NEW PHOSPHIDES OF SILVER, AND A METHOD OF ESTIMATING SILVER QUANTITATIVELY BY MEANS OF PHOSPHORUS.

BY WILLIAM FALKE, PROFESSOR OF NATURAL AND PHYSICAL SCIENCES IN MANHATTAN COLLEGE.*

In continuation of my communication commenced on page 148 of the last issue of the SCIENTIFIC AMERICAN: The question now occurred whether the phosphorus solution could be advantageously employed for the estimation of silver; for, as has been previously observed, the whole of the silver can be separated, in a short time, from many of its salts. Silver is generally estimated as chloride, and this is a process in which the very greatest care is requisite to produce accurate results. At first it must be precipitated as a chloride and be allowed to settle, then collected upon a filter and washed very rapidly to prevent any silver from being reduced by the organic matter of the filter, and, lastly, it must be transferred to a crucible and ignited. This method involves more or less difficulty and loss. After a series of experiments, the following phosphorus method is suggested as superseding the use of a filter, and in which the silver is at once weighed in the metallic state. Into a carefully weighed and dried tube or capsule, the salt of silver (the nitrate) is put, and dissolved in a small quantity of water. Then at least one fifth of its weight of phosphorus, dissolved in carbon disulphide, is added, and the tube, with its contents, slowly warmed. At first the silver is reduced with some phosphide admixture, then the carbon disulphide evaporates, and lastly the water is removed by careful evaporation, so as to prevent any spurting. After the whole is nearly dry, which is generally accomplished in less than half an hour, the tube may be heated for a short time, by gradually applying the flame to it. The excess of phosphorus undergoes combustion, and the phosphide also, so that nothing remains in the tube excepting metallic silver and phosphoric oxide, which is dissolved out with some distilled water, and the solution is poured out, as the silver adheres together in a spongy or scaly condition. After washing a few times, by decantation, the tube containing the silver is well dried by semi-ignition, and weighed by subtracting the weight of the tube from the tube and silver, and thus the weight of the silver is known.

A few of very many experiments are given to show how accurate and simple the method is: Tube, 7·275 grammes (112·267 grains); silver nitrate, 0·068 gramme (1·049 grains); phosphorus, 0·025 gramme (0·3858 grains); carbon disulphide 0·5 cubic centimeter (0·0305 cubic inch); water, 3·000 cubic centimeters (0·183 cubic inch.)

After analysis: Tube + metallic silver, 7·318 grammes (112·929 grains) — tube, 7·275 grammes (112·267 grains) = silver 0·0430; calculated in the nitrate, 0·0432, showing a difference of only 0·0002 of a grain.

Another example showed: Silver calculated in nitrate, 0·2617: silver found in nitrate, 0·2615 = 0·0002.

From this it will be seen that (by simply taking a capsule or tube previously well dried and adding the salt of silver or its solution, then the phosphorus dissolved in carbon disulphide, and mixing the whole), by careful evaporation and lastly semi-ignition, and then washing out after cooling the phosphoric acid and again drying, the silver may, as such, be at once weighed and determined. Many other salts of silver are at present under investigation, of which, in the future, more will be heard.

For descriptions of the few compounds of silver and phosphorus thus far known, which are of a very unsatisfactory nature, on account of the difficulty of the investigations, the reader may see Watt's "Dictionary of Chemistry," volume V., page 303.

English Railway Car Signals.

