party friends. To him is credited also the perfection and passage of the Signal Service Act.

At the expiration of the Forty-first Congress, General Paine refused to stand again, preferring to return to the practice of his profession. He established himself at Washington, where he has since resided. A short time since he was offered the post of Assistant Secretary of the Interior, but declined. His acceptance of the Commissionership of Patents will, we trust, prove eminently satisfactory to himself and to the country.

Touching his plan of action in the new field, General Paine lately declined to speak further than to say that he had given the subject some thought and viewed his approaching duties witnout apprehension. He knew the position to be an arduous one to fill, furnishing work enough to keep the most ambitious incumbent busy; the arrangement of details he would leave to the observation and conclusions of occupancy. In view of General Paine's long acquaintance and professional association with the Secretary of the Interior, it is believed that his appointment will prove advantageous to the Patent Office, in insuring perfect harmony between it and the ruling department. Inventors, and all likely to have business to do with the Patent Office, will be pleased to know that promptness and thoroughness will characterize the working of the Office under the new rule.

SUCCESS OF AMERICAN EXHIBITORS AT PARIS.

The number of awards to American exhibitors at the French Exhibition has been officially announced, and far exceeds any estimate previously made. They comprise ten grand prizes, thirty diplomas of honor, one hundred and thirty-four gold medals, two hundred silver medals, two hundred and twenty bronze medals, and one hundred and fifty-six honorable mentions. The aggregate is larger than the whole number of American exhibitors at the Paris Exposition in 1867, or at the Vienna Exposition of 1873. Relative to the number of exhibitors the prize winners of America exceed in number those of any other nation. This last point is especially significant, as the highest evidence of the superior character of our mechanical and industrial products. The effect of these victories upon our foreign trade, and thus directly upon our many industries, can scarcely be overestimated.

SHOULD THE NATION ENGAGE IN MANUFACTURES?

The extension of the scope and capacity of our government establishments for the manufacture of military and naval stores, contemplated by the Ordnance Department, has called out a long and very instructive review of the government arsenals and private establishments of the country, will be published in full in the next issue of the SCIENTIFIC AMERICAN SUPPLEMENT. The purpose of the writer is to show that it is neither necessary nor advantageous to the nation to enter thus into competition with private enterprise.

On the score of economy, it is shown that the various articles furnished by the government arsenals cost more and are of inferior quality, compared with the products of private establishments. The estimated cost of the Springfield rifle, for example, at the Springfield armory, is $54; yet private companies are willing to furnish in quantity an identical arm for $14. The cost of trowel bayonets to the government is $4 each; they would be furnished by a Massachusetts manufacturing company for $2.25. That our private establishments are capable of meeting any probable demand from the nation is evident from the promptness with which they supplied the a mies of Russia and Turkey in the late war. It is certain that neither the existing arsenals, nor any that the government is likely to establish, could ever approach our numerous private establishments in capacity, except in the manufacture of heavy guns. The South Boston Iron Company is the only one in the country that has the plant necessary for the manufacture of the heaviest ordnance; and this would probably be rendered valueless if the plan of the Ordnance Department were carried out.

The nations which have the best field guns and heavy ordnance in the world are England and Germany; and their superiority is attributed to the circumstance that those governments have liberally appropriated money for the manufacture of guns, and the contracts have been given to private manufacturers. Had the United States followed their example, it is argued, we might at the present time be exporters of heavy and light guns and carriages and projectiles, and have the whole world for customers, as well as exporters of small arms and small arm ammunition. Whitworth and Armstrong and Krupp are able to supply superior guns for half the world, because their respective governments have aided them by liberal orders. If our government would do likewise, it is claimed, the American makers of heavy ordnance and projectiles would soon be able to compete with the best, and a large foreign trade might be built up. The direct result would be that the country would be far better armed than now, at far less cost, and at the same time the foreign trade made possible would give employment to millions of money and thousands of men.

The government is a large consumer of paper and envelopes; it does not find it necessary, however, to engage in the manufacture of these commodities. By giving its contracts to the lowest bidder the government gets what it requires at much lower rates, probably, than government mills could secure, and at the same time advances private enterprise, instead of counteracting it. True, in selling stamped envelopes at cost, the government interferes materially in the free competition of envelope makers, and secures to the public a necessary article at prices much below what would otherwise prevail; but that is an incidental feature not likely to arise in the case of other manufactures.

