AMATEUR MECHANICS.—DRILLS AND DRILLING.

An ordinary flat drill for most purposes will answer nearly, if not quite, as well as a twist drill. It is not a difficult matter to make them, since we have such reliable material as Stubs' steel wire of every size. The best form of flat drill for general purposes is shown in Figs. 1, 3, and 4. It is made by milling or filing the opposite sides of the wire, so as to form a bit or blade having a thickness equal to about one fourth of the diameter of the wire. The angle of the point should be 90°, and the angle of its cutting edge about 45°, for most uses. For a drill for very hard substances, these angles may be more obtuse.

Having formed the drill, it should be hardened by heating it to a low red and plunging it straight down into cool (not cold) water. In case of a very small drill, it may be held in the flame of a gas burner or lamp in a pair of spring nippers over a vessel of water. When it attains the required degree of heat it may be dropped into the water.

To temper for most cases the drill, after being brightened on an emery wheel or piece of emery paper, is heated; if it is a small one, in an alcohol or gas flame, until its color at the point runs down to a brownish yellow verging on a purple. If the drill is very large it may be heated over a forge fire, or over a heavy piece of red-hot iron. If the drill is a very small one, it may be hardened and tempered at one operation by heating to a low red heat and plunging it immediately into a piece of beeswax.

If it is desired to have the point of the drill very hard, without being liable to breakage, its temper may be drawn by holding its point in pliers, as shown in Fig. 1, while the main portion is held over a gas flame. The cool jaws of the pliers prevent the point from becoming heated.

Another method, applicable to larger drills, is to employ a notched block of lead, as shown in Fig. 2. The drill in this case is driven a short distance into the lead before it is hardened; then, as it is tempered, it is replaced in the lead to preserve the hardness of the cutting edges while the temper is drawn in the other portions.

When a drill is hardened by immersing its point in mercury instead of water, it acquires a diamond-like hardness. The point of the drill just described is shown in perspective and in section at D in Fig. 3. The drill, F, is similar to the drill, D, the point of difference being a half round groove along each face adjacent to the cutting edge. This device gives the cutting edge a more acute angle, which is desirable for some kinds of work. G is a straight drill having concave or fluted sides, and E is the well known twist drill. The drills, G E, are shown in cross section in the central figure. Twist drills of recent manufacture have a central longitudinal line, which locates the point in grinding.

The best rule for grinding twist drills is to preserve, as nearly as possible, the original form. The ordinary pin drill, H, is used for counterboring, a hole being first drilled to receive the pin. The drill, I, is employed to give an ornamental appearance to plates in which pivots or small shafts are journaled, as in clock work. The bottoming drill, J, has three cutting edges, one upon each side, and a central transverse one connecting the other two. This drill, as its name indicates, is designed to make a flat bottom in a drill hole.

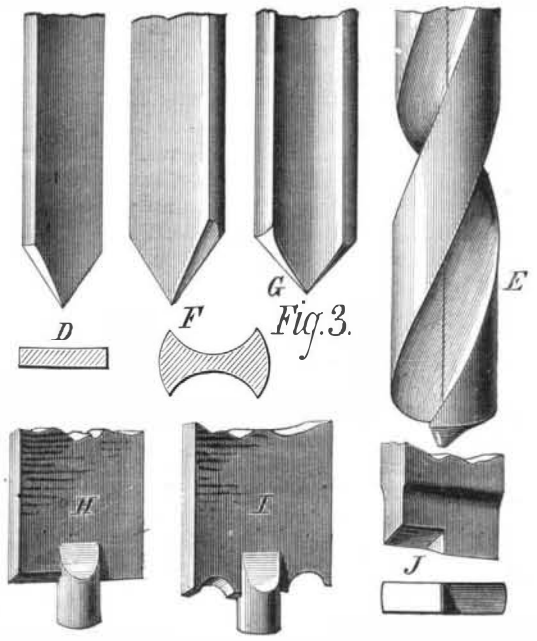
The pin drill, K, which is shown in side and end views in Fig. 6, is first carefully turned and afterward milled with the rose bit, L, producing the cutting points or lips, which are afterward beveled with a file. This drill is used for boring large holes in sheet metal, a small hole being drilled first to receive the pin. M is an expansion drill for the same purpose; its construction will be readily understood from the engraving. The spindle is mortised to receive the tool carrying arm, which is secured in the mortise by a key. The lower end of the spindle is bored to receive the drill, which also forms the pin for guiding the cutter.

