

and M. Gambetta was conveyed over the Prussian lines in a balloon. He had a most exciting trip. The first attempt of ascent was relinquished at an altitude of 600 yards, for some Prussian soldiers were perceived immediately underneath. Their arms were piled, and while they rushed to these, ballast was thrown out, but the balloon did not mount sufficiently fast to prevent several balls penetrating it, one of them grazing Gambetta's head. The ascent was safely made near Montdidier. Subsequent to Gambetta's departure from Paris, says Mr. Vizetelly, "the government decided on dispatching other ardent republicans through the clouds to arouse the provinces from their lethargy. Louis Blanc was asked to proceed to England to awaken the sympathies of the British nation in favor of France. Victor Hugo was also offered a commission to the departments, but both of these illustrious democrats declined, the former on the plea to a particular aversion to balloon traveling and the latter on the score that his mission was to consecrate himself exclusively to the defense of the capital."

Of all the balloons which left Paris at this time, by far the most successful voyage was that of the "Washington," which took out no fewer than 120,000 letters. Military balloons were also used in Paris for obtaining a view of the enemy. The Germans had Herr Krupp cast special cannon of extremely small caliber to destroy the balloons.

Carrier pigeons were also used to a considerable extent, and 1,100 trained birds were brought in before the siege and lodged at the Jardin des Plantes. Pigeons were dispatched with balloons to bring back word of the safe descent of the balloons, these pigeons being furnished by several carrier pigeon societies. Not infrequently the pigeons, when they returned, were found to be wounded either by some bird of prey or by shots from the German rifles. The Germans brought birds of prey to the environs of Paris in order that they might pursue the carrier pigeons. The dispatch was generally contained in a quill fastened to a tail feather that remained immovable when the pigeon spread its tail to fly. Very many of the messages were lost, however.

With an aerial fleet at their disposal, there had never been any difficulty in getting letters out of Paris in a reasonable time, but the means of obtaining news from the provinces were limited in the extreme, and at last the people had to fall back to the employment of pigeon messengers. Originally the latter were only employed to convey government dispatches to announce the safe arrival of some balloon in the provinces, but in the month of October it was also suggested that they might be used to convey the correspondence of the general public. At first the messages had to follow a fixed form, the words being limited to "no" and "yes," to questions such as "Are you well?" "Do you want money?" etc., which had been previously asked in letters sent out of Paris by balloon. The charge for conveying these messages was one franc. The messages were sent to the postal delegate at Clermont-Ferrand, where they were copied on a single sheet of paper and then reduced by photography to the most minute proportions and sent by pigeons into the capital. On the arrival of these dispatches, the characters were enlarged with a microscope and each message was copied onto a card and forwarded to the person to whom it was addressed. The plan was found to be rather inconvenient, and at last ordinary messages were allowed to be sent. A charge of half a franc was made for each word contained in the dispatch and the limit of the message was twenty words. The messages were set up in type and printed; they were then photographed, thus rendering them a great deal more legible. When reduced, they occupied a piece of paper $1\frac{1}{2}$ by $1\frac{1}{4}$ inches, having the appearance of a diminutive journal of four columns. One message followed the other without interval of any kind. The reverse side was also filled with messages. Three of the first birds sent off carried nearly a thousand dispatches by means of this arrangement. Post office orders to the value of 300 francs each could be forwarded in a similar manner, and photographic reproductions of the "Tours Moniteur" and "The London Times" were sent into the capital. The films used were of collodion. A suitable number of copies were made of each sheet. They were then rolled and inclosed in a small quill, which was sewed on the tail feathers of as many pigeons as could be procured. The employment of thin films of collodion instead of paper was a great improvement, for these films were ten times thinner and lighter than paper, so that a pigeon was able to carry an increased budget of news with a diminution of both weight and volume.