How to establish a suitable means of communication between the interior of the passenger cars and the engine driver is still a harassing and unsettled problem in the minds of our British cousins. The simple cord used in this country, they think, will not do, because they fear that the unruly subjects of the Queen, pent up in the little apartments of the cars, will pull the string when they ought not. Hundreds of devices have been proposed. What John Bull wants is something that is simple, and that will show to a certainty in which of the thirty compartments of a train the signal originated. Here is the last contrivance: Mr. Stewart, patentee of a new flag signal for railway carriages, recently exhibited his invention in the theatre of the Society of Arts. The invention consists of an apparatus which is inclosed in a small wooden box and placed inside of the carriage against one of the top corners of the compartment. On a catch being released by means of a cord suspended from the roof, a flag is projected through the side of the carriage, and at the same time a rope in connection with the apparatus causes the ringing of a bell in the guard's van and the whistle of the engine to be sounded. The intention of the invention is to provide instantaneous communication simultaneously with the guard and driver of the train, and, at the same time, means of informing both, by the exhibition of the flag, of the exact carriage in which the apparatus has been set in motion. A rope, running from end to end of the train, keeps the boxes in the various compartments in connection with the guard's van and the engine. The general opinion of those who examined Mr. Stewart's model was that, provided the machinery should not be liable to get out of order in the working, and that the expense should not deter railway managers from its adoption, it would be a great improvement on the existing means of communication between passengers and guards in traveling trains. The projection of the flag from the side of the carriage in which the bell had been rung was considered to be very valuable, as directing the attention of the guard at once to the spot where his assistance had been called for. Mr. Stewart stated that the probable cost of fitting railway carriages with his apparatus would be about one per cent of the cost of the carriages, which would be $50 for a car costing $5,000.

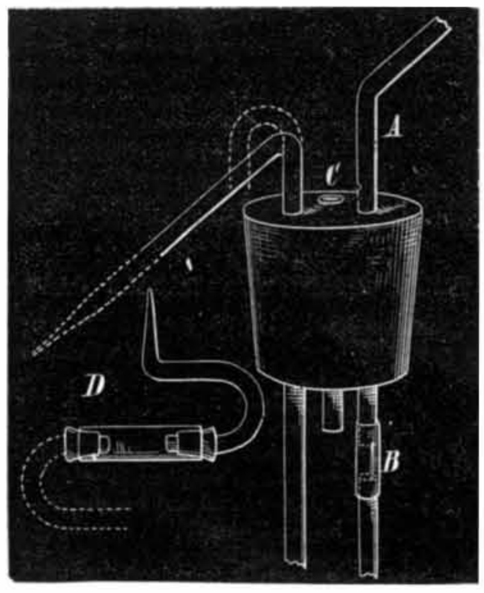
* A part of this article formed the subject of a paper read before the New York Academy of Sciences (late Lyceum of Natural History), December 13, 1875.

Correspondence.

An Improved Wash Bottle.

To the Editor of the Scientific American:

I recently noticed at the Stevens Institute of Technology a very handy form of wash bottle, devised by Mr. F. L. Bardeen, of which I inclose a sketch. It may be termed a constant bottle, for it throws a stream as long or longer than is required for most washing purposes. With a globe-shaped flask, holding about a liter (four fifths of a quart), the stream is constant for 45 seconds; and with the hot water bottle of the same size, for 1 minute or more, owing to the expansion of air within. With larger flasks, the time of flowing would of course be lengthened. The length of time, obviously, depends on the size of the jet and amount of air in jected; but for ordinary purposes, the time is about as stated. Globe-shaped flasks should be used. and they should never be more than two thirds full; and as the space for air increases as the water flows out, the stream remains constant for a greater length of time.



The device is made by perforating the cork in three places: the first for the exit tube, which extends to the bottom of the flask, the second for the tube through which the air is forced, and the third for an open tube for stopping the flow by relieving the pressure. On the lower end of tube, A, is a valve, made by slipping a short piece of rubber tubing over the tube, making a slit in the side, at B, and closing the lower end with a piece of glass rod. As this slit opens outwardly, all air forced through it is retained, and the expansion of this produces the jet. At C is the third opening in the cork, in which is a short piece of small tube, left even with the cork at the top and projecting a little way through the cork at the bottom.

