APPLIED SCIENCE

Some Curious Investigations.

"BINGING AND DARCING" PLANE. The following abstract of Professor Tyndallis enrious experimental lecture upon singing and dancing flame, delivered at the Royal Institution, has been contributed by himself to the last number of the Philosophical Maga-

The sounding of a hydrogen flame when inclosed within a glass tube was, I believe, arst noticed by Dr. Higgins, in 1777. The subject has been since investigated by Chladni, De La Rive, Faraday, Wheatstone, Rijke Sondhauss, and Kundt. The action of units mant sounds on flames inclosed in tubes has ebservation that the flame did not jump until it was near flaring. That the discovery was not further followed up by this learned investigator was probably due to too great a stretch of courtesy on his part towards myself. Last year, while preparing the experiments for one of my "Juvenile Lectures," my late assistant, Mr. Barrett, observed the effect independently; and he afterwards succeeded in illustrating it by some very striking experiments. With a view to the present discourse, and also to the requirements of a forthcoming work on sound, the subject of sounding and sensitive flames has been recently submitted to examination in the laboratory of the Royal Institution. The principal results of the inquiry are embodied in the following abstract:-

"Pass a steadily burning candle rapidly through the air, you obtain an indented band of light, while an almost musical sound heard at the same time announces the rhythmic character of the motion. If, on the other hand. you blow against a candle flame, the fluttering noise produced indicates a rhythmic action, When a fluttering of the air is produced at the embouchure of an organ pipe, the resonance of the pipe reinforces that particular pulse of the flutter whose period of vibration coincides with its own, and raises it to a musical sound. When a gas flame is introduced into an open tube of suitable length and width, the current of air passing over the flame produces such a flutter, which the resonance of the tube exalts to a musical sound. Introducing a gas flame into this tin tube three feet long, we obtain a rich musical note; introducing it into a tube six feet long, we obtain a note an octave deeperthe pitch of the note depending on the length of the tube. Introducing the flame into this third tube, which is fifteen feet long, the sound assumes extraordinary intensity. The wibrations which produce it are sufficiently powerful to shake the pillars, floors, seats gallery, and the five or six hundred people who occupy the seats and gallery. The flame is sometimes extinguished by its own violence, and ends its peal by an explosion as loud as a pistol shot. The roar of a flame in a chimney is of this character; it is a rude attempt at music. By varying the size of the flame, these tubes may be caused to emit their harmonic sounds. Passing from large pipes to small ones, we obtain a series of musical notes which rise in pitch as the tube diminishes in length. This flame, surrounded by a tube 17; inches long, vibrates 458 times in a second; while that contained in this tube, 10% inches long, vibrates 717 times in a second. Owing to the intense heat of the sounding column, these numbers are greater than those corresponding to organ pipes of the same length sounding in air. The vibrations of the flame consist of a series of partial extinctions and revivals of the flame. The singing flame appears continuous; but if the head be moved to and fro, or if an opera glass directed to the flame be caused to move to and fro, or if, after the method of Wheatstone, the flame be regarded in a mirror which is caused to rotate, the images due to the revivals of the flame are separated from each other, and form a chain of flames of great beauty. With a longer tube and larger flame, by means of a concave mirror, I can project this chain of flames upon a screen. I first clasp my hand round the end of the tube so as to prevent the current of air which causes the flutter from passing over the flame; the image of the flame is now steady upon the screen before you. I move the mirror, and you have this continuous luminous band. I withdraw my hand, the current of air passes over the flame, and instantly the band breaks up into a chain of images. A position can be chosen in the tube at which the flame bursts spontaneously into song. A position may also be chosen where the flame is silent, but at which, if it could only be started, it would continue to sound. It is possible start such a silent flame by a pitch-pipe, by the siren, or by the human voice. It is also possi-ble to cause one flame to effect the musical ignition of another. The sound which starts the flame must be nearly in unison with its own. Both flames must be so near unison as to produce distinct beats. A flame may be employed to detect sonorous vibrations in air. Thus, in front of this resonant case, which supports a large and powerful tuning fork, I move this bright gas flame to and fro. A continuous band of light is produced, slightly indented through the friction of the air. Th fork is now sounded, and instantly this band breaks up into a series of distinct images of the flame. Approaching the same flame towards either end of one of our tin tubes with the sounding flames within it, and causing it to move to and fro, the sonorous vibrations also effect the breaking up of the band of light into a chain of images. In this glass tube, fourteen inches long, a flame is sounding. I bring the flat flame of a fish-tail burner over the tube. the broad sipe of the flame being at right angles to the axis of the tube. The fish-tail flame in stantly emits a musical note of the same pitch as that of the singing flame, but of different quality. Its sound is, in fact, that of a membrane, the part of which it here plays. Against a broad bat's-wing flame I allow a sheet of air, issuing from a thin slit, to impinge. A musical note is the consequence. The note can be produced by air or by carbonic acid, but it is produced by air or by carbonic acid, but it is produced with greater force and purity by oxygen. The pitch of the note depends on the distance of the slit from the flame. Before you burns a bright candle flame. may shout, clap my hands, sound this whistle, strike this anvil with a hammer, or explode a mixture of oxygen and hydro though sonorous waves pass in each case through the air, the candle is abso-Intely insensible to the sound; there is no motion of the flame. I now urge from this small blowpipe a narrow stream of air through the flame of the candle, producing thereby an incipient flutter, and reducing the brightness of the flame. I now sound the whistle; the flame jumps visibly. Matters may be so arranged that when the whistle sounds the flame shall be either almost restored to its pristine brightness, or the amount of light it still possesses shall disappear, Before you now burns a bright flame from a fish-tail burner. I may, as before, shout, clap my hands, sound a whistle, or strike an anvil; the flame remains steady and without response.

