century, we cannot claim to have made any discovery as to its mode of action. We know for certain that it will cure psoriasis, pemphigus, and their allies, and that it will prevent the recurrence of recurrent herpes and many other relapsing maladies. We never cease to wonder at the extreme rapidity and certainty with which, in some of these, its effects become manifest. How those effects are brought about, however, we cannot even guess. We know also that it may, whilst curing some diseases, produce others, and that herpes zoster is one amongst several different type-forms of peripheral neuritis which may result directly from it. That it has some peculiar affinity for nerve tissue, and some peculiar influence upon nerve function, we may safely believe, but further than this we can scarcely go. As regards its general employment as a remedy for skin diseases, whilst recent observations have strengthened our faith in certain directions, they have limited it in others, and they have impressed upon us the great need of caution. They leave us with the practical creed that we may, as heretofore, freely avail ourselves of its services, but that we must, perhaps rather more than has heretofore been felt necessary, watch its effects, and be prepared, if need be, to forbid its further use.

ON THE PHYSIOLOGICAL ACTION OF CARBON MONOXIDE OF NICKEL.

By JOHN G. MCKENDRICK, M.D., F.R.S.,
Professor of Institutes of Medicine, University of Glasgow ;
AND

WILLIAM SNODGRASS, M.A., M.B.

[From the Physiological Laboratory, University of Glasgow.]

By the kindness of Mr. Ludwig Mond, we have had the opportunity of examining the physiological action of carbon monoxide of nickel, a substance of unique chemical composition represented by the formula $\text{Ni}(\text{CO})_4$. This substance was discovered by Mr. Mond co-operating with Dr. Carl Langer and Dr. Friedrich Quinke, and its chemical properties have been described by them.¹ It is a clear liquid of high refractive power, boiling at 43°C . at 751 millimetres, and having a specific gravity of 1.3185 at 17°C . The fluid is soluble in alcohol, benzene, chloroform, and pure olive oil. It readily evaporates on exposure to the air, the remainder, even in a well-stoppered bottle, undergoing decomposition. For this reason, it must be kept in sealed glass tubes, and we found it difficult to preserve it when the point of the tube was broken off and a small quantity removed for purposes of experiment, however quickly we sealed up the point in a blowpipe flame.²

The method of administration adopted was by subcutaneous injection. The following experiments were in the first instance made upon frogs:—

EXPERIMENT I.—At 11.3 A.M., 1.14 cubic centimetre injected under skin of the back. The substance evidently acted as an irritant, as the animal contorted its body and rubbed the skin over the seat of the injection with its hind limbs. At 11.30, there was paralysis of fore and hind limbs. At 11.50, respiration was very slow. At 12.20, the animal was dead. The blood was of a bright red colour, and when examined with the spectroscope showed two absorption bands in the position characteristic of carbonic oxide hæmoglobin. The two bands persisted after the addition of sulphide of ammonium.

EXPERIMENT II.—At 2.48 P.M., 0.54 cubic centimetre injected under skin of back. At 2.51, the frog croaked repeatedly, and rubbed irritated spot with its hind limbs. At 2.53, we observed that the eyes were remarkably prominent. At 2.56, it rubbed its head with its fore limbs. At 3.12, the eyes were much retracted. The web of the foot, examined under the microscope, showed a very slow blood stream in the vessels. At 4.20, there was slow respiration, and 4.22 the animal was

dead. A spectroscopic examination showed two absorption bands, irreducible by sulphide of ammonium.

EXPERIMENT III.—At 3.25 P.M., 0.3 cubic centimetres injected under skin of the back. At 3.31, the frog rubbed its back with its hind limbs and its head with its fore limbs. At 3.32, the eyes were retracted. At 3.46, the circulation in the web was very slow. At 3.58, there was gasping respiration. At 4.2, there was almost complete stoppage of circulation in the web. At 4.8, the animal was killed. The heart was beating feebly, and a drop of bright red blood taken from it showed the double absorption band irreducible by sulphide of ammonium.