The mode of use is as follows: Place the first finger of the hand that holds the bottle over the hole, C, and give a strong blast. If the finger remains over the hole, the water will flow for the space of 1 minute or more. The flow is instantly stopped by removing the finger. By using the movable nozzle, indicated at D, the jet may be directed to any required spot. It is especially convenient, as thus constructed, for washing down the precipitate from an inverted beaker; and as it is frequently desirable not to disturb the latter, in the above device the head is not obliged to follow the bottle into uncomfortable positions and remain so while the washing proceeds. W. KNOWLTON.

New York city.

The Great Engineer for President.

To the Editor of the Scientific American:

"The right man in the right place." This oldfashioned doctrine is revived in your able article nominating James B. Eads for the Presidency.

A statesman, an anti-monopolist, an advocate for the rights of the laborer, a gentleman of the highest scientific attainments and literary culture, James B Eads has rendered more lasting service to the Republic than any man living in the United States.

He is truly a representative of the best type of American citizen. Progressive, energetic, endowed with inventive powers in an extraordinary degree, he has contributed more to the advancement of practical science than any man of the age. Constructing an ironclad navy for the Western waters, he originated many important improvements therefor, which resulted in the building of ironclads of lighter draught than had been deemed possible.

As a civil engineer, James B. Eads occupies an eminent position. There is nothing in scientific history to compare with the St. Louis and Illinois bridge, with its wonderful aisson work. Slender and airy as the masonry of this bridge in its perfect symmetry appears, it contains 103,000 cubic yards of masonry—almost double the amount contained in the piers of any other bridge of equal length. The reports of the projector have been translated into many languages, and form the basis of text books used in schools of engineering in America and Europe

Although yet in the prime of life, James B. Eads has accomplished grand public improvements which might compass a centnry. The records of the Patent Office exhibit him as the originator of many useful and varied improvements. The Jetty system, now being constructed by this distinguished engineer, at the mouth of the Mississippi river, is one of the grandest works of the nineteenth century. The Mississippi river drains one of the most extensive, fertile, and salubrious valleys on the face of the globe, yet the only outlet to the sea, of this grand region, has always remained blocked by a bar over which commerce has vainly striven to find unfettered passage. The success of this great enterprise is already nearly established.

An honest man, an enlightened gentleman, gifted with administrative abilities of a high order, a statesman of broad, comprehensive views and sound logic, James B. Eads is pre-eminently fitted to fulfil the duties devolving upon the Executive of this great nation.

A PATRON OF HUSBANDRY.

Can We Protect our Bank Vaults?

To the Editor of the Scientific American:

The article in your issue of February 20 on this subject is worth attention; but let me ask how it is that bank safes in London, Paris, and Vienna are not robbed? They certainly keep as much specie and currency generally on hand in London as we do here, yet I cannot call to mind a single case of a bank safe being robbed in that city. When I resided in London, I was informed by a friend who had been employed as clerk in a London bank that, when he first commenced his duties there, he was compelled to sleep on the premises with some three or four other junior clerks, and that it was made obligatory on them that two of them should always remain at home to look after the building, in conjunction with the janitor and his family. Thus a band of burglars could have no opportunity of robbing such a bank, save by collusion with four or five persons. The country banks in England, I am told, are guarded in the same manner. It seems to me that, if we give the burglars full opportunity to work, it is quite useless making strong vaults and safes. Guard the building: that is the true remedy. Our safe deposit institutions have wisely adopted this plan, and so far successfully. DEPOSITOR.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

The computations and some of the observations in the following notes are from students in the astronomical department. The times of risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the objects mentioned. M. M.

Position of the Planets for February, 1875.

Mercury.

Mercury, which was seen so beautifully after sunset in the latter part of January, can in March be seen before sunrise. On the 1st of March it rises at 5h. 30m. A. M., and on the 31st at 5h. 15m. A. M. The best time to look at it is on the morning of the 10th.

Venus.

Venus becomes more and more conspicuous in the evening sky, setting on the 1st of March a little before 9 0 P. M., and on the last of March a little after 10 P. M.

As Venus passes the meridian between 2 and 3 in the afternoon all through the month of March, with an increasing apparent diameter and at higher and higher altitude, it can probably be seen with the naked eye at its culmination.