I urge against the broad face of the flame a

printing and the

pleyed. The flame is cut in two by the stream analyzed, their constituents are found to of air; it flutters slightly; and now, when the wary in accordance with the foregoing whistle is sounded, the flame instantly starts. A knock on the table causes the two half flames to unite and form for an instant a flame of the ordinary shape. By a slight variation of the experiment, the two side flames disappear when the whistle is sounded, and a central tongue of flame is thrust forth in their

"Passing from a fish-tail to a bat's-wing burner, I obtain this broad, steady flame. It s quite insensible to the londest sound which would be tolerable here. The flame is fed from this gas-holder, which places a power of pressure at my disposal unattainable from the gas-pipes of the Institution. I turn on more The flame enlarges, but it is still insenbeen investigated by Count Schaffgotsch and sible to sound. I enlarge it still more, and now myself. The jumping of a naked fish-far a slight flutter of its edge answers to the sound fame, in response to musical sounds, was first of the whistle. Turning on a little more gas, noticed by Professor Leconte at a musical part of the whistle. Turning on a little more gas, noticed by Professor Leconte at a musical part of the whistle. Finally I turn on gas the little more distinct. Finally I turn on gas a still more distinct. until the flame is on the point of rearing, as flames do when the pressure is too great. I now ound my whistle; the flame roars and thrusts suddenly upward eight long quivering tongues.

I strike this distant anvil with a hammer; the flame instantly responds by thrusting forth its tongues. Another flame is now be fore you. It issues from a burner formed of ordinary gas tubing by my assistant. The flame is eighteen inches long, and smokes co-piously. I sound the whistle; the flame falls to a height of nine inches, the smoke disappears, and the brilliancy of the flame is angmented. Here are two other flames, also issuing from burners formed by my assistant. The one of them is long, straight, and smoky: the other is short, forked, and brilliant. sound the whistle; the long flame becomes short, forked, and brilliant; the forked flame becomes long and smoky. As regards, therefore, their response to the sonorous waves, the one of these flames is the exact complement of the other. Here are various flat flames, ten inches high and about three inches across at their widest part. They are purposely made forked flames. When the whistle sounds, the plane of each flame turns ninety degrees round, and continues in its new position as long as the whistle continues to sound. Here again, is a flame of admirable steadiness and brilliancy, issuing from a single circular orifice in a common iron nipple. I whistle, clap my hands, strike the anvil, and produce other sounds; the flame is perfectly steady. Observe the gradual change from this apathy to sensitiveness. The flame is now four inches high. I make its height six inches; it is still indifferent. I make it ten inches; a barely perceptible quiver responds to the whistle. make it fourteen inches high, and now it jumps briskly the moment the anvil is tapped or the whistle sounded. I augment the pressure; the flame is now sixteen inches long, and you observe a quivering which announces that the flame is near roaring. I increase the pressure; it now roars, and shortens at the same time to a height of eight inches. I diminish the pres-

sure a little; the flame is again sixteen inches

long, but it is on the point of roaring. It

stands, as it were, on the brink of a precipice.

