that aqueous solutions extracted from light benzene reduce ammoniacal silver solutions, the author concludes that aldehydes are contained in the first runnings from benzene. He treated a large quantity of fraction L 1 with sodium bisulphite, but obtained only about 1 per cent. of extract, and was, therefore, unable to examine the mixture of aldehydes and ketones more closely. He, however, detected the presence of acetone by the characteristic odor, the formation of iodoform and the indigo reaction with orthodinitrobenzaldehyde and sodium hydroxide. According to Michael, a bright resinous substance is obtained on boiling aldehyde with an alcoholic solution of resorcinol and a minute quantity of hydrochloric acid (see this *Journal*, 1884, 253). The author has obtained a similar product by applying the same reaction to light benzene.

4. Ethyl Alcohol.—The author has not been able to isolate this product from any of the fractions obtained by the distillation of light benzene. He, however, obtained a faint reaction of ethyl alcohol from a sample which had been in contact with water for a fortnight, and concludes from this result that light benzene contains an ethyl compound which is gradually decomposed by water with formation of ethyl alcohol.

5. Phenols.—The examination for phenols was conducted in the following manner: After treatment with hydrochloric acid the light benzene was shaken up with dilute soda lye. The alkaline extract was then acidified with sulphuric acid and distilled with steam or extracted with ether. In both cases a product having a tarry odor was obtained, but the quantity was too small to admit of further investigation.

6. Mercaptans.—To detect the presence of these compounds in light benzene the different fractions were heated with mercuric oxide and alcohol, and in a second series of trials they were added to an alcoholic solution of mercuric chloride. The presence of mercaptans could not, however, be established with certainty, as only a slight turbidity was obtained.

7. Detection of Bodies belonging to the Pyrol, Thiophen and Furfuran Series, also of Hydrocarbons of the Benzene Series.—The vapor from fraction L 1 imparts a greenish color to pine shavings moistened with hydrochloric acid. The reaction with the phenanthraquinone and with isatin and concentrated sulphuric acid gave no coloration, so that it may be inferred with certainty that no closed chain compounds of the pyrol, furfuran, or thiophen series are present. It is not possible to separate aromatic hydrocarbons by treatment with a concentrated solution of picric acid, although benzene was found in the residue obtained by fractional distillation.

8. Unsaturated Compounds.—The different fractions from the light distillation of light benzene absorb bromine very eagerly, and form additive as well as substitution compounds. The group of unsaturated compounds includes derivatives of acetylene, the author having found that on adding ammoniacal solution of cuprous chloride to light benzene and allowing the mixture to stand, a red-brown precipitate is obtained. —*Dingl. Polyt. Jour.; Chem. Trade Jour.*

THE UNBURNED GASES OF GAS STOVES AND BURNERS.*

I HAVE been working for some time with a view of determining whether the gases escaping as flue gases from gas stoves and different burners were really free from gas capable of combustion, such as carbon monoxide, or unburned hydrocarbons or hydrogen. I spent some time in trying to separate and determine the quantity of carbon monoxide present, if any, but this problem was beset with so many difficulties that for the moment I abandoned it and contented myself for the present with determining the quantity of unburned carbon and hydrogen in whatever forms these might exist. For this purpose I arranged an apparatus consisting of two carefully weighed U tubes filled with strong sulphuric acid, and two weighed U tubes filled with soda lime, through which the flue gases were first passed. These absorbed the water and carbon dioxide contained in the flue gases, leaving the hydrocarbons (not absorbed by vitriol), hydrogen and carbon monoxide to pass through a red hot glass tube filled closely for 15 in. with oxide of copper, prepared *in situ* from copper wire gauze. The gases were then passed through strong sulphuric acid and soda lime contained in previously weighed U tubes, and the results were calculated on the gas measured at 60° Fahr. and thirty in. barometric pressure, from the measure of gas drawn into the aspirator (treated as water-saturated gas). The carbon dioxide and water vapor absorbed in the tubes were then added on to make up the measure of flue gas originally employed and which was taken for the determinations. The coal gas employed was previously passed through large cylinders filled with calcium chloride to dry it before combustion, and at the same time as the experiment was going on, and side by side with it was estimated the carbon dioxide and water vapor present in the air itself by passing it by means of another respirator through strong sulphuric acid and soda lime in U tubes previously weighed.