Mars.

Mars rises on the 1st of March at 8h. 33m. A. M., and sets at 10h. 5m. P. M. On the 31st, Mars rises at 7h. 30m.A.M., and sets at 9h. 54m. P. M. The apparent diameter of Mars is now very small, in consequence of its distance. but on the 29th it may be recognized from its nearness to Venus.

Jupiter.

Jupiter continues to be very near to the star β *Scorpii* and its motions can be very nicely followed by comparing its position with that of the star. In the first half of the month of March, Jupiter is seen to be moving away from the star; on the 17th it is stationary, after which its motion becomes retrograde, and on the 31st it is very near the star.

Jupiter is coming into better position for evening observers; on the 31st of March it rises about 10h. 32m. P. M., and comes to meridian at 3h. 10m. the next morning, at which time the star β *Scorpii* is west of Jupiter by about half the diameter of the moon.

Saturn.

Saturn sets before the sun in March, but it rises earlier and earlier through the month, and in the latter part can be well seen in the morning. On the 31st, Saturn rises at 4h. 28m. A. M., and sets at 3h. 5m. P. M. Mercury and Saturn are in conjunction on the morning of the 18th.

Uranus.

On the 1st of March Uranus rises at 3h. 36m. P. M. On the 31st, Uranus rises at 1h. 34m. P. M. Uranus can be found at meridian passage, which on the 1st is at 10h. 37m. P. M., at an altitude (in this latitude) of about 58°. On the 31st, Uranus passes the meridian at 8h. 36m., at an altitude of 58¼°

Sun Spots.

The report is from January 19 to February 20, inclusive. The photographs of January 20 and January 21 show a large spot (followed by a very small one) coming on, a small group near the center, and another on the western limb.

Clouds prevented photographing till January 25, when the group seen going off on January 21 had disappeared; the group then near the center was now on the western limb,and the large spot had separated into a group, composed of one large and several small ones.

From January 26 to February 12, when observations could be made, the sun's disk appeared free from spots. On February 12 a large spot, measuring nearly $\frac{1}{15}$ of the sun's diameter, with very marked penumbra and followed by faculæ, was observed. On February 16 this spot was seen to have broken up into a chain of small ones, which measured when last seen, February 20, nearly $\frac{1}{16}$ of the diameter of the sun. Observers should look for the return of this spot about March 9.

PRACTICAL MECHANISM.

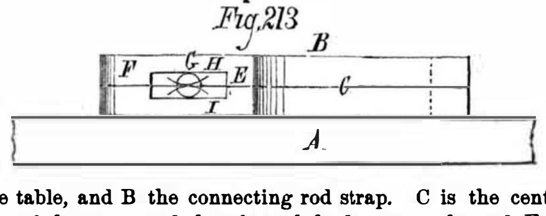
BY JOSHUA ROSE.

NUMBER XLIII.

MARKING OUT A CONNECTING ROD.

Our next operation is to mark out the keyway, which is performed after the butt end of the rod and the inside and outside of the strap have been planed. We first, with a pair of compass callipers, which are better for the purpose than compasses, mark the center of the strap edgeways, and then, laying it with its broad surface on the marking-off plate, we mark off the keyway as follows: In Fig. 213, A represents

Fig. 213

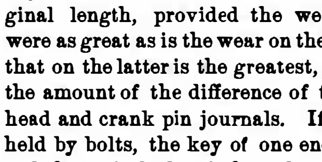


the table, and B the connecting rod strap. C is the center line of the strap, and therefore of the keyway; the end, E, of the keyway should be drawn the necessary distance from the inside crown of the strap, as denoted by the dotted line, because it is that distance upon which the thickness of the brasses depends. Hence the line, E, is the first one to be drawn; then, from the line, E, we mark the length of the keyway, and strike the line, F; the breadth of the keyway we mark by setting the compasses to the radius of a circle whose diameter will be equal to the required breadth of keyway. Then using the center line as a center, we mark the circle, G, and (parallel with its diameter, the center line) the lines, H and I, thus completing the marking of the keyway on the strap. Our next operation is to mark the oil hole of the strap, which should be placed exactly in its proper position, for the following reasons:

