Correspondence.

Improvement in Patent Office Conditions.—A Letter from the Chief Clerk of the Patent Office.

To the Editor of the SCIENTIFIC AMERICAN:

Permit me to correct several statements which appear in an editorial of the SCIENTIFIC AMERICAN for November 24, 1906:

"There is no sign of improvement in the serious congestion that hampers the work of the Patent Office. . . . At the present writing there are about 21,000 cases on file which have not yet been examined. . . . The office is falling behind at the rate of 300 to 350 cases a week."

As a matter of fact, all of the examining divisions of the Office have been making substantial progress with the work for some time past. A summary of the condition of the work in the various examining divisions made yesterday shows that the average position of all the divisions is now *within sixty days* on both new and old work. Half the divisions are close to one month on both the dates, while but two are four months in arrears, and two five months on their new work. None of the divisions are over two months in arrears on the amended work, averaging thirty-six days.

Since the return of the examiners from their summer leaves of absence, and the training in of the twenty-nine new men who began work here on July 1, the work has gone steadily forward, with large reductions of the delays in taking up new cases and in the number of cases on hand.

The most pressing need of the Patent Office is a new building, equipped with modern conveniences and of fireproof construction for the accommodation of the Office force and the public, and also for the preservation of the valuable records that are filed in the present building.

A regular annual increase in the Office force and larger salaries are also regarded as necessary in order to accomplish the best results, C. M. IRELAN,

Chief Clerk U. S. Patent Office.

Washington, D. C., November 28, 1906.

The Causes of Gun Erosion.

To the Editor of the SCIENTIFIC AMERICAN:

While the subject of big-gun erosion is being so thoroughly discussed in your paper, perhaps a student of Ohio Wesleyan University may be entitled to be heard on the subject. I have had quite a little experience in gunnery, and I hold with you in what you said in your editorials of September 15 and September 29, with the exception that I think you, and Mr. Cardullo also, overrate the amount of abnormal erosion.

Mr. Cardullo's theory that the erosion is caused directly by the heat generated by the explosion is certainly new, and if erosion needed a new explanation, might be worthy of consideration. But it does not appear that the eroded places exhibit any distinctive features that would prove them to be "burns"; though even if they did, it would not establish his theory, for if the gases are capable of burning the interior of a gun anywhere, it must be at a point where they rush at an inconceivable velocity through a small opening. That "burning" of the gun-wall under such conditions may be a possible, nay, probable, cause of abnormal erosion, I do not deny. Ironworkers tell me that in a "scrap" furnace, which is constructed so that the flame and gases of combustion must pass through a very small neck between the furnace and the chimney, the fire brick at the narrowest place is slowly eaten away by the volume of flame which roars past them. It might be adduced that in a gun the projectile is moving, and that consequently a new and cool surface is being constantly presented against the play of gas; but it must be remembered that we only seek to account for erosion in that part of the gun's length where the projectile is moving slowly. That the abnormal erosion could be caused in so short a time, merely by the free circulation of even the hottest gases, is not to be taken for granted without stronger support than the fact that the erosion progressively increases from muzzle to breech.

In any operation we can conceive of by which so heavy a projectile as the 12-inch shell could be accelerated through a 45-foot tube to a speed of 2,900 feet per second, there must be enormous friction, and consequently, great wear, on the inner wall of the tube. This necessary erosion is what I describe as "normal." In rifled guns I have always been inclined to take as a unit of normal erosion an amount slightly less than the amount actually produced one or two feet below the muzzle, and if this unit could be accurately expressed in figures for any given caliber of gun, ordnance theories would be robbed of much of their complexity; for, given this unit, it would be only necessary to refer to a table showing the varying amounts of acceleration the shell received from the breech to the muzzle, to be able to find what the normal erosion for any point of the gun's length was. In the absence of any such data, however, we can only affirm that the amount of normal erosion should progressively increase from the muzzle to the breech.