While universal chucks are recommended for holding drills, another form of chuck, shown in Fig. 4, may be used with equal advantage. It consists of a main portion, A, which screws on the lathe spindle, and has a tapering threaded end for receiving the milled nut, B. The threaded end is split to admit of its contraction as the nut, B, is screwed on. The part, A, is bored longitudinally to receive sections, C, of iron or steel rod. To prepare this chuck for holding drills, the pieces, C, are inserted in the chuck, centered with a pointed tool, and are drilled with the drill with which they are intended to be used. They are then split longitudinally with a saw for about three fourths their length. The pieces, C, when once prepared, will always answer for the same sized drill; they may also be used with an ordinary chuck having a set screw.

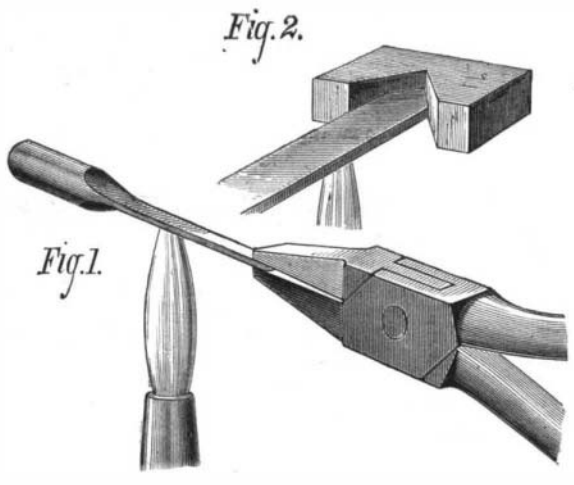
The fluted countersink, O, may be classed among the drills; its special application is to form the centers of articles to be turned. It has the same form as the lathe centers, and makes a truly circular conical hole, providing the number of flutes or cutting edges is odd.

Every lathe should be provided with a plate, or drill rest, P, fitted to the tail spindle, for supporting plain work while drilling it. The lathe should also have a hinged or pivoted rest, Q, which may be clamped at any desired angle for drilling irregular work. This plate should have several perforations for receiving pins, for preventing the work from slipping. For supporting cylindrical objects to be drilled transversely, a fork, R, is inserted in the tail spindle.

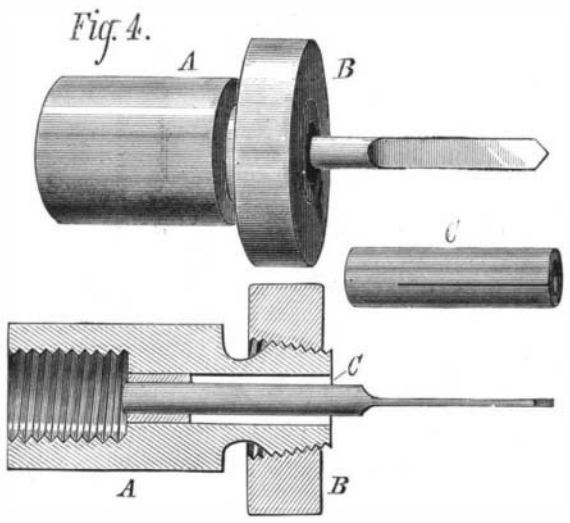
As to the matter of drilling, little need be said, as nearly everything must be learned by experience; however, a few points may be mentioned. The work should be carried forward with a regular and not too heavy pressure. The speed of the drill will vary with the material being worked. For steel, wrought iron, and copper, the speed should be slow; for brass and cast iron, it may be quite rapid. In drilling steel or wrought iron, oil is the best lubricant for the drill; in drilling glass, the drill should be wet with turpentine, to which gum camphor has been added; the drill may be used dry in drilling brass and cast iron. M.



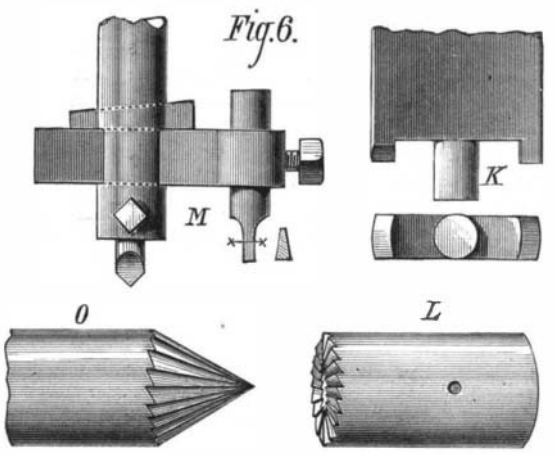
FORMS OF DRILLS.