These experiments all pointed to the poisonous action being similar to that of carbonic oxide.

EXPERIMENT IV.—At 10.33 A.M., 0.3 cubic centimetres injected under the skin of the back of a white mouse. At 10.36, there was slow, prolonged breathing; 10.38, convulsive twitchings of limbs, especially of hind legs; 10.39, a general spasm; 10.39½, fibrillar twitchings of muscles; 10.40, gasping breathing, lying on back paralysed; and at 10.48 the animal was dead. On opening the body, the tissues were seen to be of a bright red colour, and the vessels were full of bright red blood. The blood from the heart showed a double absorption band in the spectrum, not changed by addition of sulphide of ammonium. The animal died in fifteen minutes.

EXPERIMENT V.—At 10.43, a small rabbit, weighing 330 grammes, had 1 cubic centimetre injected under skin of back. It died in twenty minutes. There was marked paralysis of the limbs, appearing first in the hind limbs. The respirations became extremely rapid and gasping towards the close of life. This was the first case in which the temperature of the rectum was taken at intervals. The first reading, immediately before receiving the injection, was 35.5°C ; the temperature steadily fell, and at the moment of death it was 32°C . This observation directed us to the remarkable reduction of temperature caused by $\text{Ni}(\text{CO})_4$. The next experiments illustrate this point.

EXPERIMENT VI.—A larger rabbit than the subject of Experiment V was taken, but the weighing was unfortunately overlooked. The animal was wrapped in a towel, and a thermometer was kept in the rectum during the greater part of the experiment. Great care was taken to keep the thermometer always at the same distance in the bowel, as it was found that pushing it a little further in or drawing it a little further out caused considerable variations. The following are the readings:—

12 noon, 37.3°C ; 12.5, 39.1; 12.10, 38.9; 12.12, 38.8 (0.13 cubic centimetre of $\text{Ni}(\text{CO})_4$ injected under skin of back); 12.13, 38.5; 12.14, 38.5; 12.16, 38.4; 12.17, 38.4; 12.18, 38.35; 12.20, 38.2; 12.21, 38.2; 12.22, 38.1; 12.23, 38.0 (no convulsions, respirations slower); 12.24, 37.85; 12.25, 37.7; 12.26, 37.68; 12.27, 37.6; 12.28, 37.5; 12.28.5, — (twitching of right hind leg); 12.29.5, 37.4; 12.30, 37.35; 12.31, 37.28; 12.32, 37.19 (twitching of right hind leg); 12.33, 37.1; 12.34, 37.0; 12.35, 36.91; 12.37, 36.8 (slight twitching); 12.38, 36.8; 12.39, 36.7; 12.40, 36.6; 12.41, 36.5; 12.42, 36.47; 12.43, 36.39; 12.44, 36.31; 12.45, 36.25; 12.46, 36.18; 12.47, 36.1; 12.48, 36.01; 12.49, 35.94; 12.50, 35.95 (thermometer pushed slightly farther in); 12.51, 35.95; 12.52, 35.9; 12.53, 35.89 (micratures on instrument); 12.54, —; 12.55, —; 12.55.5, 35.72; 12.56, 35.7; 12.57, 35.51; 12.58, 35.49 (twitching of right hind leg resumed); 12.59, 35.4; 1 P.M., 35.38; 1.1, 35.3; 1.2, 35.27; 1.3, 35.26; 1.4, 35.2; 1.5, 35.11 (marked twitching); 1.6, 35.09; 1.7, 35.06; 1.8, 35.02; 1.9, 35.00; 1.10, 34.91; 1.11, 34.9; 1.12, 34.88; 1.13, 34.9 (micratures on thermometer); 1.14, 34.9; 1.15, 34.82; 1.16, 34.72 (animal allowed to run about a little; shows weakness of hind limbs; vessels in ear full of bright red blood); 1.29, 33.3 (animal lies quiet on table without being held; slight tremor in right hind leg; twitching of right upper eyelid); 1.31, 32.5; 1.47, 31.93; 1.51, 31.6; 1.55, 31.4; 2.0, 31.0; 2.5, 30.47; 2.12, 30.0; 2.15, 29.5; 2.17, — (severe convulsive seizure, gasping); 2.20, 29.3; 2.25, 28.6; 2.34, 28.1 (rabbit placed in a large jar of pure oxygen); 2.47, 26.3; 3.0, 26; 3.5, — (respirations 52 per minute); 3.13, — (respirations 40 per minute; taken out of jar of oxygen and placed in a box before the fire to warm the body, which had become perceptibly cold; the temperature rose up to 28.5°); 4.30, — (animal died after a severe convulsive spasm).