The carbon dioxide in the air itself ranged from 0.41 to 0.66 grain per cubic foot of air, and the water from 3.51 to 7.23 grains in the same volume. The amounts of carbon dioxide and water collected from the flue gases, after deducting the quantities actually present in the air, were taken as those due to the combustion of the coal gas. The standard I employed was one used by Professor Roberts-Austen in his analysis of the flue gases from the burning of coal, and the apparatus employed was generally similar to that also employed by him. The carbon and hydrogen left unburned were measured in terms of 1,000 parts of carbon, actually derived from the combustion of the gas in the stove or burner. The total quantities of carbon dioxide and of water in the flue gases amounted to from 6.6 to 10.8 grains per cubic foot for the former and from 5.6 to 10.5 grains of the latter, in the same volume.

The amount of flue gas passed in each experiment was about one cubic foot, and although the variations were considerable, the general results were conclusive in showing that the combustion of gas, when burned

in gas stoves for heating purposes, is much more incomplete than one might be led to suppose.

The only burner in which the weights of the tubes remained constant after passing the burned gas, and in which the combustion was presumably complete, was in a paraffin oil lamp in which the flame was not turned to its highest point. In another experiment with the flame turned full on, 12.04 and 3.09 respectively of carbon and hydrogen escaped combustion per 1,000 of carbon completely burned.

The next nearest approach to complete combustion was in an Argand burner, in which all the carbon was completely burned, but an amount representing 0.2575 part of hydrogen escaped combustion per 1,000 parts of carbon completely burned, while in a second experiment 0.113 of carbon and 2.5414 of hydrogen escaping combustion were registered per 1,000 parts of carbon completely burned. Then came one of Bray's ordinary flat flame burners, burning four cubic feet per hour, which gave 11.12 of carbon and 0.95 hydrogen unburned per 1,000 of carbon completely burned.

Following in order these results came the Welsbach light, in which the gas heats to whiteness a tube or mantle composed of a filmy thickness of the oxides of zirconium and titanium, the mantle being surrounded by a glass tube similar to that used in some paraffin oil lamps. In this case the unburned carbon exceeded in amount the unburned hydrogen, there being 15.486 of the former and 3.794 of the latter per 1,000 of completely burned carbon.

Three experiments were made with a Marsh-Greenall's heating stove, in which three Bray's luminous burners were employed. The first was made with a consumption of 5.62 cubic feet of gas per hour, when 12.6 and 3.0 parts of carbon and hydrogen respectively were registered per 1,000 parts of carbon completely burned.

The second experiment, with a consumption of 5.74 cubic feet per hour, gave 37.6 and 11.8 respectively of carbon and hydrogen unburned. The third experiment, with an increased consumption of gas (7.1 cubic feet per hour), gave 97.4 and 12.1 of carbon and hydrogen respectively unburned.

Two experiments were made with one of Mr. Thomas Fletcher's heating stoves, in which eight Bunsen burners play upon some fancy metal work (iron coated with magnetic oxide). The one experiment in which the amount of gas passing was not measured gave 43.3 of carbon and 24.6 of hydrogen unburned per 1,000 of carbon completely burned. In the second experiment, where 6.81 cubic feet of gas were burned per hour, 66.3 and 20.0 respectively of carbon and hydrogen unburned were registered.

One experiment was made with one of Mr. Fletcher's stoves, in which twenty Bunsen burners play on asbestos projecting from a fireclay back, with a consumption of 8.14 cubic feet of gas, 138.9 and 11.7 parts respectively of carbon and hydrogen per 1,000 parts of completely burned carbon were found.

In a stove in which the hot gases rise to the top of a cylinder filled with pipes (through which cold air passes to be heated), and from the bottom of which the burned gases escape after having cooled to a considerable extent, upward of 200 parts of carbon escaped combustion per 1,000 parts of carbon completely burned.

CORRECTING IRREGULARITIES OF THE TEETH.*

By V. H. JACKSON, M.D., D.D.S., New York, N. Y.

THERE have been presented to the profession by dental specialists from time to time new systems for correcting irregularities of the teeth. Each has received more or less attention, and some of them will continue to be of service as long as irregularities need correction.

Orthodontia will no doubt eventually become a distinct specialty of dentistry, but it is necessary at present for the general practitioner to be more or less familiar with the systems in use, in order that he may choose that which will be the most effective in a given case and require the least outlay in construction. It is my purpose in this brief paper to describe and demonstrate with models and apparatus some methods of applying removable springs without the use of a plate for regulating teeth, describing methods that I am using daily, and with which I have attained good results in a limited time, and in passing I desire to express a growing confidence in the use of the removable spring for moving teeth. Piano wire is at present the best spring for the purpose, although spring gold, silver, and German silver are often applicable, especially if the temper is not drawn while soldering, and that can be avoided in some cases by keeping the spring portion cool, or by using soft solder, which is usually preferable.