FUEL GAS.

The heating gas made by what is known as the "Strong Process" has recently been the subject of critical scientific investigation by several well-known chemists and experts. The report upon the process by Prof. Gideon E. Moore, Ph.D., is most thorough, and affords ample indorsement of the belief so rapidly gaining ground that the solid must give way to the gaseous form of fuel, at least in our city homes.

Without attempting a general review of Dr. Moore's determinations, it will be sufficient to state that the gas is found to be of the following constitution, having a specific gravity of 0·54008:

Oxygen	·77
Carbonic acid	2·05
Nitrogen	4·43
Carbonic oxide	35·88
Hydrogen	52·76
Marsh gas	4·11
	100·00

This analysis presents a composition, ninety-three (93) per cent of which is formed of the three most valuable heat-producing gases known to science.

Dr. Van der Weyde, whose researches in gas chemistry entitle him to great respect, and who has made the Strong gas the subject of careful study, gives an analysis wherein ninety-six (96) per cent of the entire volume of this gas is composed of the three combustibles named. Upon these determinations we should naturally expect a very high theoretical flame temperature. This Dr. Moore finds to be 5,482·9° F., or about 900° F. higher than that of ordinary illuminating coal gas. Since it is free from what are termed the illuminants, no deposition of carbon is possible during its combustion. These two features—the high calorific power and the smokeless character of the flame of this gas—indicate its superior fitness for a fuel. We are not left in doubt on this point, for a careful observation of its behavior in the melting and puddling of iron and in the raising of steam sustains the inference, in fact forces the conviction, that not only in the arts and manufactures, but more especially in domestic use, it will take the place of solid fuel, provided the question of economy is also clearly established. Concerning this vital point, we print the following letter from the inventor:

OFFICE, 87 ASTOR HOUSE, September, 1878.

To the Editor of the Scientific American:

SIR—The recent announcement in the journals of Mr. Edison's discovery of a way to subdivide the electric current whereby it is practicable to employ electricity for domestic illumination at a fraction of the cost of coal gas, seems to have caused some uneasiness in the minds of the gaslighting fraternity.

Without entering into any discussion as to the merits of Mr. Edison's alleged discovery, or its precise bearing upon the business of gaslighting as now conducted, I desire to suggest the possibility of its being to the coal-gas men a "blessing in disguise."

Should electric supersede gas lighting, how shall the gas companies employ their plant? The coming change from solid to gaseous fuel affords an answer, and suggests a use for their buildings, holders, mains, and meters, both day and night, to an extent far beyond the present service, and at a profit which shall remind them of old times. That a non-luminous gas, similar to that investigated by Dr. Moore, is, in point of efficiency, convenience, comfort, and health, vastly superior to coal in cooking our food and warming our houses, no one can doubt who has any knowledge of the subject. The question is, Will it prove *economical?*

In England the application of ordinary illuminating gas to fuel purposes has been far more extensive than in this country, and the evidence is conclusive that it is there effecting a decided economy in domestic life. To be sure, gas in London and Liverpool is supplied at about one dollar per thousand cubic feet, but we must not forget that coal is proportionately cheap. In this country, while the use of gas as a fuel has been limited, there is ample evidence that for cooking it is cheaper than coal, even when the price charged is $2.50 per thousand cubic feet. When I say cheaper I mean *intrinsically* cheaper, and take no account of the collateral points of economy, to wit, that its use saves time and labor, avoids dirt and smoke, and preserves health, comfort, and good temper.

If this be true of illuminating gas, what shall be said of a pure, non-luminous gas, the perfect combustion of which may be attained without the intervention of Bunsen burners or the pre-admixture of air, and which can be supplied to the consumer at one-fifth the price of ordinary coal gas?

Gas companies are not usually communicative as to the cost of gas either in the holder or at the consumer's meter.