On the arrival of the pigeons in Paris, the quills containing the microphotographic dispatches were split open with a penknife and the films were rapidly unrolled in water containing a few drops of ammonia. The films were then dried and inclosed within two plates of glass. They were then ready to be deciphered by the microscope. This mode of reading proving slow, recourse was had to the projecting lantern, using the electric light. The thin film of collodion containing the message was placed in the proper

part of the apparatus and the message was thrown on a large screen, so that four transcribers could work at once on different parts of the dispatch sheet, each square of which contained some 1,600 messages. At a later time the dispatches were photographed on collodion films on the scale of the original printed matter, so that each section was enlarged from the most minute dimensions to the size of an 18mo page: the characters, being in good, bold type, could thus be read off with perfect ease. The collodion film was, moreover, raised from the glass and transferred to a sheet of black oiled cloth dressed with gumarabic. Finally, the telegrams were separated from each other by means of scissors, and each person received his dispatch in facsimile of the original printed matter. This system proved to be very satisfactory, and when the pigeons escaped the hawks and guns, the Parisians were tolerably sure of obtaining information from their friends. Many of the dispatches have been transferred and are now exhibited as specimens of microphotography, thus affording a unique microscope object. Other means that were tried was to tie messages onto dogs and have them penetrate the German lines, but the scheme was not found to be satisfactory.

DEPARTURE OF TROOPS FOR MANILA.

BY OUR CALIFORNIA CORRESPONDENT.

The Presidio, the military reservation of California and headquarters of the department of the Pacific, is just now the scene of active military operations occasioned by a large concentration of Western troops designed for the occupation of Manila. It occupies 1,600 acres which front upon the Golden Gate, in a situation most charming in natural picturesqueness, about four miles from the Pacific Ocean. A peninsula extends into the strait, contracting the entrance of San Francisco Bay to less than a mile in width, where the channel is deepest and the currents most strong. At the extremity of this peninsula and guarding the narrow passage stands Fort Winfield Scott, an immense pile of brick and mortar, and mounting a hundred guns. The fort is now an abandoned structure, its strength in a military sense having departed. A 13-inch shell dropped inside the fort would immediately demolish it. The government no longer maintains a garrison here, only a sentry, to keep the too curious from depredation, being maintained at the present time. The situation, however, commands the channel, and upon the bluffs above the fort and on the hills which rise precipitously on the opposite shore are seventeen mortar batteries, dynamite guns and monster cannon.

The Presidio is regarded as a sort of sanitarium for the department, where soldiers fresh from the arid plains of the interior can there recuperate in a climate remarkably genial and temperate. The government has spent large sums in beautifying the place, in laying out roads and planting trees and flowers. Practically, it is an addition to the park facilities of San Francisco, and at all times its magnificent views of ocean, bay and shore collectively form one of the most superb attractions that can be found upon the continent.

Until Dewey's victory at Manila the chance of Western soldiers being needed on the opposite side of the globe had, apparently, never occurred to the military authorities. The reserves from the regular army were dispatched to New Orleans bound to Cuba, and the sudden demand for troops for Manila found the post almost denuded of available forces. Orders were hastily sent to concentrate in San Francisco, the quotas from Washington, Oregon, Colorado and California, and in a few days 7,000 of the finest, lustiest and most magnificent specimens of manly strength to be found in the whole world were encamped on the slopes of the Presidio.

Accommodations had to be improvised to some extent, and the government's resources were severely taxed in supplying rations, uniforms, tents and blankets on such short notice. San Francisco, though always an important military station, had never before seen war on such a scale.

The whole population flocked to the Presidio, and in one day over 100,000 people were on the grounds. The sudden call for troops found the government unprepared with transportation for so large a force, but the resources of the port are so great that no inconvenience or delay resulted. The first troop ship to be chartered was the "Peking," one of the best steamships of the Oriental and Occidental fleet. The "City of Sydney," belonging to the Panama line, and the "Australia," of the Oceanic Steamship Company, both vessels of the first class, were afterward engaged.

On May 25 this flotilla sailed for the East under circumstances most impressive.

A new chapter of history began as the three great vessels passed out of the Golden Gate. The "Peking" bore a regiment of the First California National Guards, and was crowded to the last inch. This regiment is composed of the flower of the youthful manhood of San Francisco, and the march from the Presidio down Van Ness Avenue and Market Street to the dock was one of the most impressive of scenes. The ave-

nues were crowded with people, among whom not one but had some personal tie with the departing troops. Such a vast crowd, controlled by emotions that could not find expression, was never seen before. The gravity of the occasion was felt to its fullest extent.