A connecting rod whose crosshead end has a strap with a gib and key (or, what is better, two gibs and a key to hold it, the crank pin end having its strap held by bolts, and the key between the bolts and the brass) would maintain its original length, provided the wear on the crosshead brasses were as great as is the wear on the crank pin brasses; but since that on the latter is the greatest, the rod wears longer to half the amount of the difference of the wear between the crosshead and crank pin journals. If both the straps of a rod are held by bolts, the key of one end being between the brasses and the main body of the rod, and the key of the other end between the brasses and the crown of the strap, it would maintain its original length if the wear on both ends was equal; but this not being so, it wears longer, as above stated. The oil hole of a strap, for either a connecting or side rod, should therefore be in the exact center of the space intended to be filled by the brasses. It will thus be central with the joint of the brasses, and from center to center of the oil holes, and will, therefore, represent the proper length of the rod. When, therefore, the brasses of a rod end, whose strap is held by a gib and key, have worn so that the key is let down, the brasses must be lined up to bring the key back to its original position, the back brass being lined up so that its joint face comes even to the center of the oil hole, and the other brass being lined up sufficiently to bring the key back to its original position; then the rod is sure to be of the proper length. But if the strap is held by the bolts (in which case it does not move when the brasses are let together and the key further through), lining the back brass up to the center of the oil hole at once insures the rod being of its correct length, without any reference as to what thickness of liner is put on the other brass, or how far the key may come through. In either case it will be observed that the center of the oil hole, when placed as described, forms a gage to keep the rod its proper length.

To mark off the oil hole, we lay the strap on its side face, as shown in Fig. 214, and, placing a straight edge along the inside crown face of the strap, we mark a line even with it and across the jaw of the strap, as shown at A, in Fig. 214, and from that we mark with the compasses the line, B, the distance between the two being half the total depth of the brasses, or, what is the same thing, the thickness of the crown brass (when new) from its joint face to its bedding crown. We then, with a square and scriber, carry the line, B, over to the center line of the edges of the strap (C in Fig. 213), and the junction of the two is the center of the oil hole. In centerpunching the center for the oil hole to be drilled, make a deep centerpunch mark to prevent the drill from running to one side and thus deceiving the machinist (who may have to line up the brasses when they become worn) as to thickness of the liner to be placed behind the back brass to keep the rod to its original length.

Fig. 214.



The marking of the keyway in the butt or stub end of the rod is performed in the same manner as that of the keyway in the strap, care being taken to make the edge of the keyway nearest to the end of the rod at the exact proper distance from that end: otherwise the amount of space left, when the strap is in its place, between the end of the rod and the crown of the strap (which regulates the thickness of the brasses), will not be correct, and the oil hole will not stand in its correct position on the strap, unless the key and gib are made to suit the inaccuracy of the position of the keyway in the rod end. For example: Suppose the keyway of the rod to approach too near the rod end; then the strap will, if the gib and key are made of the proper width (when placed together, as shown in Fig. 215) across, as at A, not pass sufficiently along the block end, and there will be too much space allowed for the brasses, and the oil hole will stand too near the crown of the strap. The only method of correcting this defect is to make the width of the key and gib, at A, Fig. 215, wider to the necessary amount, and to cut the keyways, both in the strap and the rod end, wider, by cutting out the metal on the edge of the keyway furthest from the rod end, and the metal on the edge of the keyway in the strap at the end nearest to the crown of the strap. If the keyway of the block end errs in the opposite direction, the keyways must of course be made wider, the metal being cut out in the exact opposite to the above direction. By marking out the two keyways as above described, we have no occasion to take any account of the draw, since that will come right of itself when the brasses are put in their places in the strap, and the strap is put in its place upon the rod end. In marking off the rod end from keyways already cut in the strap, the following plan must be adopted: Place the strap upon the rod end, leaving the space between the rod end and the crown of the strap narrower than is required to receive the brasses (when the latter are new) by an amount equal to the amount of taper there is in the full length of the key, and mark the keyway in the rod end even with the strap, taking no account of the draw required on the keyway, which is provided for in the position in which the strap is placed on the rod end, as will be perceived when we consider that the length of a keyway is always the width of the key and gib, at A, when placed together, as shown in Fig. 216. Hence, by marking off the keyway in the rod end with the keyway in the strap, the latter is in the position in which it will stand when the key and gib are in the position shown in Fig. 216. Supposing then the gib and key to be in their