This experiment shows that, after a subcutaneous injection of 0.13 cubic centimetres of $\text{Ni}(\text{CO})_4$, the temperature steadily fell from 38.8°C . to 26°C ., and that the animal died in four hours eighteen minutes. There was a fall of temperature of 12.8° .

EXPERIMENT VII.—A rabbit, weighing 572 grammes, was wrapped in a towel and the temperature of the rectum was taken at intervals.

12.10 noon, 38.9°C . (thermometer in rectum); 2.15, 37.0; 2.20, 37.0; 2.25, — (thermometer accidentally came out); 2.30, 36.5; 2.35, 35.8; 2.36, 35.5 (thermometer removed); 2.38, 35.6; 2.45, 35.6; 2.50, 36.0; 2.55, 35.9 (animal released and allowed to run about); 3.5 to 3.20, 36.6 (temperature remained fairly constant).

As already stated, we found that a slight variation in the

¹ *Journal of the Chemical Society*, August, 1890, vol. lvii.

² A notice of a communication on $\text{Ni}(\text{CO})_4$ by M. Hanriot appears in *Nature*, of April 9th, 1891, as having been communicated by him to the Société Chimique on February 27th. In this notice it is stated that M. Hanriot found the substance to be more poisonous than carbonic oxide, and that the blood gave the characteristic spectrum of CO-Hæmoglobin. Our work was carried on independently at intervals during last winter.

distance to which the thermometer was pushed into the rectum caused a considerable variation in the reading, and to secure accuracy we had a mark on the thermometer, and the instrument was inserted up to this mark in each observation.

3.21 P.M., — (0.06 cubic centimetre injected below skin of back); 3.27, — (rabbit less lively; slight paresis of hind limbs), 3.30, 35.8° C. (vessels in ear full of bright red blood); 3.35, — (fore limbs weak; animal resting on belly); 3.40, 34.7; 3.45, — (marked weakness of right leg); 3.47, — (both legs extended); 3.50, 34.3; 4.1, 34.2 (head falling forwards); 4.10, 33.2 (no attempt to pull itself together when the animal's limbs were moved); 4.20, 33.7 (as animal felt cold, it was placed before the fire); 4.30, 33.9 (after gasping respiration, animal died).

In this case 0.06 cubic centimetre killed the animal in one hour ten minutes, and the temperature fell from 36.6° to 33.9°, a fall of 2.7°. The seat of the injection was somewhat congested. Chemical tests showed the presence of nickel in the tissue of that region. The blood also gave reactions showing the presence of nickel.

As 0.06 cubic centimetre of the pure liquid Ni(CO)₄ represented 1 minim of the fluid, and as we were desirous of giving smaller doses, we next attempted to use a solution of 1 of Ni(CO)₄ in 10 of chloroform. This we termed the one-tenth solution, and 1 minim represented 0.006 cubic centimetre of pure Ni(CO)₄.

The following experiments were performed with this solution:—

EXPERIMENT VIII.—Rabbit weighing 720 grammes. Respirations 54 per minute. Temperature of rectum taken repeatedly at intervals and found to be fairly constant at 38.3°.