Considerable experience enables me to say that in New York and Brooklyn the manufacturing cost of coal gas is not less than sixty cents per thousand, but I desire to be on record as asserting that the heating gas of which we are speaking can be in most of our Northern seaboard cities manufactured and delivered into the holder ready for distribution at a cost not exceeding ten cents per thousand, where the production is equal to one million cubic feet daily. Your engineering readers can estimate the cost of delivery for themselves, bearing in mind, however, these three important facts: *First*, this gas is absolutely non-condensible in the sense in which that term is usually employed by gas men, and therefore a large source of loss in the distribution of illuminating gas may be ignored in this estimate. *Second*, since the volume of heating gas required throughout a given district will be largely in excess of the volume demanded for light, the percentage of leakage through defective mains will be proportionally less. *Third*, the loss in dollars and cents by leakage will be in proportion to the respective cost of the two gases.

Truly yours,

M. H. STRONG.

AN IMPROVEMENT ON TEA CHROMOS.

The desire to have something "thrown in" with every purchase, a desire apparently very prevalent among the less intelligent classes of humanity, leads to some comical results in trade. Multitudes of people have cheerfully paid two dollars and a half for a paper they didn't want, for the sake of getting a fifty cent chromo. And to judge from the windows of uptown tea and coffee shops and corner groceries, the gift of a ten cent picture or a chance to win a pair of ugly vases is a much more powerful attraction to small buyers than superior goods or moderate prices. The absurdity of expecting shop keepers to give away something for nothing, even when that something is intrinsically worthless, does not seem to appear to the customers of such prize giving shops. They always have something thrown in, and that insures a good bargain.

The practice began, we believe, in England, where it is still a profitable "dodge," The only drawback seems to be that people ultimately get their houses fully stocked with pictures and other trumpery, and then they want something more substantial. This has led a Glasgow house to introduce a "new system," which consists in giving each buyer of tea the sugar to sweeten it "for nothing," at the rate of four pounds of sugar for one pound of tea. How much more than the cost of the sugar they add to the price of the tea they prudently refrain from telling. Not to be outdone, a Swansea tea company offer to give on certain days a hat worth five shillings with every pound of tea, or if the purchaser prefers, a splendid silk necktie.

This is much better than chromos, even if the hat is not a work of art; and doubtless the tea is just as bad in the new system as in the old.

It is one of the misfortunes of people of narrow means that they have to buy the necessaries of life in small quantities, the ratio of profit to the seller usually increasing with every diminution of the size of the package. Yet it is safe to say that most poor people pay far more for their limited purchases than they might, were their buying more intelligently done. Indeed a frequent cause of poverty is the inability to turn thriftily the proceeds of industry. They never learn the lesson that while it is pleasant to think that the sugar is "thrown in" with the tea, they are sure to have to pay for it, perhaps doubly.

A SOUTH AUSTRALIAN OFFER FOR AN IMPROVEMENT.

South Australia is rapidly becoming a great grain-growing country; and, like all new countries, finds its capacity of production most seriously limited by the lack of labor, more correctly perhaps by a lack of labor low priced enough to enable producers to get their products to distant markets at a profit. The only solution of this difficult problem lies through the use of machinery which will make the labor of one man produce as much as many men can unaided. And lying further from the great grain markets of the world than other great grain producers, Australia has the more urgent need of machinery which will lessen the cost of her staple cereals. Accordingly the government of South Australia has offered a reward of $20,000 to the inventor of the "best machine combining within itself the various operations at the same time of reaping and cleaning, fit for bagging on the field, the various cereal crops of South Australia."

The competitors for the prize will be tested in December, 1879, with especial reference to their strength, durability, lightness of draught, cost, work done, results of cleaning, and simplicity. To win the prize the successful machine must be an improvement on any in use in the province; and then the bonus will be paid over only on condition that the successful competitor is debarred the privilege of patenting his machine. In other words, he will be allowed to patent his machine only on condition that he declines to receive the bonus.

To what extent American machines, accomplishing the ends in view, have been introduced into South Australia, we do not know; it is evident, however, that the competition, if there be any, will lie between such machines and possible improvements of them. It is evident, also, that the successful competitor will gain the lead in a very wide and advantageous market, from which the profits are likely to be far greater than the bonus offered. Our manufacturers and inventors may find the field worth cultivating.

A Correction.

Owing to the indistinctness of the photographs from which were made the drawings illustrating a horse's motion (SCIENTIFIC AMERICAN, October 19), the figures D and 9 were incorrectly drawn. It is clear, from a more critical study of the different strides, that the positions of the fore legs in D should be reversed, that is, the right leg should be straight and the left bent. Again, in 9, the left fore leg should be advanced and the right bent under the body.