Fig. 215.

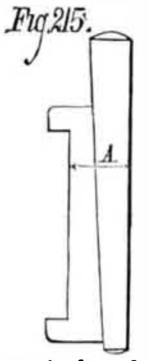


Fig. 216.

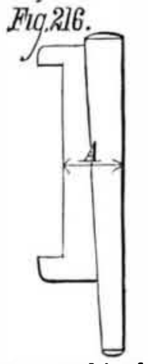
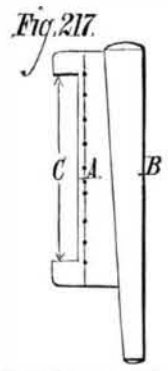


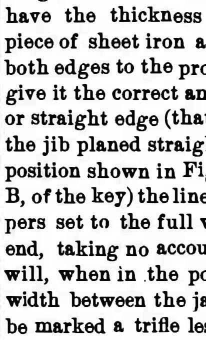
Fig. 217.



places in the rod and strap, and in the position shown in Fig. 216, and that we then lift the key up so that it will stand in the position shown in Fig. 215, and that we then pull the strap as far off the block end of the rod as it will come, the key will then stand in its correct position, and there will be the proper amount of draw in the keyway, both in the strap and on the rod end, and the space between the end of the rod and the crown of the strap will also be correct. To mark off the key and gib, we proceed as follows: After the keyways are filed out, we take a piece of thin sheet iron and fit it to a tight fit in the breadth or thickness of the keyway, and have the thickness of the key and gib planed, using the piece of sheet iron as a gage; we then mark off the key on both edges to the proper width at top and bottom, and hence give it the correct amount of taper. We also have the plain or straight edge (that is, the edge opposite to the jaws) of the jib planed straight; we then place the jib and key in the position shown in Fig. 217, and mark off (from the edge face, B, of the key) the line, A, on the gib, using the compass callipers set to the full width of the keyway in the strap or rod end, taking no account of the draw. Hence the key and gib will, when in the position shown, just fill the keyway. The width between the jaws of the gib, as denoted by C, should be marked a trifle less than is the extreme outside width of the jaws of the strap, so as to allow for the metal taken off in filing up the outsides of the jaws of the strap and off the inside of the jaws of the gib.

When the rod is fitted up and ready to mark off the brasses, to bore them out by, we proceed as follows: We take the top brass and mark on its outside face two lines level with the faces which fit against the inside jaws of the strap, as shown in Fig. 218, A and B being the lines referred to. We then key up the brasses in their places in the rod and fasten a center piece in the brasses at each end of the rod. Upon these centerpieces we first mark a line parallel with and central between the lines, A B, and then a line across the joint of the brasses if the joint faces meet, and in the center of the space between them if they do not meet, and in either case to the center of the oil hole, if the rods have been correctly made; and the distance between the junction

