge, and has already published several works similar to this. The descriptions of the various insects treated in the present volume are very full, notably free from technicalities and are abundantly illustrated. The chapter on the ancestry of insects wherein the strong genetic bond uniting the worms crustacea and insects is traced, and the various steps of the evolution of the articulate division of the insect kingdom pointed out, will be read with especial interest by all naturalists, while the insect calendar wherein the times of the appearance of injurious insects are noticed will be of much value to the farmer.

OUTLINES OF MODERN ORGANIC CHEMISTRY. By Professor C. Gilbert Wheeler, of the University of Chicago. A. S. Barnes & Co., New York city and Chicago.

A simple treatise on the science, partially based on Riches *Manuel de Chimie*, and especially adapted to the uses of colleges and schools, where extended study of the subject is not included in the course. It is in harmony with the most recent advances, and is concisely and clearly written.

THE SPORTSMAN'S NOTE BOOK. By Wakeman Holberton, 102 Nassau street, New York.

This a convenient little book bound in soft covers for use by sportsmen. It contains blank pages for a diary, blank scores for rifle matches, game scores, and valuable advice in regard to guns, fishing tackle, camp cookery, receipts for accidental wounds, and a condensed record of game laws and seasons in all the States.

THE TELEPHONE. An account of the Phenomena of Electricity, Magnetism, and Sound, as involved in its action; with directions for making a speaking telephone. Professor A. E. Dolbear, Tufts College. Lee & Shepard, Boston. Illustrated.

Professor Dolbear has written this small book to meet the public want for a clear and concise explanation of the telephone. He makes plain the phenomena of electricity, magnetism and sound, and the numerous cuts inserted render the mechanical conditions intelligible. As the inventor of the magneto-electric speaking telephone, he describes at length his first instrument and gives directions to make an improved pattern. The book contains a great deal of useful information.

THE COUNTRY is the title of a new weekly journal devoted to the dog, the gun, yachting, fishing, etc., and published by "the Country" Publishing Association, No. 36 Murray street, this city. The first number before us has a capital table of contents. There are practical articles on training dogs, which abound in valuable suggestions; the correspondents columns are well filled with letters evidently prepared by men who know how to write as well as they understand handling gun and rod, and in a word the entire paper is bright, lively, and thoroughly interesting. Its aim is to deal with everything relating to the country, and with outdoor sports of all kinds. It is handsomely gotten up, and is well illustrated. We can bid the new comer a cordial welcome, and can commend it to our readers who are interested in outdoor sports. The subscription price is but 3 dollars a year.

#### Recent American and Foreign Patents.

##### Notice to Patentees.

Inventors who are desirous of disposing of their patents would find it greatly to their advantage to have them illustrated in the SCIENTIFIC AMERICAN. We are prepared to get up first-class WOOD ENGRAVINGS of inventions of merit, and publish them in the SCIENTIFIC AMERICAN on very reasonable terms.

We shall be pleased to make estimates as to cost of engravings on receipt of photographs, sketches, or copies of patents. After publication, the cuts become the property of the person ordering them, and will be found of value for circulars and for publication in other papers.

#### NEW MECHANICAL AND ENGINEERING INVENTIONS.

##### IMPROVED MACHINE FOR CROCHETING THE TOPS OF HOSIERY GOODS.

Joseph M. Merrow, Merrow Station, Conn.—This invention relates to a machine for crocheting or over stitching the top or edge of hosiery or knit goods, and it consists in certain improvements upon that type of machine in which a reciprocating needle carries the yarn or thread through the goods as advanced by a feed, while a hook forms a stitch by looping the thread above and below the work plate. The stitch, consisting of a loop from above the fabric and a loop from below the fabric, of two adjacent stitches having drawn through them a loop from the next stitch in order, is peculiar to this machine, and forms an elastic and ornamental finish for the edge of the work. This stitch is also adapted to joining or overseaming the edges of work, forming a strong seam, which is fully as elastic as the goods in which it is made.

##### IMPROVED PISTON PACKING.

J. H. Ferdinand Otto, Reedsville, Wis.—This invention relates to improvements in metallic piston packing, by which the packing rings are readily adjusted to the required degree of tightness by a simple mechanism. The inner and outer split packing rings of the piston are guided between the end plates and expanded by three or more interior band springs. These springs are operated upon by sliding nuts that are moved forward or back by means of radial screws, which are operated by a worm gear. The shafts of the intermeshing pinions pass parallel to the piston rod into inner sockets of the face plate, which is attached by screw bolts to the body of the piston. The sliding nut is guided between lugs on the inside faces of piston head and follower. The socket openings of the face plate are closed by short cap screws, which admit, when removed, the engaging of the key with the nicked ends of the pinion shaft, so as to turn the same and sets the springs and rings to the required degree of expansion.

##### IMPROVED TOOL POST FOR LATHES.

Robert Neasham, Mount Washington (Pittsburgh), Pa.—This relates to tool posts for engine lathes and similar tools, and it consists of a support for the tool which is made in two parts, the upper part being screwed into the lower part, and capable of being raised or lowered by turning the said lower part. The tool post passes through the support, and is mortised to receive the tool, which is clamped by a set screw in the usual way.

##### IMPROVED RAILWAY SWITCH SIGNAL.

George W. Anders, Woodsboro, Md.—The object of this invention is to provide an improved signal to indicate the position of the movable rails of a switch in the night time for the purpose of informing the engineer of an approaching train that the switch is open or closed, as the case may be. The invention consists in attaching to the switch lever a lantern having differently colored glass panes, and provided with a swinging lamp whose position in front of one or another of the colored panes indicates the position of the lever, and thereby the position of the switch rails also. The invention further consists in the particular construction of the lantern and swinging lamp.

##### IMPROVED COMBINED CRANK AND TREADLE POWER FOR DRIVING SAWS AND OTHER LIGHT MACHINERY.

Henry Shear, Arcola, Ill., assignor to himself and Edward Cornthwait, of same place.—The ends of the shaft, which revolves in bearings attached to the upper rear part of the frame, project at the sides of the frame, and to them are attached the cranks, which are made with an offset, forming a second crank. To the inner and shorter cranks are pivoted the ends of the connecting rods, the lower ends of which are pivoted to the ends of the treadles. The treadles are pivoted at their centers to pins attached to the lower part of the frame. To the driving shaft is attached a pulley, which is made large and heavy to adapt it to serve also as a flywheel, and around which is passed a band. The band also passes around a pulley attached to another shaft, which revolves in bearings attached to the upper part of the frame. In using the machine a man stands upon each treadle with a foot near each end, and grasps the crank with his hands. Then, by the natural motion of turning the crank his weight will be thrown alternately upon the opposite ends of the treadle.

##### IMPROVED SPARK ARRESTER.

John A. Blair and William C. Bush, Fair Hill, Md.—The object of this invention is to provide an improved spark and cinder catcher for locomotives and other engines which will catch the cinders and conduct them to