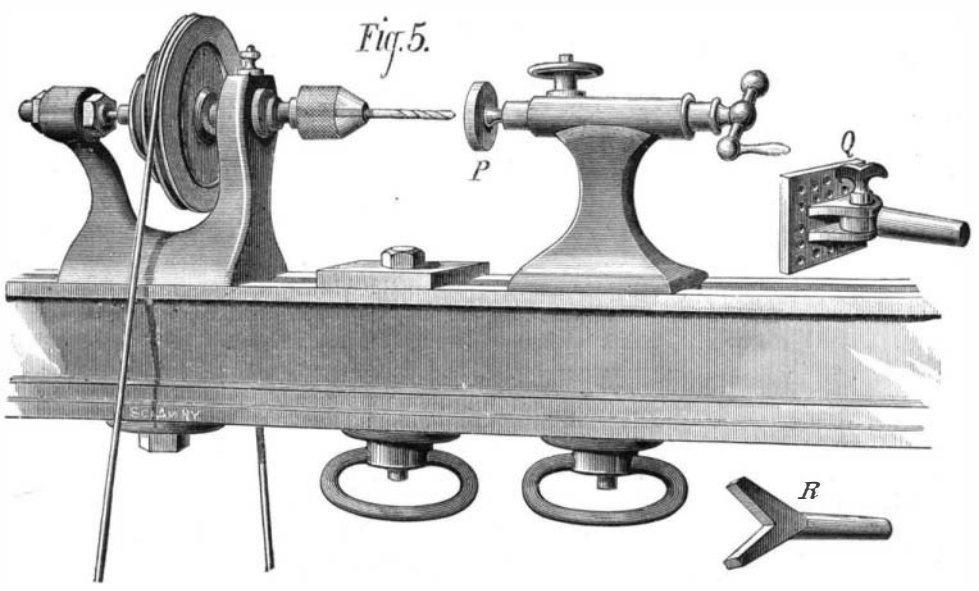
TEMPERING.



DRILL CHUCK.



DRILLS AND ROSE BIT.



LATHE, WITH WORK SUPPORT.

Novelty in Cleaning Iron Scraps.

An English inventor proposes to utilize tin plate and terne plate scrap by employing a centrifugal apparatus, so arranged as to permit of the scrap being readily placed therein and withdrawn therefrom, and of receiving a central fire for heating the scrap. The rotating cylinder or drum of this apparatus is fitted with a cage, which is packed with the scrap intended to be utilized, and in the center of the cylinder and of the inserted cage is a chamber for the fuel.

When the cylinder is charged and the fuel ignited, a rapid rotary motion is applied to the cylinder and its contents, and an indraught of air to the ignited fuel is thus produced and maintained. The heat thereby generated is caused to impinge upon the scrap and raise the temperature of the mass to a sufficient height to fuse the coating metal.

The effect of the centrifugal action is to discharge the fused metal in the form of spray into the casing of the apparatus, and to leave the iron in a clean state.

The cage containing the scrap is then to be removed and replaced by another charged with fresh scrap, and the operation may then be repeated. Instead of using a central fire the heat may be supplied from an adjacent stove. This will permit of the temperature being nicely adjusted to suit the work in hand, and thereby prevent the volatilization of the metal, as, for example, when zinc is required to be recovered, or otherwise injuring the substance under treatment. The scrap iron thus cleaned is in a fit state for working up again into plates, or to be used for bottoms for puddling furnaces.

Recent Engineering Inventions.

Mr. Samuel G. Martin, of South Amboy, N. J., has devised an improved Steam Steering Apparatus, in which a steam steering mechanism and the ordinary hand steering mechanism are combined in such a manner as to enable either to be used alone whenever desired, without interfering with the action of the other.

Mr. James Manes, of New Haven, Conn., has patented an improved Process and Apparatus for Manufacturing Sulphuric and other Acids, and for extracting volatile matters from ores and other substances. It consists in a revolving roasting chamber and a partitioned condensing chamber of novel design.