The regiment marched to the dock and was hastily put aboard the ship. The "Peking" then drew into the stream and real military discipline commenced. The steamships "City of Sydney" and the "Australia," with the Fourteenth regiment of United States infantry and volunteers from Oregon, were next to load, and at five o'clock in the evening the three steamers started for Manila. The bay was alive. Every tug or steamer, every rowboat, was pressed into service and as long as possible kept the steamships in view.

SINGING FLAMES.

In a recent number of The American Journal of Science, Mr. H. V. Gill has an interesting paper on "The Theory of Singing Flames." The phenomenon of a gas jet burning inside an open tube emitting a musical note is one of those facts which, although known for many years and much written about, has never been fully explained. Among the more interesting theories was that of De la Rive, who supposed the sound to be due to a periodic condensation of the water vapor produced in the combustion of hydrogen gas. Faraday showed the inadequacy of this theory by the use of a flame which did not form water vapor, and proposed in its stead the theory that the so-called singing was caused by successive periodic explosions of a mixture of gas and air. This was accepted by Tyndall. Another theory which has been proposed is that the sound is produced by vibrations maintained by heat, the heat being communicated to the mass of air confined in the sounding tube at a place where, in the course of vibration, the pressure changes. Sondhauss performed a series of experiments, his chief conclusion being that the condition of the column of gas in the supply tube had an important influence on the phenomena. Mr. H. V. Gill sums up his conclusions as follows: "We think we have made it clear that the pressure on the gas plays the important part in this phenomenon, and that a consideration of the reactions we have described will be found to explain the many facts noted in the case of a singing flame, some of which we have alluded to. We look, therefore, on the chief cause as a mutual reaction between the pressures in the tube and on the gas, the energy necessary to sustain the note being supplied by the pressure on the gas and the action of the flame. We may compare the singing flame to the siren, in which the current of air causes the disk to rotate, the note being produced by the reaction of the disk on the current of air. . . . We have, then, three kinds of singing flames, one depending on changes of pressure, another on air currents, and a third depending at once on both changes of pressure and on air currents."

ANALYSIS OF AIR BY A MUSHROOM.

By causing various green plants to vegetate in nitrogen gas containing some carbonic acid, I became convinced that they are essentially anaerobic, that they can vegetate without free oxygen, that they are the means by which nature has provided the atmosphere with free oxygen, and that as the composition of the air gradually changed, becoming more and more oxygenated with the lapse of centuries, plants of aerobic nature and animals appeared.

If I place over water in a glass bell full of nitrogen containing some carbonic acid, a green plant such as *Lysimachia nummularia* (moneywort), for instance, the atmosphere of the bell soon will be proved to contain oxygen, and in a few months it will be even richer in oxygen than the external atmosphere.

In *Agaricus atramentarius*, on the contrary, we have the example of a plant (animal?) composed of aerobic cells which cannot vegetate without free oxygen, and which is capable of analyzing the air as completely as does a stick of phosphorus.

Thus, if I place over water in a graduated glass bell full of air (that is nitrogen containing some oxygen) one of these mushrooms which is entirely plunged in the air, i. e., not in contact with the water, and expose it to the solar light, as I did with my green plants, I soon remark a considerable condensation of water vapor, and then all the oxygen is absorbed. The carbonic acid produced being dissolved in the water, the latter rises in the bell glass. For instance, in a small bell glass of 200 c. c. capacity, the level of the water in a few days will be 160 c. c., and remain there. The bell glass contains then only nitrogen, and the mushroom will dry up in it, and can thus be preserved, for its vegetation has ceased. It is, in fact, mummified in nitrogen.

If I immediately place a green plant, such as the *Lysimachia* already mentioned, alongside of the *Agaricus*, I find that in a few days the latter will sometimes recommence slowly to vegetate; but the green plant providing more oxygen than the mushroom can utilize, the level of the water will soon stand at about 180 c. c.—D. T. L. Phipson, in Chemical News.