3.47 P.M., — (1 minim 0.006 cubic centimetre of Ni(CO)₄ of nico-chloroform solution injected under skin of back); 3.55, 37.1° C.; 4.5, 36.2; 4.10, — (respirations 48 per minute); 4.13, — (animal eating); 4.15, 35.6; 4.20, — (eating freely); 4.25, 35.75; 4.35, 35.7; 4.45, 36.2; 4.55, 36.3; 5.5, 36.5; 5.15, 36.5; 5.25, 36.0; 5.35, 35.9 (animal left running about in a warm room); 7.0, 36.1; 8.30, 37.0 (animal seemed vigorous and uninjured).

EXPERIMENT IX.—On the following day, at 10.35 A.M., the same rabbit had a temperature of 37.35°.

10.40 A.M., — (1 minim 0.006 cubic centimetre of Ni(CO)₄ of nico-chloroform injected under skin of back; the fluid showed a slight turbidity of a greenish colour); 10.50, 36.5° C.; 11.0, 36.35; 11.10, 36.2; 11.20, 35.9; 11.30, 35.0; 11.40, 35.0; 11.50, 35.9; 12.0, 36.0; 12.10, 35.6; 12.20, 35.8; 12.30, 35.7; 12.50, 35.7; 4.10, 35.7.

The animal throughout the experiment appeared to be little affected, but there was a fall of temperature. In both Experiments VIII and IX the temperature rose after the effect of the injection passed off.

EXPERIMENT X.—The same rabbit as was subjected to Experiments VIII and IX was again used. At 1.35 the temperature of the rectum was 38°, and it was found to be fairly constant. The solution of Ni(CO)₄ in chloroform showed a dirty greenish precipitate, which was suggested to be hydrated oxide of nickel, produced by the chloroform not being anhydrous.

1.36 P.M., — (2 minims 0.012 cubic centimetre of Ni(CO)₄ of nico-chloroform were injected under the skin of the back); 1.45, 37.9°; 2.0, 38.0; 2.5, — (animal drowsy, as if affected by chloroform); 2.20, 37.2; 2.50, 37.0; 3.15, 37.0; 4.10, 36.8; 4.35, 36.5.

In this experiment there was a slight fall of temperature. The rabbit, although carefully looked after, was found dead in its hutch two days later. The bladder was distended with urine, the kidneys were congested; there was serous fluid in the pericardium, the left ventricle was empty, and the right was full of clot. No trace of nickel could be discovered in the heart, blood, and urine. Probably the chloroform solution had decomposed, and no Ni(CO)₄ was present. The slight fall of temperature may have been due to the chloroform.

We attempted, but without success, to use a solution of Ni(CO)₄ in pure olive oil. Thus, the point of a small sealed tube containing 0.75 cubic centimetre of Ni(CO)₄ was broken underneath the surface of 86 cubic centimetres of pure olive oil.

EXPERIMENT XI.—A rabbit weighing 1,290 grammes at 2.46 had a temperature in the rectum of 38.1° C. At 2.49 20 minims of olive oil solution of nico ($\frac{2}{5}$ cubic centimetre of Ni(CO)₄) were injected under the skin of the back. At 3 o'clock there was no perceptible effect. At 3.1 the temperature was 38.1° C.; at 3.24, 37.7° C.; at 3.43, 37.6° C.; and at 4, 37.6° C.

EXPERIMENT XII.—A small house mouse had 10 minims ($\frac{1}{10}$ cubic centimetre of Ni(CO)₄) of olive oil solution of nico injected under skin of back. No effect observed.

We next made a solution of Ni(CO)₄ in pure anhydrous chloroform as follows: A small sealed tube, containing 0.75 cubic centimetre of Ni(CO)₄, was broken in a dry well-stop-

pered bottle, containing 16 cubic centimetres of anhydrous chloroform. Thus there was 1 of Ni(CO)₄ in 21 of chloroform, and 1 minim represented about $\frac{1}{21}$ cubic centimetre of Ni(CO)₄.

EXPERIMENT XIII.—A rabbit, weighing 1,460 grammes, was the subject of the next experiment.