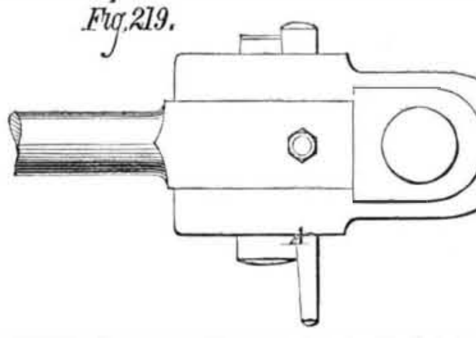
Fig. 218



of the lines so obtained will, from one to the other, be the length of the rod. The rod should, however, always be tested with a pair of trammels set to the necessary distance between the brasses from center to center of their bores, care being taken to stand the rod, while trying the trammels, in the position in which it works, for all rods deflect by their weight, the amount of such deflection depending upon the position in which the rod is suspended. The trammels also deflect, it is true, but their deflection is allowed for in setting them, whereas the deflection of the rod will not be accounted for unless it is trammeled when standing or lying in the position in which it works.

We now come to ascertaining what thickness of liner it is necessary to insert on the back of each brass, when such is necessary on account of the wear of the brasses and on account of the key having passed through the keyway so that its head is level with the top of the jib, and hence requires to be set back. Beginning with the back or bottom brass, which beds against the crown of the strap, we find that the brass at each end of the rod furthest from its key will, no matter what the construction of the rod may be, require lining up so that the center of its bore is even with the center of the oil hole in the strap, that is, providing the oil hole has been marked off as directed. The thickness of liner

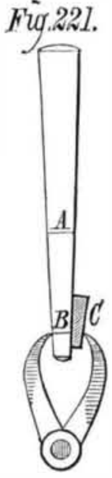
Fig. 219.



necessary to place behind the brass nearest to the key should be ascertained as follows: The brass furthest from the key having been lined up, we put the rod end, together with the brasses and keys, in position, and key the rod up properly, when, as shown in Fig. 219, the key will pass too far through the rod end. Then we mark across the face of the key a line, A, even with the edge face of the strap; we then put the key back to its proper position, and mark another line B, even with the edge face of the strap; and taking the key out, we shall find the two marks shown in Fig. 220, A being the first and B the second line struck upon the face of the key; and the difference between the width of the key at A and its width at B will be the thickness of the liner necessary to be placed behind the brass nearest to the key. To ascertain the precise amount of this difference (because a very small error as to this amount causes a great deal of extra labor), we set a pair of outside callipers to the width at A; and then passing the calliper points down to B, we keep one of the points even with the line, B, and insert a wedge until it just fills the space between the other point and the side of the key. as shown in Fig. 221, C being the wedge, which should be chalked along its surface so that, when inserted (as shown) until it touches against the calliper point, the latter will leave a mark on the wedge, denoting exactly how far the wedge entered and hence the exact required thickness of liner.

Fig. 220.

Fig. 221.



Bicycle vs. Horse.

A ten mile race, between a fast horse named Happy Jack and a velocipede rider named Stanton, recently took place at Lillie Bridge, England, for $250. For the first three miles the horse kept level with the bicyclist. The ground was rather sticky—owing to late rains—for both, and Stanton seemed laboring, but this is his peculiar way of riding. Stanton was the favorite at as much as 3 to 1, for the start allowed him was generally considered too much. For three miles the horse went easily; where he lost at the corners he made up in the straight. This style he kept up until the sixth mile, when his stride began to falter, not being ridden so well as on the last occasion, combined with the effect of the extra weight he was carrying. Stanton from this point gradually went ahead, and in the next mile he had gained fifty yards. The horse was now beaten, and after going another lap was pulled up at eight miles. Stanton went on and finished the distance, ten miles less 764 yards, in 34 minutes 34 seconds, being at an average velocity of nearly eighteen miles an hour. He rode a 58 inch machine made by Keen, weighing 40 lbs. He seemed to have a good deal more in him had it been required.

A correspondent says: For kitchen and pantry floors there is nothing better than a coat of hard paint; the cracks should be filled with putty before it is applied, and the paint allowed to dry at least two weeks before using. Then it is easily kept clean by washing (not scrubbing) with milk and water; soap should never be allowed to touch it. "Red lead and yellow ocher I prefer for coloring; the former makes a hard paint that wears well."