The difficulty experienced in regulating the teeth of the lower arch often prompts the dentist to delay the operation from time to time, and more often to avoid even its consideration.

I have been using for a considerable length of time, as is known by some of the gentlemen present, metal spring appliances that are also applicable for the correction of irregularities of the teeth in the lower arch, cases of which I shall first briefly describe.

Fig. 1.—In the model here presented it will be seen

FIG. 1.

that the right inferior cuspid was much too prominent

and articulated outside of the upper teeth, there being insufficient space for it in the arch.

The first molar was extracted, as it was defective, and a piano wire was formed to the lingual side of the teeth in the arch, following the line of the gum to the distal tooth on either side, around which the ends were formed to clasp. The gum was very prominent just back of the molars, and accordingly the plaster model on which the appliance was formed was then carved slightly to allow the spring to more perfectly clasp about the necks of the teeth.

A second spring wire was then formed to join the one described, and pass just in front of the second molar through the space made by the extraction of the first molar, and extend forward, terminating in a curve on the anterior surface of the prominent cuspid.

The two spring wires were then joined with soft solder, having first wound the part forming the joint with small copper wire. The whole appliance can, if desired, be plated by immersion in melted tin.

The pressure of the spring was regulated by bending it toward or from the main wire, and by curving the end. The tension was such as to draw the cuspid and and bicuspid backward, and move the cuspid into proper line within a month's time.

A variety of methods have been adopted to keep this form of appliance from pressing on the gum and slipping off from the teeth. Some of these have been published.

The principal forms were wire points soldered to the main wire and reaching into the spaces between the teeth to keep the appliance from slipping off and a similar wire extended on to the grinding surface, usually at the junction of two teeth, to keep the fixture from pressing on the gum.

This system has proved to be, for a certain class of cases, the most rapid in moving the teeth, and of the least inconvenience to the patient and operator of any yet used.

The inner bar can be stiffened at any place desired by winding with binding wire, and flowing over it tin or soft solder, or an extra wire can be added in a similar manner at any stage of the operation.

A spring can extend from the main wire to either side of the arch to move teeth out into line, or to the labial side of the arch to force prominent teeth back to a proper position, or be adapted to rotate one or more incisors by pressing them against the main wire.

Fig. 2.—The arch can be easily expanded in many cases with a similar spring appliance. When used for

FIG. 2.

that purpose, the principal or foundation spring can be arranged either on the inside or outside of the arch, as it is found best suited to the individual case, although it should in most cases have a small loop formed in the wire at the median line of the arch.

This point I referred to in a previous paper in the *Dental Cosmos*, vol. xxix, p. 373, describing a method of spreading the anterior part of the lower arch with a plate without covering the teeth. The same wire should extend back along the line of the necks of the teeth and clasp around the last one in the arch, and continue forward usually to the mesial side of the first bicuspid, and there extend over the grinding surface and be soldered to the original wire, which will keep the appliance from pressing on the gum, and also clasp the teeth firmly.

The opening of the median line loop from time to time will spread the bicuspid portion of the arch. The incisors can often at the same time be moved outward into line by the foundation spring, by opening the loop and shaping the spring to press against them. For this purpose the spring should not be too stiff.

One or more additional loops of wire may pass over the grinding surface at the junction of two teeth and be united to those on either side, if the appliance is not otherwise well retained.

This device for attaching apparatus to the teeth I have termed a "crib," a more minute description of which will be given further on.

Fig. 3.—An effectual method of drawing too prominent or overcrowded lower teeth into proper line (as well as

FIG. 3.

those of the upper arch) where a bicuspid has been removed on either side, leaving a space, is to arrange a spring wire on the lingual side of the teeth in the line they should assume when regulated. The wire should extend back, following the outline of the gum, and again forward on the labial side, forming a crib as described, except that the ends should be left free to form

* Read by Mr. William Thomson, F.R.S. Ed., F.C.S., before the Chemical Section of the British Association.

* Read before the International Medical Congress at Berlin.—*Dental Cosmos*.

springs which extend forward on the labial side of the teeth, beyond the median line, thus passing each other.

By the inward pressure of the springs the teeth are forced against the main wire and thus drawn into proper line. It is remarkable that the pinching pressure exerted on the teeth embraced between the inner and outer spring wires squeezes the teeth also to the right and left as if they were being directly pushed backward along the curved inclosure of the crib, which thus simultaneously compels and controls the movements of the teeth in the desired directions.

