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RESUSCITATION APPARATUS

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During the past four or five years a number of mechanical devices for resuscitation from electric shock, drowning, and asphyxiation by poisonous gases have appeared on the market. Properly speaking, none of these devices is anything more than a means of supplying artificial respiration with air more or less enriched with oxygen. There has been a general failure to distinguish between a method for maintaining the pulmonary ventilation and methods (for practical purposes as yet undiscovered) for restoring the heart beat after fibrillation or standstill, and for counteracting the paralyzing effects of asphyxia on the nerve centers of the brain and cord. This has resulted in the term "resuscitation" apparatus being generally applied. It is important to keep in mind the limited character of this resuscitation.

The demand for such apparatus arises from the modern "safety first" movement. Any piece of apparatus which proved fairly effective for resuscitation would undoubtedly be a source of great financial profit to its manufacturers. Competition is already keen, and new forms of apparatus are demanding advertising space in medical journals.

As a result editors, superintendents of hospitals, mines, gas works, electric light and telephone companies, commissioners of city police and fire departments, persons in charge of swimming places, and others are writing in increasing numbers to the United States Bureau of Mines to ask as to the value of such apparatus in general, and as to the relative merits of the different kinds.

This paper is intended to supply such information. I have served as consulting physiologist to the bureau during the past three years, have examined for it such apparatus as has been submitted, and have cooperated with the engineers of the bureau in drawing up the regulations covering such matters. I was also a member of the Resuscitation Commission of the American Medical Association and the National Electric Light Association, which in 1913, with Prof. W. B. Cannon as chairman, studied and reported on resuscitation apparatus and methods, and which later made a similar report to the Bureau of Mines.[1]

1. Report of the Commission on Resuscitation from Electric Shock, published by the National Electric Light Association, New York, 1913. Report of the Committee on Resuscitation from Mine Gases, Technical Paper 77, U. S. Bureau of Mines, Washington, 1914. Work of the Commission on Electric Shock, editorial, THE JOURNAL A. M. A., Nov. 1, 1913, p. 1637.

It is noteworthy that the control over the manufacturers of resuscitation apparatus indicated in the preceding paragraph has not had back of it any specific legislation. The approval or disapproval of the Bureau of Mines and of the National Electric Light Association, and the acceptance or rejection of advertisements by such magazines as THE JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION, practically make or destroy the market for apparatus. Both in effectiveness and in flexibility, this method of control under disinterested expert advice and solely in the interest of the public seems far preferable to that by legislation, either national or by the separate states.

PULMOTOR

The first of the several forms of apparatus now on the market to attract attention was the pulmotor. In this device a tank of compressed oxygen was connected through a reducing valve with an injector, so that a considerable volume of air was drawn in, mixed with the oxygen, and the current directed through a hose to the face mask. It was generally believed by persons purchasing the pulmotor that pure oxygen, or air greatly enriched with oxygen, was supplied to the patient. This, however, was not the case, as the injector diluted the oxygen with ten or twelve times as much air. In various analyses the oxygen content of the gas supplied by the pulmotor was found to be about 28 or 30 per cent. As pure air contains 21 per cent., the oxygen enrichment was therefore not considerable. The purpose really served by the compressed oxygen was to supply the motive power which worked the apparatus. Compressed air would have been equally effective for this purpose.

The force of the air coming from the injector actuated an ingenious mechanical device by which a valve was alternately thrown in one direction or the other, so that air was blown to or sucked from the mask fastened over the patient's face. In order for this device to reverse, however, a considerable positive or negative pressure was necessary, and these pressures came just at those points in respiration at which they were most unnatural. Furthermore, in case of any obstruction to the flow of air, the positive and negative pressures necessary to reverse the apparatus were induced in such rapid succession that the suction and injection phases alternated too rapidly for the subject's lungs to be properly distended and deflated. This was liable to occur if for any reason there was an obstruction in the throat. Some part of the injector or reducing valve was also found liable to get out of order, thereby rendering the apparatus ineffective.

The objections to the pulmotor concerned not only its deficiencies as a means of administering artificial respiration, but also its extraordinary effect on public opinion. Although its manufacturers, the Draeger Company, have shown themselves at all times during my experience with them to be a highly honorable and well intentioned business concern, nevertheless there has probably never been invented an apparatus which of its own accord aroused such extravagant and unfounded expectations among the general public. It was, indeed, impressive to see the apparatus working automatically. Coupled with the ignorance of most persons as to the distinction between mere unconsciousness and respiratory failure, and as to what part treatment can play in resuscitation, the interest which the pulmotor excited caused it for a time to receive such an amount of free advertisement through the newspapers as would undoubtedly have resulted in its being purchased almost universally within a few years. Public opinion in numerous cities compelled the gas, electric light and telephone companies, and the fire and police departments to purchase pulmotors. From the newspaper accounts of cases in which the pulmotor was employed, one would have supposed, and many persons, including even physicians, evidently did believe, that the pulmotor was practically capable of restoring the dead to life. It was described as "forcing oxygen in and sucking the poisonous gases out." For a while no one seems to have inquired why, in these processes, the lungs were not exploded. or the pulmonary blood sucked out through the trachea.