The whistle pushes it over. Observe, it shortens when the whistle sounds, exactly as

it did when the pressure was in excess. The

sonorous pulses, in fact, furnish the supple-

ment of energy necessary to produce the roar and shorten the flame. This is the simple philosophy of all these sensitive flames. "The pitch of the note chosen to push the flame over the brink is not a matter of indifference. I have here a tuning-fork which vibrates 256 times in a second, emitting a clear and forcible note. It has no effect upon this flame. Here are three other forks, vibrating respectively 320, 384, and 512 times in a second. Not one of them produces the slightest impression upon the flame. But, besides their fundamental notes, these forks can be caused to sound a series of over notes of very high pitch. I sound this series of notes; the vibraions are now 1600, 2000, 2400, and 3200 second respectively. The flame jumps in response to each of these notes, the response to the highest note of the series being the most prompt and energetic of all. To the tap of a hammer upon a board the flame responds; but to the tap of the same hammer upon an anvil the response is much more brisk and animated. The reason is, that the clang of the anvil is rich in the higher tones, to which the flame s most sensitive. Here again is an inverted bell, which I cause to sound by means of a fiddle bow, producing a powerful tone. The flame is unmoved. I bring a half-penny into contact with the surface of the bell; the consequent rattle contains the high notes to which the flame is sensitive. It instantly shortens, flutters, and roars when the coin touches the bell. Here is another flame, twenty inches long. I take this fiddle in my hand, and pass a bow over the three strings, which emit the deepest notes. There is no response on the part of the flame. I sound the highest string; the jet instanty squats down to a tumultuous bushy flame, eight inches long. I have here a small bell, the hammer of which is caused to descend by clock-work. II hold it at a distance of twenty yards from the flame. The strokes followed each other in rythmic succession, and at every stroke the flame falls from a height of 20 to a height of 8 inches. The rapidity with which sound is propagated through air is well illustrated by these periments. There is no sensible interval between the stroke of the bell and the shortening of the flame. Some of these flames are of marvellous sensibility, one such as is at present burning before you. It is nearly 20 inches long, but the slightest tap on a distant anvil knocks it down to 8. I shake this bunch of keys or these few copper coins in my hand; the flame responds to every tinkle. I may stand at a distance of 20 yards from this flame; the dropping of a sixpence from the height of a couple of inches into a hand already containing coin, knocks the flame down. I cannot walk across the floor without affecting the flame; the creaking of my boots sets it in violent commotion; the crumpling of a bit of paper or the rustling of a silk dress does the same; it is startled by the plashing of a raindrop; I speak to the flame, repeating a few lines of poetry; the flame jumps at intervals, apparently picking certain sounds from my utterance to which it can respond, while it is unaffected by others.

"In our experiments down stairs we have called this the vowel flame, because the dif-ferent vowel sounds affect it differently. Vowel sounds of the same pitch are known to be readily distinguishable. Their qualities or clang-tints are different, though they have a common fundamental tone. They differ from each other through the admixture of higher tones with the tones with the fundamental. It is the presence of these higher tones in different proportions that characterizes the vowel sounds; and it is to these same tones, and not to the funda-mental one, that our flame is sensitive. I utter a loud and sonorous U, the flame remains steady; I change the sound to O, the flame quivers; I sound E, and now the flame is affected strongly. I utter the words boot, boat, and the beat in succession. To the first there is no response; to the second the flame starts; but by the third it is thrown into I urge against the broad face of the flame a violent commotion; the sound Ah! is still stream of air from the blow-pipe just em more powerful. When the vowel sounds are

experiments, those characterized by the sharpest overtones being the most pow-erful excitants of the flame. (See Helmholtz in Pogg. 'Annalen,' vol. cvlii, p. 286.) The flame is peculiarly sensitive to the utterance of the letter S. If the most distant person in the room were to favor me with a hiss, 'the flame would be instantly shivered into tumult. The utterance of the word 'hush' or 'puss' produces the same effect. The hissing sound contains the precise elements that most forcibly affect the flame. The gas issues from its burner with a hiss, and an external sound of this character added to that of a gas jet already on the point of roaring, is equivalent to an augmentation of pressure on the issuing stream of gas. I hold in my hand a metal box containing compressed air. I turn the cock for a moment, so as to allow a puff to escape-the flame instantly ducks down, not by any transfer of air from the box to the flame, for I stand at a distance which utterly excludes this idea; it is the sound of the issuing air that affects the flame. The hiss produced in one orifice precipitates the tumult at the other."

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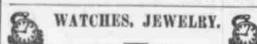
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	CAPITAL		Н
	Authorized Paid up in full	\$200,000'00	
	ASSETS.		1
	Value, or nearly as may be, of the Real Estate held by the Company. Cash on hand and in Hank Cash in hands of Agents and in course of	50,400°06 12,954°41	
	Amount of Loans accured by Bonds and	204165	
Į	United Sattes and other Bonds. Par Value. Market Value.	67,320 00	
	Amount of Stock held by the Company as collateral security for Loans, Par Value, Market Value,	281,741*00	
	Amount of interest on Investments made by the Company, due and unpaid and ac-	26,650'00	
ı	Amount due for Rents, including not ac-	2,160.00	
	Revenue Stamps on hand	898-50	

INCOME OF THE COMPANY. Amount of Cash Premiums received....... \$226,2201

\$253,993.18 EXPENDITURES OF THE COMPANY.