This is only the natural working out of the law which governs a projectile, when it is being accelerated and at the same time made to hold itself to certain uniformly twisted grooves. When the charge is exploded the projectile begins to move. As it begins to move forward, it also begins to turn. The strain of making it move forward is borne by the gun, and is called the elastic strain; the strain of making it turn is borne by the rifles, and is called the rifling strain. It is the rifling strain that causes normal erosion. If the projectile is light and accelerated to only a moderate velocity in a comparatively long space of time, the rifling strain and its accompanying erosion will be slight; but if the projectile is heavy and accelerated to an enormous velocity in a very short space of time, the rifling strain and its accompanying erosion will be proportionately greater.

It must be constantly borne in mind that the rotary acceleration is the primary cause of normal erosion, and that, in a gun with uniformly-twisted rifles, the rotary acceleration throughout the gun's length varies directly with the forward acceleration. As the projectile receives a larger part of its forward acceleration at the breech, and consequently a larger part of its rotary acceleration, than in any other equal portion of the gun's length, it is evident that both the elastic strain and the rifling strain must be greatest at the breech. The greater elastic strain is taken care of by the breech jacketing, or the gun would burst. But the greater rifling strain is left to take care of itself, and the result is excessive, but still normal, erosion.

Of course there would still be erosion in a gun if the rifling was perfectly straight, or even if there were no rifles; but it would be inconsiderable. To appreciate the amount of erosion caused by the twist in the rifling, suppose the projectile started at full speed—if the bearing rings on the projectile were of the proper material to "stand up" the rifles of the gun would be stripped for half their length.

If one looked only at the 12-inch gun, it might be difficult for him to prove that there was present any such a thing as abnormal erosion; though there would remain even then the strong probability of it, for there are present elements in the firing of a big gun which one would naturally suppose would cause erosion. The most important of these is the imperfect fit of the shell to the bore of the gun.

But when we compare the 12-inch gun with other forms of firearms, the probability of abnormal erosion becomes a certainty. For instance, a 30-30 rifle of about ninety calibers in length will fire from four to ten thousand rounds without seriously deteriorating from its original accuracy, and here there is probably no abnormal erosion whatever. A 6-inch cannon, forty-five calibers in length, will fire from one to two thousand rounds without serious erosion; here there is the probability of there being considerable abnormal erosion, but we still consider all the erosion normal. Then comparing the weights, calibers, and erosion of the two guns, we must calculate the life of a gun of the size of the 12-inch as from 300 to 400 rounds. But we find our calculations greatly in error, and so we have no choice but to conclude that there is an erosion outside of what we have fixed upon as normal, which increases progressively as we increase the caliber of the gun. Turning now to the probable cause of abnormal erosion that we spoke of before, the imperfect fit of the shell, we find that a 30-30 bullet can be made to fit the rifle almost perfectly, that the 6-inch shell fits imperfectly indeed, but is light and is able to readily set itself to the rifling grooves, but that the 12-inch shell fits very imperfectly, is very heavy, and is intractable about taking the rifles. This would seem, at least on its face, to connect abnormal erosion with an imperfect fit of the shell.

There is another element which may play a part in producing abnormal erosion, and its testimony is in the same direction. The inertia of a 12-inch shell is greater than that of a 6-inch shell in the ratio of 8 2-5 to 1, while the base of the 12-inch shell is greater than that of the 6-inch shell only in the ratio of 4 to 1. It will be readily seen that the 6-inch would start under a much lower pressure than the 12-inch; consequently the gases, if they do produce the abnormal erosion by flowing past the shell, would have a longer time to work before the shell started, and would work under a higher pressure both before and immediately after the shell had begun to move. Certainly, if the hot gases succeeded in getting past the projectile before it had begun to move, there would be little need to look further for the cause of abnormal erosion. What reason is there for supposing that they do not do this very thing? There must be a considerable pressure behind the shell before it begins to move, and as soon as the pressure reached any figure at all the gases generated would certainly begin to flow through any apertures that might have been left between the wall of the gun and the shell, both eroding the bore and heating the rifles.