This exploitation was brought to a sudden stop by the report three years ago of the Commission on Resuscitation, adverse to the apparatus, or rather to the extravagant reports and beliefs current concerning it. In particular, the investigations of the committee showed conclusively that in at least a large percentage of the alleged resuscitations — especially from illuminating gas poisoning — the subject was breathing spontaneously before the apparatus was applied. Artificial respiration was therefore not needed and could not possibly have contributed materially to the patient's recovery.

LUNGMOTOR

The other devices thus far placed on the market are of a simpler type. The "lungmotor" consists of two pumps — to all intents and purposes, such pumps as are used to inflate bicycle or automobile tires. They are fastened together in such fashion that the down stroke forces air from one of the pumps into a mask held over the patient's face, while the up stroke withdraws some of the air from the patient's lungs into the other pump. An oxygen tank can be connected so that the air injected into the lungs can be enriched to any desired extent with oxygen.

The advisability of actively withdrawing air from the lungs is a matter on which there may at present be a reasonable difference of opinion. Such light as experiment can throw on the matter is afforded by the fact that some years ago an apparatus which worked in this fashion was invented by Prof. Hans Meyer of Vienna and was installed in a number of physiologic laboratories both in America and Europe. Apparently it has been generally discarded, and return has been made to the ordinary method of intermittent injection of air into the lungs with intervening periods for the elastic recoil of the chest to force the air out through a hole in the side of the tube leading to the mask or tracheal cannula. I am inclined to doubt, however, whether an active withdrawal of air with a pump of limited stroke has any very serious objections, since the suction ceases at the end of the stroke. Some years ago in experiments with two pumps arranged in a manner similar to the "lungmotor," and worked quite violently, I observed no particular ill effects on the lungs. The manufacturers of the "lungmotor" claim that in drowning cases the suction feature is advantageous. The apparatus can be worked so as to use only the injection pump, by leaving the tube to the suction pump disconnected.

VIVATOR

Even simpler is the "vivator." It consists of one pump, which forces air through a tube to the mask held over the patient's face when the plunger is forced down, and of a valve which is opened to allow this air to escape during the upstroke of the pump. It is practically identical with a simple arrangement of an automobile tire pump which has worked satisfactorily for experiments requiring artificial respiration in my laboratory for the past ten years. It is, however, rather clumsy and noisy. It is possible that both with it and with the "lungmotor" a somewhat excessive positive pressure might be produced. To prevent this it appears advisable that in apparatus of the pump type there should be a blow-off valve or equivalent device, set to open under a water column pressure of 25 cm. (10 inches), and that when as in the "lungmotor" there is also a suction pump, there should be an inlet valve set to open under a pressure of 15 cm. (6 inches). It would be of advantage also if there were another valve on the mask which could be opened in order to test the capacity of the victim to maintain natural breathing without removal of the mask.

PULMOTOR MODEL B

Recently the Draeger Company has brought out an apparatus which they call the "Pulmotor Model B." Its motive power is supplied either by a tank of compressed oxygen or by a tank into which air is first pumped by the operator. The compressed gas, oxygen or air, passes through a tube to an injector where it aspirates a considerable amount of outside air and thus provides a sufficient current and pressure for artificial respiration. By means of a switch worked by hand the injector can be directed so that the current is blown through a tube to the face mask, or aspirates the air from it. The apparatus is in all essentials a pulmotor without the automatic feature, to which the committee mentioned above particularly objected, and which exercised for a time such a hypnotic effect on newspaper reporters and the public.

The "Pulmotor Model B," like the original form, appears not to be capable of supplying a high percentage of oxygen, as the injector necessarily draws in a considerable volume of air with which the oxygen is diluted. The mechanism of the apparatus is also rather delicate and liable to be put out of order by rough usage. On the other hand, in a hospital or laboratory where compressed air is available, or where a small air blower connected with an electric motor could be installed, for treatment in morphin cases or asphyxia neonatorum, or in the operating room, it is possible that "Pulmotor Model B" might prove a satisfactory and useful instrument. For the intern charged with maintaining respiration in a morphin case and with compressed air at hand, it would certainly have the advantage of being far less tiring than any other piece of apparatus now available.

In order to avoid any danger of excessive positive or negative pressure, it is recommended that there should be inlet and blow-off valves set to a positive pressure of not more than 15 cm. (6 inches) water gage, and a negative pressure of 10 cm. (5 inches) water gage. The limits of pressure should be lower than in the case of pump apparatus because the patient's lungs may be subjected to the pressure for a longer time. The apparatus should also be made capable of feeding pure oxygen, or at least air largely enriched with oxygen.

OTHER APPARATUS

The latest but probably by no means the last apparatus to appear is the "life motor." This device has not yet come under my examination. It is claimed, however, by its manufacturers that it is an efficient and easily adjustable apparatus for administering artificial respiration, and for supplying oxygen or air enriched with oxygen.

