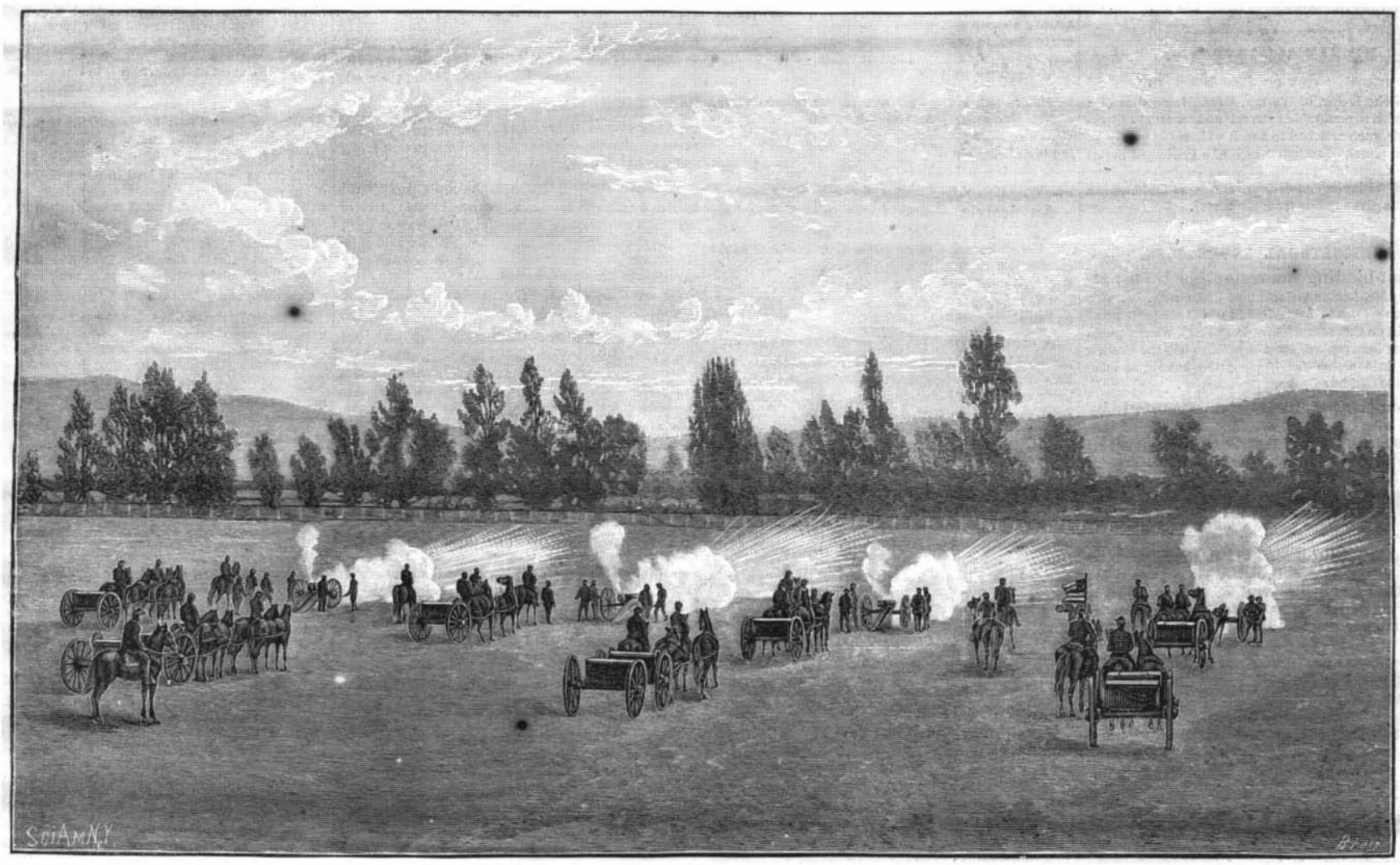
EXPULSION OF UNBURNED GUNPOWDER FROM CANNONS.

It has long been known by students of gunnery that the combustion of gunpowder in cannon, especially in those of short caliber, was imperfect. The result of this fact is that a quantity of powder is blown out of guns when fired, in grains, burning as it goes through the air. The erosion of the bores of cannons is probably effected by this cause. In a recent article, Sir Frederick Abel attributes erosion to the action of gas vapors and liquid products upon the heated surface of the bore. When it is known that a large quantity of powder is driven out in the solid form, its influence on the process of erosion should not be lost sight of. In muzzle loaders, where a considerable windage exists above the ball, the wear takes place in the upper surface of the piece. The products are driven through the gap with great velocity, wearing away the metal. In breech loaders, where the shot fits tightly, and there is no such windage, the wear is more evenly distributed. This has given rise to a division of the effect into "muzzle-loading" and "breech loading" erosion.

The 7 inch gun, muzze-loading, and weighing 7 tons (English ordnance), began to first show this feature of deterioration. After firing 600 rounds it was seriously injured. The heavier the gun, and consequently the charge, the worse the effect has proved. The large currence is rendered visible. Each bright line presumably shows the path of a grain of incandescent powder.

In cannon of large caliber, where heavy shells have to be expelled, an instantaneous deflagration of the powder is inadmissible, as it would strain the gun. The powder is made in large grains to secure slower ignition. This avoidance of sudden ignition tends to cause the loss of powder we are describing. The lengthening of the pieces is a step in the direction of avoiding this trouble, though of course increased weight and awkwardness of the cannon results from taking it.