An improved Ore Washer has been patented by Mr. Theophilus T. Allen, of Denver, Col. The object of this invention is to provide a simple and effective gold washer, which will operate automatically and may be easily cleaned. It consists in an arrangement of gratings, sluices, riffles, and spiral jets, the construction and operation of which cannot well be described without an engraving.

Mr. Louis Leypoldt, of New York city, has devised a Railroad Rail composed of outer steel plates, inner iron plates, and central strip of lead, the metallic strips being separated by layers of leather or similar material.

The International Dairy Fair.

Cheese factories and creameries in practical operation constitute a special feature of the Dairy Fair in this city, beginning December 2, and continuing through the week. Three hundred gallons of milk and twenty-five gallons of cream are required for these operations. The entries of butter and cheese, each over 200 lbs. in weight, exceed 1,000, and the single packages will reach 10,000. One exhibit is a cheese weighing 1,500 lbs. A large display of blooded dairy cattle and dairy implements and machinery add to the interest of the fair.

The secretary has given the following statistics with regard to the importance and rapid growth of the butter and cheese trade:

The production of butter and cheese as specialties began in the eastern part of this State scarcely thirty years ago; thence it extended northward and westward, until it has become the leading industry of the State. In Pennsylvania, the best counties are devoted to dairying; the northern part of Ohio makes it a specialty, several counties of Michigan, all of northern Illinois, the best sections of Wisconsin, and portions of Iowa, give almost exclusive attention to making butter and cheese. Colorado has established several cheese factories, and California within ten years has changed from an importing to an exporting State in these articles. Fifteen years ago, Chicago merchants obtained their supplies of cheese from the East; while at the present time one hundred millions of pounds pass through that city for New York annually. Canada within a brief period has become our competitor in the English markets to the extent of 80,000,000 lbs. yearly; while she formerly bought of us. With the exception of the States mentioned and a few counties in Vermont and New Jersey, the remainder of the United States buy more than they produce. The entire South is supplied from this city and the West.

The value of the land and cows in the United States employed in furnishing milk, butter and cheese is not less than $1,300,000,000, or the sum of nearly half the national debt, at its highest point. Over three thousand factories are engaged in the manufacture of these articles and tens of thousands of private dairies besides; more than one quarter of each are in this State. One manufacturer in Western New York State has over forty factories; others in different sections have from five to thirty each. Different firms in this city handle from $2,000,000 to $3,000,000 worth of cheese and butter annually.

The production of cheese is estimated at 350,000,000 lbs. per annum, and of butter about 1,500,000,000 lbs.; of the former 130,000,000 lbs. will be exported this year and about 25,000,000 lbs. of the latter. The value of the two is about $350,000,000, or $50,000,000 more than the wheat crop of the country; three times more than the oats crop; four times more than the potato crop; one seventh more than the hay crop; one third more than the cotton crop, and but one fifth less than the corn crop. The number of cows in the United States is over 13,000,000; which is six times the number in Great Britain, over twice the number in France, two and a half times more than in Prussia, and more than in the countries of England, Ireland, Scotland, Wales, Denmark, Norway, Sweden, Russia, Finland, Austria, Hungary, and Switzerland combined, although these countries together contain four times the population of the United States. The proportion of cows to the inhabitants here is twenty-three to each one hundred persons.

The productions of cheese and butter have increased thirty-three per cent this year, and the exports have been in like proportion.

The cheese and butter exported this year have paid freight to the amount of over $1,000,000 to the ocean commerce of this port, or a sum almost sufficient to support a line of weekly steamers. These articles pay to the railroad companies over $5,000,000 annually for transportation, and the article of milk pays nearly as much more. Loaded on railway cars, ten tons to each car, the butter and cheese produced in this country in one year would fill 22,000 cars, and make a compact line 135 miles long.

Corrections of Errors in Patents.

The following rules have just been promulgated by Gen. Paine, the Commissioner of Patents, which, having received the approval of the Secretary of the Interior, will hereafter govern the action of the Patent Office in such cases as come under their provisions:

Where a mistake incurred through the fault of the Office is clearly disclosed by the records or files of the Office, and does not constitute a legal ground for reissue, a certificate showing the fact and nature of such, signed by the Secretary of the Interior, countersigned by the Commissioner of Patents, and sealed with the seal of the Patent Office, will, at the request of the patentee or his assignee, be indorsed without charge upon the letters patent and recorded in the records of patents.