LIABILITIES, NONE.

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lished in accordance with an ast of Assembly, CAPITAL.

	1100101050000
ASSETS.	
Value, or nearly as may be, of the Real Estate held by the Company Amount of Cash on hand Amount of Cash in hands of Agents, and in course of transmission Amount of United States and other bonds (par value, \$244.55p.0; market value, \$25.0650)	\$1,100°00 6,866°10 5,944°47 8,622°74
Amount of Premjum Notes unpaid	2,085'00
LIABILITIES. Amount of losses during the year, which	\$382,386°21

Amount of losses during the year, which have been paid.

Amount of losses during the year, which have not been settled.

Amount of losses reported and not acted on Amount of Dividenda declared.

Amount of Dividenda declared, due and un-\$88,591'14 INCOME.

Amount of Cash Premiums received.

Amount of Interest money received from
Investments.

Amount of Income of Company from Divi-EXPENDITURES.

Amount of losses paid during the year.

Amount of losses paid during the year,
which accrued prior to the year.

Amount of reinarance Premiums. Amount of reinsurance Premiums
Amount of Return Premiums
Amount of Dividends paid during the year.
Amount of Expenses paid during the year,
including Commissions and Frees paid to
Agents and Officers of the Company.
Amount of Taxes paid by Company
Amount of all other expenses and expendi-

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200,000 United States 7 3-10 Per Cent,
Loan, Treasury Notes.
125,000 City of Philadeiphia Six Per Cent.
Loan (exempts).
54,600 State of Pennsylvania Six Per
6c,000 State of Pennsylvania Five Per
Cent, Loan.
50,000 State of New Jersey Six Per
Cent, Loan.
20,000 Pennsylvania Railrond, 1st
Montgage, Six Per Cent, Bonds,
25,000 Pennsylvania Bailrond, 2st Mortgage Six Per, Cent, Bonds,
25,000 State of Tennesses Five Per Cent,
Loan.
20,000 State of Tennesses Five Per Cent,
Loan.
20,000 State of Tennesses Five Per Cent,
Loan.
20,000 State of Tennesses Five Per Cent,
Loan. 198,500*00 211,509'00 54,700.00 44,620.00 50,750°00 20,300 00 24,250°00

7,080 State of Tennessee Six Per Cent. 5,040'00 15,000 300 Shares Stock of Germantown 15,0000

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Company. 8,305*25 5,950'00 28,000% 155,900:00 Market value, \$1,670,29075 Cost, \$1,630,55275, \$1,045,050 par. Real Estate.

Bilis receivable for insurances 36,000 90

Balance due at agencies.—Premium on Marine Policies, Accrued interest, and other
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\$5,173. Estimated value.—
Cash in Bank \$811,10220 27,607:20 38,923 90 2,930'0 \$811.102*26 447*14 Cash in Drawer 41,540*00

\$1,407,821:56 *This being a new enterprise, the Par is assumed as the market value. a the market value,
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granted to the undersigned by the Registrar of Wils of
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make payment, and those having claims will please
present them immediately to
JAMES PARIES, Executor.
No. 311 CARPENTER Street;
Or to his Attorney.

Or to his Attorney,
E. COPPEE MITCHELL,
No. 502 WALNUT Street.
PHILADELPHIA, February 21, 1867. 2 21 th8

PHILADELPHIA. February 21. 1867.

MEDICAL BOARD FOR THE EXAMINATION OF CANDIDATES FOR ADMISSION INTO THE NAVY AS ASSISTANT SURGEONS.

BUREAU OF MEDICINE AND SURGERY, NAVY DEPARTMENT, December 29. 1806.

A Board of Medical Officers is now in session at the NAVAL ASYLUM Philadelphia, for the examination of candidates for admission into the Medical Corps of the Navy.

Gentlemen decircus of appearing before the Board must make application to the Honorable Secretary of the Navy, or to the undersigned, stating residence, place and date or birth. Applications to be accompanied by respectable testimonials of moral character.

Candidates must not be less than twenty-one nor more than twenty-six years of age.

No expense is allowed by the Government to candidates attending the sessions of the Board, as a successful examination is a legal pro-requisite for appointment in the Navy.

The many vucancies existing in the Medical Corps insure immediate appointments to successful candidates.

P. J. HORWITZ, Chief of Buresu.

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