2.34 P.M., — (injected 10 minims of chloroform—solution of nico = $\frac{1}{10}$ th cubic centimetre of Ni(CO)₄); 2.36, 39.0°; 2.50, 38.6 (weakness of hind limbs); 2.57, 38.5; 3.00, 38.3; 3.5, 38.25; 3.10, 38.2; 3.15, 38.0; 3.20, 37.9; 3.25, 37.7; 3.30, 37.5; 3.35, 37.2; 3.40, 37.0; 3.45, 36.8; 3.50, 36.6; 3.57, 36.3; 4.0, 36.2; 4.7, 36.1 (animal eating turnip); 4.12, 35.8; 4.15, 35.5 (animal left with complete paralysis of hind limbs, and temperature still falling); 6.45, 33.2 (hind limbs still paralysed; no eating; pupils dilated); 7.35, 32.8 (next day the animal was alive, and the hind limbs were paralysed); 11.15, 29.5 (in rectum); 12, 31.3 (in mouth); 12.30, 32.2 (in mouth); 3.30, 32.5 (in mouth); 5.30, 32.5 (the animal was kept in a box near the fire); 6.20, 33.5; 8.30, 34.7; 9.40, 34.4 (still paralysed in hind limbs).

At 10.40 A.M. on the following day the temperature of the rectum was 31.3°. The animal was weak, refused food, and the bowels were loose. Next morning it was found dead.

This experiment shows that the $\frac{1}{20}$ cubic centimetre (0.033) of Ni(CO)₄ in 0.4 cubic centimetre of anhydrous chloroform was lethal, and caused a fall of temperature of no less than 9.5°.

As it is known that chloroform causes a fall of temperature, a control experiment was performed, in which the same quantity of anhydrous chloroform was given as in Experiment XIII, but without Ni(CO)₄.

EXPERIMENT XIV.—A rabbit, weighing 1,342 grammes, had, at 4 P.M., 10 minims (0.4 cubic centimetre) of anhydrous chloroform introduced below the skin of the back.

4.0 P.M., 38.8° C.; 4.25, 38.5; 4.30, — (rabbit drowsy); 4.35, 37.6; 5.0, 37.3; 5.15, 36.9; 5.30, 36.1; 5.45, 35.5; 6.0, 34.7; 6.15, 34.3; 6.25, 34.1; 8.30, 35.2 (rabbit running about); 9.17, 36.0; 4.35, 36.0.

At 10.45 A.M. next day the temperature was 38.2°, and the animal was quite well. This experiment showed a fall of temperature of 4.7° in the course of two hours twenty-five minutes, when the temperature began to rise, and the normal temperature was regained next morning. In Experiment XIII the temperature had fallen 5° in about the same period of two hours twenty-five minutes, but it continued to fall for twenty-four hours longer, when it began slowly to rise. The effect of Ni(CO)₄ was therefore much greater and more persistent than the effect of the chloroform in which it was dissolved.

As 1 cubic centimetre of the liquid Ni(CO)₄ at 17.0° C. contains 0.4470 gramme of nickel, we next studied the action of a corresponding amount of nickel in an aqueous solution of nitrate of nickel, of such a strength that 1 cubic centimetre contained 0.4470 gramme of nickel. Two solutions of this in water of the strengths respectively of 1 in 300 and of 1 in 20 (the same strength as in Experiment XIII) were used.

EXPERIMENT XV.—A rabbit, weighing 1,836 grammes, had at 4.30 a temperature in the mouth of 38.9°. Ten minims (0.4 cubic centimetre) of $\frac{1}{10}$ th solution of nitrate of nickel in water containing the same amount of nickel as $\frac{1}{10}$ th cubic centimetre of nico were injected under skin of back. The temperature was unaffected. At 6.16 it stood at 39.1°, and at 8.45 at 38.6°. Then 10 minims (0.4 cubic centimetre) of 1 in 20 solution containing the same amount of nickel as $\frac{1}{10}$ cubic centimetre of nico (as in Experiment XIII) were injected below skin of back. At 9.15 the temperature was 38.9°, at 9.40 at 37.6°, and at 10.50 on the following day it was 38.8°. We may conclude that a reduction of temperature is not caused by a quantity of nickel equal to that in the doses of Ni(CO)₄, which produced the remarkably persistent fall of temperature as in Experiments VI and VIII.