Where a mistake incurred through the fault of the Office constitutes a sufficient legal ground for reissue, such reissue will be made by the correction of such mistakes only, without charge of office fees, at the request of the patentee.

Mistakes not incurred through the fault of the Office, and not affording legal grounds for reissues, will not be corrected after the delivery of the letters patent to the patentee or his agent.

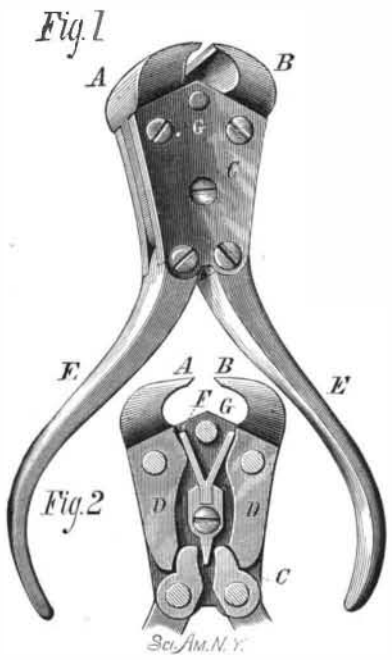
No changes or corrections will be made after their delivery to the patentee or the agent, except as above provided.

THE FAIRBANKS PRIZES.

Messrs. Fairbanks & Co., the scale makers, are used to winning prizes; yet their experience at the Paris Exhibition must have been a surprise even to them. Seven medals, in as many different classes, constitute a victory as unique as it was honorable. Their honors embrace three gold medals, two of silver, and two of bronze. One gold medal was received for their general exhibit; their scales received one gold, two silver, and one bronze medal; the improved type writer won a gold medal; and the oscillating pumps, for which the company are world agents, received a bronze medal. It is through the skill and integrity of houses like Fairbanks & Co., that the high rank of American manufactures has been achieved; for such products not only compel admiration abroad but rivalry at home. Every article of sterling merit, like the Fairbanks scales, raises a standard in its department of manufacture which all other makers must strive to equal or their success is impossible. The whole country is benefited, both directly and indirectly, by such victories in industrial competition.

NEW CUTTING NIPPERS.

Cutting wire by means of the ordinary cutting pliers is an operation often requiring the entire strength of both hands, making it a difficult matter under some circumstances to use a tool of this description. Any one who has used cutting nippers has seen the necessity of an easier means of doing this kind of work. The accompanying engraving represents a new form of cutting nippers which seem to fulfill the requirements. It was recently patented in this country and in Europe by Mr. Thomas G. Hall, of New York city, and is manufactured by the Interchangeable Tool Company, 71 Broadway, New York.



HALL'S CUTTING NIPPERS.

In the engraving Fig. 1 is a perspective view, and Fig. 2 has the side removed to show the internal arrangement. The jaws, A B, having cutting edges of the usual form, are pivoted between plates, C, and their arms, D, are engaged by the shorter arms of the handle levers, E; these levers being also pivoted between the plates, C.

A spring, F, engages the two cutting jaws and throws them apart. The screws, which serve as pivots for the jaws and handles, also serve to hold the plates, C, together. A pin, G, acts as a stop on the jaws. By means of the double leverage obtained by this construction, wire cutting is made a very easy operation.

In addition to the great power attained, it possesses the further advantage of not becoming entirely useless from the fracture of jaw or handle. In this nipper a broken jaw or handle can be easily replaced, as all of the parts are perfectly interchangeable, and a new piece may be obtained from the manufacturers at the cost of a few cents. This advantage will be apparent, as all users of such tools well know that other nippers broken in the handle or jaw are useless, and must be replaced by a new tool.

REMEMBER that the information contained in the SCIENTIFIC AMERICAN, on mechanical subjects, new inventions and discoveries, cannot be obtained through any other source.

ANOTHER TRADE MARK DECISION.

The first trade mark case under the recent treaty between the governments of Great Britain and the United States was decided at the Patent Office, December 2.

English trade marks have been registered at Washington for many years under a section of the Revised Statutes, authorizing reciprocal privileges to citizens of countries wherein American citizens were granted the right of registration.

In 1876, Secretary Chandler, at the suggestion of Commissioner Duell, and with the advice of the head of the Department of State, decided that the treaty of 1794 between the United States and Great Britain, under the provisions of which the American patent officials had been registering British trade marks, did not warrant such registry, even before its abrogation, which took place long ago, and that no further privileges of that character could be granted British subjects until a treaty was entered into authorizing it. Thus for more than two years these privileges have been withheld, or, if not, they were granted in violation of the ruling of the head of the department.