ARTILLERY FIRING.—(From an Instantaneous Photograph.)

amount of powder expelled in the solid form, even from small guns, and burned outside the gun is clearly shown in the accompanying engraving. It suggests strongly how large a factor solid powder may be in the scoring of gun tubes.

Two interesting photographs illustrating the phenomena attending the discharge of light battery pieces have been received through the courtesy of Mr. Geo. T. Ruddock, of San Francisco, Cal. Light Battery K, U. S. Artillery, stationed at the Presidio in San Francisco, takes annual practice marches. During a recent march to Monterey, the photographs in question were taken at San Jose. The photographer was Lieut H. E. Harris of the Battery, Instructor in Photography in the U. S Army. One of them we reproduce, showing the expulsion of unexploded powder from guns. In front of the smoke escaping from the mouth of each piece, bundles of horizontal lines are shown, presumably due to powder unconsumed, but burning a it is driven through the air. In the photograph the delicacy of the effect is unsurpassed. The picture is quite remarkable. A perfect tassel of threads of light is seen extending out from the cannon. The effect cannot be adequately reproduced in our engraving.

Another interesting feature to be noted is the simultaneousness of the discharges, as indicated by the equal height of the columns of smoke above the touch holes. It seems doubtful if the escape of unburned powder was ever before so graphically shown. By firing at screens, the fact of the escape has often been proved by the marks made by the powder upon them; but in the photograph here reproduced, the actual oc-

Paste for Labeling.

1. Tragacanth, 1 oz.; gum arabic, 4 oz.; water, 1 pint. Dissolve, strain, and add thymol, 14 grains; glycerine, 4 oz.; and water to make 2 pints. Shake or stir before using it.

2. Rye flour, 4 oz.; alum, ½ oz.; water, 8 oz. Rub to a smooth paste, pour into a pint of boiling water, heat until thick, and finally add glycerine, 1 oz.; and oil of cloves, 30 drops.

3. Rye flour, 4 oz.; water, 1 pint. Mix, strain, add nitric acid, 1 drachm, heat until thickened, and finally add carbolic acid, 10 minims; oil of cloves, 10 minims; and glycerine, 1 oz.

4. Dextrin, 8 parts; water, 10 parts; acetic acid, 2 parts. Mix to a smooth paste, and add alcohol, 2 parts. This is suitable for bottles of wood, but not for tin, for which the first three are likewise adapted.

A paste very similar to 3, but omitting nitric acid and glycerin, is also recommended by Dr. H. T. Cummings.—*L. Eliel, Am. Journ. Pharmacy.*

Magnets.

It is somewhat strange that the journals identified with the milling interests have never had much of anything to say regarding the use of magnets in flour mills. This cannot be because magnets are of slight importance, for many educated and intelligent millers know their great value. But it is, nevertheless, true that magnets are seldom mentioned in milling journals and are still unknown in far too many mills, large and small. To be sure there are regions, though becoming few and far between, where the absence of wire-binding harvesters, and the exercise of unusual care in garnering, diminish the danger to reels and rolls from bits of metal; but even under such conditions it would undoubtedly be a wise precaution and an economical measure to employ magnets. It is quite a common practice to fix them in gangs in the wheat spout, and if well done this will doubtless be effective for a while; but they soon become choked with captured fragments, and must be frequently cleaned if they are to do satisfactory work.

In any event, they are not really cheap; for if well attended they take valuable time, and if ill attended they become worse than useless. For instance, we were once in a mill where the shorts betrayed unmistakable traces of metallic substances. The miller admitted their presence, but declared that he could not account for it. Did he use magnets? "Oh, yes, of course." Yet when he showed them to us, he found to his surprise that they were either deficient in power or so loaded with broken wire, nails, screws, etc., as to be practically ineffective. We have also seen rolls the surfaces of which were cut and scratched to an extent which showed that they must have been regarded by the miller in charge as fit receptacles for miscellaneous hardware; and how he could expect them to remain in perfect alignment and parallelism under such treatment is quite beyond our powers of conception.

The demand, then, is for a device which will do its work well without constant watching and cleaning—that is, some arrangement in which the magnets are automatically and regularly cleaned. These points have been embodied in the "magnetic separator," an invention which is almost infallible in detecting and arresting unwarranted metallic intruders. Once in a great while something will make its way past a separator and leave its mark on the rolls, but a suitably protected, closed spout, leading from the discharge of the separator to the first-break hopper, is almost certain to prevent such an occurrence.

Probably one-half the magnets sold to millers are practically worthless for use in flour mills. When tested, they prove to be insufficiently charged, and hence have but limited power to attract pieces of metal. A good ten inch magnet should be able to lift a twelve pound weight and hold it, but we have seen many that would not hold one pound. The steel for a reliable magnet must be of even and close grain, by no means soft, for its power depends on this in a measure. It not infrequently happens that two pieces of steel of the same rolling will make magnets of different strengths, and it is only by years of study and experience that a manufacturer can be sure of always producing well charged magnets. He has to go through with many experiments, using different grades of steel, before he can tell which is best for his purpose. It is therefore not to be expected that a good separator can be had for a song, although its price is not beyond the means even of the small miller.

First be sure that you need a separator, then go ahead and get one of the first class. Don't be satisfied with anything less. This is true economy.—*Roller Mill.*

PROF. RIPLEY NICHOLS, of the Massachusetts Institute of Technology, Boston, died in Hamburg, Germany, July 14, 1886, aged about forty years. He was a distinguished analytical chemist, particularly of water, in which he obtained a well deserved reputation. He was also the author of a number of scientific essays, and the author of several excellent scientific text-books. He was abroad at the time of his death with the hope of gaining relief from pulmonary disease, with which he had been a sufferer for many years.

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