We next endeavoured to examine roughly the gases of the blood after poisoning by Ni(CO)₄.

EXPERIMENT XVI.—A rabbit, weighing 997 grammes, at 2.58 had 2 minims (0.08 cubic centimetre) of pure Ni(CO)₄ injected below skin of the back.

2.58 P.M., temperature of mouth, 38.7° C.; 3.13, 37.6; 3.21, 37.5; 3.30, 36.3; 3.40, 36.1; 3.50, 35.1; 4.4, 33.1; 4.47, — (animal died after severe convulsions).

The animal was bled from the neck, and the blood was quickly introduced into a Torricellian vacuum produced by a mercurial gas pump. A small quantity of gas was obtained, and this was found on analysis to contain carbonic oxide.³ No trace of nickel was found in the gases, but it was found in the blood from which the gases were drawn.

Two experiments were made in which the animal was

³ The gas analyses were performed by Dr. G. G. Henderson, Chemical Laboratory, University of Glasgow.

caused to breathe an atmosphere containing the vapour of $\text{Ni}(\text{CO})_4$.

EXPERIMENT XVII.—A rabbit, weighing 1,090 grammes, was placed in a bell jar containing 24 litres of air. A small tube containing 0.6 cubic centimetre of $\text{Ni}(\text{CO})_4$ was broken inside the jar, and the fluid evaporated very quickly. As 1 cubic centimetre of the liquid $\text{Ni}(\text{CO})_4$ at 17°C . contains 0.87146 gramme of CO, which at 0° and 760 millimetres yields 696.5 cubic centimetres of gas, 0.6 cubic centimetre would yield about 417.9 cubic centimetres of CO gas. As 1 molecule of $\text{Ni}(\text{CO})_4$ contains 4 molecules of CO, the animal breathed an atmosphere containing 0.432 per cent. of $\text{Ni}(\text{CO})_4$ gas.

3.0 P.M., animal placed in jar; 3.7, agitated muscular tremors; urination; defecation; 3.13, animal sitting up on hind legs; no paresis; vessels of ear full of bright red blood; 3.25, weak in movements, but no marked symptoms; removed from jar; 3.26, temperature of mouth, 37.3°C ; 3.40, trembling and weak in legs.

The animal was found dead next morning, showing a lethal effect after breathing an atmosphere containing 0.432 per cent. for twenty-five minutes.

EXPERIMENT XVIII.—A rabbit, weighing 489 grammes, was placed at 3.45 in the 24-litre jar, the air of which contained 0.58 cubic centimetre of $\text{Ni}(\text{CO})_4$ = 0.41 per cent.

3.45 P.M., animal placed in jar; 3.46, vessels in ears full of bright red blood; animal agitated; 3.56, no very evident effect, except animal rubbing its nose with forepaws; 3.57, another quantity of 0.69 cubic centimetre of $\text{Ni}(\text{CO})_4$ = 0.49 per cent. of $\text{Ni}(\text{CO})_4$ gas was added; the air contained now nearly 0.9 per cent. of $\text{Ni}(\text{CO})_4$; 4.0, violent convulsions; animal lying on belly with the hind legs stretched out; great difficulty in breathing; the animal was quickly removed and placed in a large jar of pure oxygen; 4.10, died in severe convulsions.

It was rapidly bled, and the blood was passed into a vacuum and a small quantity of gas was obtained. This gas contained carbonic oxide, but no trace of nickel. The metal was found in the blood. Quantitative measurements of the gases were not made, as the object at this stage of the inquiry was to ascertain the presence or absence of carbonic oxide in the blood.

CONCLUSIONS.