Meantime a convention was entered into to meet the exigency, and the resulting treaty, which was framed by Minister Pierrepont and Lord Derby, was promulgated by the President last July. A question immediately arose as to the validity of the British trade symbols registered previous to Mr. Chandler's decision, and that question has remained undecided to this time, when a registration of the mark of George Westenholm & Son, the well known Sheffield cutlery firm, was allowed, thereby recognizing the former insufficiency of all others of its class. The Patent Office officials have determined to make the best of a bad job by registering all such marks without further fees under the heading of office errors.

This decision is thought to affect the interests of some three hundred British subjects whose goods are sold in our markets, though no large interests will be sacrificed if the parties concerned take proper steps to protect themselves.

A Warning to Amateur Chemists.

A recent fatal explosion of an oxygen retort in London calls out the fact that two other accidents of the same nature have occurred within a few years. In both these cases binoxide of manganese was used as the source of the gas, and it was afterwards discovered that the oxide was adulterated, in one instance with soot, in the other with antimony sulphide, making mixtures as dangerous as gunpowder under the conditions required in the manufacture of oxygen. As this compound of manganese is very frequently used in the production of oxygen for experimental purposes, in the class room and elsewhere, it should always be tested beforehand for such adulterations.

Correspondence.

C. E. Andrews & Co.'s Baking Powders.

To the Editors of the Scientific American:

In your issue of the 16th ult., was a communication by Henry A. Mott, Jr., in which our name is used in a manner calculated to mislead the public, by saying that *the* baking powder manufactured by C. E. Andrews & Co., of Milwaukee, Wis., contained ingredients unhealthy and injurious. If the analysis given meant our oldest baking powder, known under the brand of Pearl, and that *it* contained no cream tartar, we now propose: If any chemist in New York, or elsewhere, will select with *us*, wherever sold, a number of one-pound, full-weight cans of *our* Pearl Baking Powder, that we may be confident that the labels have not been broken and the powder tampered with, then we will select a chemist, and the two to select a third, and then upon analysis, if they declare that the analysis then given corresponds with that given in your issue of the 16th ult., under the ambiguous title of "The Baking Powder," and that the Pearl does not contain cream tartar, that biscuits made from it would be injurious, then we are ready to pay upon demand any amount previously agreed upon.

If the result of the analysis made by the chemists so chosen does *not* correspond to the analysis given of "*The* Baking Powder" in yours of the 16th ult., but that the principal ingredient in our Pearl is cream tartar, then the opposite party is to pay us the amount previously agreed upon.

We DO make and sell a baking powder containing exsiccated alum, and if that is *the* baking powder meant in yours of the 16th ult., why was not the name "Regal," which is the only printing matter on the front part of the label, given, as the names of the other powders alleged to have been analyzed were stated? Our alum baking powder we take as much interest in, as in our oldest, the Pearl. When sold it was always stated to be an alum powder, and no misrepresentations made. WE were satisfied that biscuits made from it were in no way injurious. We shall continue to sell it, with the name of the powder, Regal, and our firm name upon the labels, especially after the clear, concise, and intelligent exposition of the harmless effect of exsiccated alum in baking powders, given by Mr. Henry Pemberton, Jr., in your issue of December 7th, and corroborated in same issue by the opinion of such an eminent chemist as R. Ogden Doremus, M. D., LL.D., Bellevue Hospital Medical College, New York.

We take the liberty to quote you, Messrs. Editors, from your issue of December 7th: "Finding alum in the baking powders named, Dr. Mott leads the reader to infer that there must be alum in the biscuits made therewith. This inference, as Mr. Pemberton shows beyond a doubt, is altogether wrong; the chemical process of baking causing the total disappearance of the alum as such, the resulting compounds being either wholesome or inert. . . . . The whole matter, indeed, seems on examination to resolve itself into a rivalry between different *methods* of producing baking powders; and in lauding one form at the expense of another equally wholesome."

In conclusion, if Henry A. Mott, Jr., is actuated solely for the public good, and is republican in his wishes, and not ROYAL in his proclivities, he will admit the truth of your editorial from which we have quoted.

Respectfully,

C. E. ANDREWS & CO.,

Manufacturers of Pure Spices, Pearl and Regal Baking Powders, Milwaukee, Wisconsin.