If the front teeth are not prominent enough, as seen in Fig. 4, the appliance should be made the same as

FIG. 4.

the one last described, except that the main wire should be arranged on the labial side of the teeth and the springs on the lingual side, to press the teeth out into the circle made by the main wire in front of them.

Fig. 5.—A "crib" for one side of the arch, with a spring wire passing across to the opposite side, provid-

FIG. 5.

ed with a partial clasp fitted to the tooth to be moved and soldered to the wire end, is efficient in some cases for pressing into line a cuspid or other tooth that is inside of the arch.

A similar crib can also be arranged on either side of the arch and the two be joined by a small spring wire, to which can be attached a T piece to draw back prominent incisors, as in the V shaped arch, and at the same time spread the anterior part of the arch by having the spring press against the lingual side of the teeth that are to be moved outward.

I now present the model of the teeth of a lady thirty-six years old, all of whose upper front teeth closed inside the lower ones.

It will be seen that one lateral incisor and bicuspid and three molars are missing, some of them having been extracted years ago with the hope of correcting the irregularity. But the teeth had crowded together and the articulation became so changed as to give an unpleasant expression to the features. Besides this, the labial surfaces of the superior incisors were becoming worn.

The second model was made from an impression taken while the apparatus was in the mouth, and shows the method adopted for forcing the teeth forward.

The difficulty that is often experienced of moving nearly all of the oral teeth in one direction was very marked in this case, as will be seen by the models.

A crib was made for each side of the arch, to encircle all of the teeth back of the incisors; a slight separation was made by wedging in front of the cuspids, and a round iridio-platinum wire was flattened to pass into the space on either side, and extended back, following the line of the gum and surrounding the cuspid, bicuspid, and molars. This was supported and made to more firmly clasp the teeth by making cross bars to connect the two sides of the crib by passing over the articulating surface at the junction of the teeth, serving also to keep the crib from pressing on the gum.

There was a loop soldered to the crib wire opposite the palatal surface of the first molar on each side of the arch, into which loop was hooked the end of a piano wire formed like the letter S, and extended forward, passing just back of and following the curve of the incisor. There were placed on the incisors gold collars with lugs soldered on their palatal surfaces, to hold that portion of the spring in position.

FIG. 6.

Fig. 6 shows the device in place on the four incisors in another completed case of the same character.

Pressure was made as needed, by straightening the S loops of the spring wire a little at a time.

The incisors were moved rapidly, and when sufficiently forward the portion of the crib in front of the cuspids was removed, and a piece of piano wire was soldered to the original spring wire, which extended to the distal sides of the cuspids, by the application of which they also were moved forward. Another spring was then attached by solder to the original one, as before, to move the bicuspid forward, and at the same time one of the cuspids was prepared to be rotated by placing on it a collar, with a cylinder soldered to its palatal surface, to hold a spring which extended to the opposite side of the arch and hooked into the loop in the crib.

Fig. 7.—A cuspid or other tooth that is inside and a central or lateral outside of the line of the normal arch may at the same time be forced into line by constructing a crib for the back teeth on the same side of the arch as the teeth to be regulated, and from this crib extending forward the ends of the spring wire to the respective labial and lingual sides of the teeth which are to be moved.

FIG. 7.

FIG. 8.

Fig. 8 shows an appliance on a model for rotating a tooth. It is made like a crib, with the main wire following the outline of the gum as before described, and the ends left free to act as a spring on the labial and lingual surface of the tooth to be rotated, on which is placed a collar having slight depressions or sockets to receive the ends of the springs, which are curved to proper form to cause pressure in the desired direction, and conform to the surface of the gums. The appliance is easily made, can be used for any tooth, and does rapid work. The wide range of the action of these arms is peculiarly noticeable, for by them every conceivable direction may be given to the tooth according as one, or the other, or both of the arms shall be adjustably bent for action.

In uniting piano wires to form the crib, the joints are strengthened by first drawing the temper of the end of the wire, and flattening it very thin with the hammer, again drawing the temper and bending it around the main wire before soldering. If great strength is needed very thin copper wire should be wound about the joint before soldering. It is always well to make the parts bright and tin them before uniting, if soft solder is to be used. Use at all times a very weak solution of muriate of zinc, and preferably employ the soldering iron. Collars are indispensable in many cases for holding the ends of the spring in position on the teeth.

For the ordinary case a lug may project from the collar, but for special rotating purposes a socket is made, usually by soldering to the collar a loop of small platinum wire in suitable position to receive the end of the rotating spring.