The general results of the investigation may be briefly summarised thus:—

1. $\text{Ni}(\text{CO})_4$ is a powerful poison when injected subcutaneously.
2. The vapour of $\text{Ni}(\text{CO})_4$ in air, even to the extent of less than 0.5 per cent., is dangerous.
3. The symptoms are those of a respiratory poison, and are similar to those caused by carbonic oxide.
4. The spectrum of the blood of an animal poisoned by $\text{Ni}(\text{CO})_4$ is that of carbonic oxide hæmoglobin, and it is not reduced by sulphide of ammonium.
5. When the substance is injected subcutaneously, it is probably in part dissociated in the tissues, as there is evidence of the existence of nickel in these tissues; but the nickel also finds its way into the blood and is found there.
6. The substance produces a remarkably prolonged fall of temperature even when given in small quantities. This may be accounted for by the hæmoglobin being prevented to a large extent from supplying the tissues with oxygen. Nico, as we may for convenience term this substance, makes it possible to give graduated doses of carbonic oxide, and thus reduce temperature by directly interfering with the respiratory exchanges occurring in the tissues. The objections to its use as an antipyretic are that, owing to its poisonous properties, it is difficult to inject it subcutaneously in sufficiently small doses, while it is not easy to obtain a solution in any menstruum in which decomposition will not take place. If a convenient method of dissolving it could be devised, $\text{Ni}(\text{CO})_4$ might become a valuable antipyretic, the *modus operandi* of which is intelligible. We are at present experimenting in this direction.

We intend to continue the investigation, more especially as to (a) the solubility of the substance, (b) the quantitative effects on the gases of the blood, and (c) the quantitative effects on the gases of the air breathed by an animal under its influence.

PASTEURISM IN HUNGARY.—A muzzling Act appears to be rather urgently needed in Hungary, to judge from certain statistics which have recently been published. Between April 15th and May 1st, of the present year, no fewer than thirty new patients were admitted to the Pasteur Institute at Buda-Pesth. The total number of patients treated at the institute already amounts to 731.

A MODIFICATION IN THE FORM OF SOUND FOR FINDING SMALL VESICAL CALCULUS.

By SIR HENRY THOMPSON, F.R.C.S.,

Surgeon Extraordinary to His Majesty the King of the Belgians; Consulting Surgeon and Professor of Clinical Surgery to University College Hospital, etc.

I HAVE never been quite satisfied with any sound employed for the purpose of determining the presence of a small calculus in the bladder, and have modified the form for myself several times during the last twenty or thirty years. It is in my opinion difficult to exaggerate the importance of finding a model perfectly adapted to attain the object required. Hence any improvement, however slight, is a matter worthy of serious consideration.

The discovery of vesical calculus in its earliest stage has always been for me a subject of great interest, and one to which I called special attention many years ago. I believe I may fairly claim to be the first who regarded the ability to ascertain and demonstrate the presence of a stone when very small as an extremely important—as it was at that time an unusual—achievement of surgical art.

I now venture to offer my latest form of sound as one possessing better qualifications for the purpose named than any I have yet seen or employed.

There are two chief considerations to be borne in mind in designing such an instrument.

First, it should be so formed that all the necessary movements can be made with facility; that (a) the operator may pass it easily into the bladder, and also know with certainty the direction of the beak when lost to view; and (b) that he should be able to rotate it with ease between the finger and thumb, when the beak is turned downward behind the neck of the bladder, especially when, from enlargement of the prostate, the well-known depression exists there in which calculus is likely to lodge.

The first condition is attained by using the flattened handle of a good old pattern; the second, by placing close to it a small cylinder, a combination which now appears to me better than the entirely cylindrical handle which I originally introduced for lithotrites and sounds about the year 1860 for the purpose named. The shaft of the sound should be rather slender, and the under surface of the flat handle is rough, while the upper is polished, so that the direction of the beak (upwards or downwards) is recognised by touch.

Secondly, there should be special adaptation in the form of the beak to strike a very small concretion, and elicit a note therefrom. This is accomplished by flattening the beak a little in the opposite plane to that of the flat handle.

Fig. 1.—A, the flat handle; B, the cylindrical portion; C, the beak showing its widest diameter.