It would appear, then, that we have got at the cause of abnormal erosion, in the imperfect fit of the shell, but as in spite of the most carefully constructed theory there still remains a possibility, if not probability, of error, the question can only be settled absolutely by experiment. A few trials of firing, from an ordinary nickel-steel barrel, patched bullets somewhat smaller in size than the caliber of the barrel would probably be decisive one way or the other.

If it were found to be true that the cause of abnormal erosion is what our theory states, there can be no difference of opinion on what would constitute a remedy, however difficult it may be to produce a device that will successfully carry it into execution. Mr. Cardullo's high-speed steel would probably help, but I look for the remedy to appear in some form of your obturating pad. If this should fail, I have in mind a remedy of a different sort that might be tried as a last resort; but I think with you that our ordnance engineers have not as yet done enough to entitle them to declare the task an impossible one.

An idea has occurred to me since I began writing, which, though it would probably prove impracticable, may nevertheless be of interest. I would prescribe for abnormal erosion a small depression to extend around the projectile at the base of the first bearing-ring. This depression-ring should be in cross-section a clear-cut segment of a circle, with its chord absolutely flush with the surface of the iron. It should be of a depth subject to experiment—say ⅛ of an inch—and should extend under the base of the bearing-ring a distance also subject to experiment. The white-hot gases rushing into this depression, something like steam into a whistle, might possibly be checked sufficiently to swedge the base of the bearing-ring into the rifles before the projectile started, thus sealing the rifling ahead of the ring against any further flow of the gases into them. EUGENE VAN BREMMER.

Delaware, Ohio, October 5, 1906.

To Prevent Railroad Collisions.

To the Editor of the SCIENTIFIC AMERICAN:

Will you permit me to call your attention to the suggestion of an old railroad man, which is the result of mature judgment, and seems to me to appeal to reason and common sense? It is that all collisions with standing trains, especially rear-end collisions, often so terribly destructive to life and limb because no buffer intervenes, may be entirely prevented by the immediate isolation of every passenger train as soon as it stops. Thus by the turning of switches before and behind it, cutting it off from the main line, it is safe from other trains, whether running wild or from any reason out of control. The moving train will pass to one side, to regain the line beyond, and harmlessly expend its momentum. Thus such terrible disasters as the one at Revere, Mass., at Jackson, Mich., and lately at Lansingburg, N. Y., and in the suburbs of Boston, could not occur. May not this be, in the future not so very far, as much a requirement of the law as the safety brake and the interlocking switch?

Waterville, Me., October 21, 1906. G. S. PAINE.

The "Dreadnought."

To the Editor of the SCIENTIFIC AMERICAN:

I am interested in your editorial concerning the "Dreadnought." I have seen frequent press notices concerning its speed, etc., but no comments on its armor. I understand that this new war machine is equipped with armor plate of much greater resistance than any other in use, while at the same time the plates are much lighter. Is it not probable that the great speed of this ship may be due in part to great saving in weight of armor? Can you inform me concerning the kind of plate used?

CHARLES MANUEL, M. Am. Soc. C. E.

The Engineers' Club, 374 Fifth Avenue, New York.

[The "Dreadnought's" armor is Krupp face-hardened. Her speed is due to the 28,000 horse-power (maximum) of her turbines, coupled with her fine lines due to her great length.—ED.]

The Current Supplement.

The current SUPPLEMENT, No. 1614, opens with a splendid illustration of the President at Panama, showing him operating one of the giant steam shovels. An excellent article is that on metallic filaments for electric lamps. Dr. Wittelshofer writes of an alcohol illumination. An automatic carbonic-acid gas starter for automobiles is described and illustrated. Mr. James Alexander Smith's paper on air in relation to the surface condensation of low-pressure steam is concluded. Mr. Craig S. Thoms continues his instructive observations on how seeds are carried. In this installment he explains how seeds are carried by animals and birds. Camille Flammarion gives his views on earthquakes. Sir John Eliot writes on world weather. Steam traps are very exhaustively discussed by W. H. Wakeman in an article elaborately illustrated.