If the crib is not well retained by the devices previously described, a separation should be made by wedging, to allow a cross wire to pass between the teeth to connect the sides of the crib, or a spring can extend from the crib to clasp a tooth in the same manner as for re-

the labial surface of the right inferior cuspid when the teeth were articulated measured about three-fourths of an inch (Fig. 9).

FIG. 9.

The superior maxilla was not, however, well developed, and the incisors needed to be made more prominent to assist in improving the outline of the features.

A split plate (Fig. 10) was made as described by Dr.

FIG. 10.

W. H. Coffin, of England, except that it did not cover the teeth or open the bite. It was strongly retained by two wire clasps extending from either side to clasp a bicuspid and molar. The plate was divided laterally, leaving the anterior part sufficiently large to cover the intermaxillary portion of the process for the purpose of forcing it forward with the teeth. Collars of gold, with lugs on their lingual surfaces, were placed on the incisors, and firmly retained the anterior part of the plate.

When the incisors were moved as far forward as practicable (Fig. 11, which shows the case after six months),

FIG. 11.

the appliance shown in Fig. 12 was made and adjusted, as seen in Fig. 13.

This metal appliance was made of brass to cover the

FIG. 13.

taining a plate, or collars with slight ridges on their surfaces can be used as previously described.

I now present models and apparatus illustrating a procedure that proved efficient in correcting the position of the teeth in both the upper and lower maxillae for a patient twenty-two years of age. The distance from the lingual surface of the right superior lateral to

chin, and provided with two perpendicular tubes soldered on the outer surface, and corresponding in position with the corners of the mouth. A crib was made of German silver wire, for the lower incisors and bicuspid, with the main wire on the labial surface and extending back, following the outline of the gum, to surround the bicuspid, with the wire ends left long to

act as springs on the lingual surface of the incisors. The crossbars to connect the sides of the crib extended over the grinding surface at the junction of the bicuspid on either side. The inferior first molars were at the outset pulpless, and were subsequently extracted. Wire posts were soldered to the main wire, and curved in suitable form to allow room for the action of the lower lip and to enter the tubes in the chin appliance at the proper angle. Two German silver wires were pivoted to the lower part of the chin apparatus, with the ends projecting upward and backward sufficiently far and diverging until they were about one and one-

FIG. 12.

half inches apart. The ends were then bent at sharp angles and united with solder. A metal button was soldered to each of these angles for the attachment of rubber bands, to exert the traction on the appliance. It is obvious that properly directed traction on the chin piece would force the crib backward, carrying all the inclosed lower incisors, cuspids, and bicuspid toward the second molars, which were finally almost touched by the bicuspid.

It will be noticed that the arch of the inferior oral teeth was maintained by the crib while in transit, and that the molars were in nowise disturbed. There is great advantage in having the wire portion pivoted to the appliance, as it acts like a whiffletree, and thus the appliance is not drawn sideways at each change of the tension. The part passing over the head was made of strong cord network, with a border of silk ribbon about one inch wide, to which were attached two non-elastic suspenders with buckles on either side. The buckles were provided with wire hooks, which were concealed by a flat piece of metal to receive the rubber bands.

The resulting improvement in the relations of the teeth is shown in Fig. 14. the impression for which il-

FIG. 14.

lustration was taken six months after the application of the chin and crib apparatus.—*The Dental Cosmos*.

NEW VELVET PILE CHRYSANTHEMUM.

It was our privilege last year to present the first authentic figure of the novelty of the season, Mrs. Alpheus Hardy, and again we have the same good fortune, the figure subjoined being a lifelike representa-

NEW VELVET PILE CHRYSANTHEMUM,
LOUIS BOEHMER.

Color silvery pink, under sides of florets clothed with silvery hairs.

tion of a typical flower. It is a matter of much interest that this, like its predecessor of the velvet pile character, comes from America, being sent out by Messrs. Peter Henderson & Co., of New York, who made it known at the autumnal shows in the States last year, winning thereby golden honors. Very shortly the flower

will speak for itself, but its first speech will be in a somewhat weak tone, for hard propagation will keep down the initial vigor, and we shall not see it in perfection until it has become established in the country. But then—well, we will wait and see what then; for the present here is the portrait of the candidate, and for a season at least it will be at the head of the poll.

TRICYCLE COACHES.

THE coming introduction of tricycle coaches on the streets has met with the hearty approval of a long

suffering public, whose hopes are now raised that the conveyances will be some relief from the present slow-going street cars. The promoters of the new enterprise have been running a sample of the new coaches for several weeks, with a view to testing its adaptation to their requirements. The coaches which are to be used here, however, will be twice the size of that, carrying sixteen passengers, while that carries but eight.—*Detroit Free Press*.

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