There is really no limit to the number of devices of this sort which can be, and perhaps will be, got up: hand bellows, foot bellows, bellows run by a motor, pumps, single and double, acting directly or through an injector. The mechanical requirements are easily met. The important thing is that the apparatus should be of such a simple character as not to impose on the credulity of the ordinary man. All that any apparatus yet invented can accomplish is artificial respiration with air enriched with oxygen. The superiority of a mere pump over any automatic apparatus lies in its simplicity. The same men who regarded the pulmotor with awe and wonder remark, of the "lungmotor," "Why, you can blow up an automobile tire with that thing."

MANUAL METHOD VERSUS APPARATUS IN ARTIFICIAL RESPIRATION

Even in respect to a simple pump, evidence is accumulating that physicians, as well as laymen, are prone to overestimate what can be accomplished with apparatus. In consequence, the immediate application of manual artificial respiration is neglected, and thereby life is lost while the apparatus is being sent for and brought. Thus in a recent disaster in which an overcrowded vessel sank at its wharf, it appears that the victims when taken from the water, instead of being treated immediately by the prone pressure method, were carried some distance to a temporary hospital and were then treated with apparatus. Probably all of them were beyond recovery even when taken from the water; but it is significant of the overestimate placed even on so obvious a thing as a pump that some physicians are reported to have expressed surprise that the apparatus (lungmotors) effected no resuscitations.

On the scientific side there can be no doubt that in a man or animal in whom natural respiration has ceased but the heart is still beating, life can be maintained more easily and much longer by means of artificial respiration administered with a pump or bellows than by means of either the Sylvester or Schäfer manual methods. In all physiologic laboratories, apparatus for maintaining artificial respiration is provided. If an experiment is to be performed in which spontaneous breathing is eliminated (as under curare or after decapitation), no physiologist relies on his janitor or laboratory boy to keep the animal alive by squeezing the chest or working the fore legs.

The Resuscitation Commission found that although the prone pressure method of artificial respiration devised by Schäfer[2] is in nearly every respect superior to the Sylvester method, yet the claim of Schäfer that by his method as much air can be administered even to an apneic subject as is obtained by the subject in normal breathing is not justified. It is true that in experiments on normal men, if the subject is not in apnea, as much air — in fact *exactly* as much and never appreciably more or less — is drawn in and forced out of the subject's lungs by the prone pressure method, as the subject would himself spontaneously breathe. It was, indeed, the noting of this fact which led me, while working on the commission, to discover that in a conscious, normal, not apneic subject, the subject's own respiratory center, rather than the exertions of the operator, determines the amount of pulmonary ventilation afforded by the prone pressure method. The operator squeezes air out of the lungs, but between the applications of pressure the subject's respiratory muscles draw in what he needs — no more and no less. In fact, the chemical control of respiration is strikingly exemplified by the behavior of a normal man under "artificial" respiration. On the other hand, after the subject has performed forced breathing and has thus brought himself into a condition in which there is no spontaneous activity of the respiratory center, the amount of ventilation obtained by the prone pressure method is markedly reduced.

Furthermore, it was found on animals in respiratory failure (induced by an excess of chloroform) that the amount of air, as measured by a spirometer connected with the trachea and recording on a smoked drum, which can be drawn in and forced out of the chest by manipulation of the fore limbs and squeezing of the chest and abdomen, gradually decreases as the muscles of the body lose their tonus. At first and while the tonus or elasticity of the muscles is still high, soon after spontaneous breathing has ceased, a very considerable movement of the spirometer can be induced. But after ten or fifteen minutes, when the body has become entirely flaccid, only a quite negligible movement of air in and out of the chest results, even from the most vigorous stretching and compression.[3]

While working on the Resuscitation Commission, Dr. Meltzer found that in dogs after abolition of muscular tonus by means of curare, the Sylvester method supplied a respiration sufficient to maintain the heart beat for only twelve minutes, while with the Schäfer method the shortest time was eighteen minutes and the longest thirty-one. With no treatment whatever, the heart would have continued to beat for from eight to ten minutes.

The most important scientific point in this connection, however, is the fact that from the moment when spontaneous respiration ceases, whether by drowning, electric shock, excess of anesthesia, gas poisoning or any other form of asphyxia, the probability of restoration by any method grows rapidly less as the minutes pass. The Resuscitation Commission, after considering the matter in the light of such evidence as is available, concluded that probably ten minutes is the extreme limit of time beyond which restoration is practically impossible. It is true that there are occasional popular reports of persons who are supposed to have been in the water or buried in a cave-in for a longer time than this, and who have been restored; but in such cases it is highly improbable that there was complete submergence or that the reports in other respects represent the actual facts. In the class of cases with which I am best acquainted, namely, those in which

2. Schäfer, E. A.: Harvey Society Lectures for 1907-1908, New York, 1909, p. 223.

3. Liljestrand, Wollin and Nilsson made similar observations (Skand. Arch. f. Phys., 1913, xxix, 198).

respiration fails under anesthesia in cats and dogs under experiment, the large majority have proved susceptible of restoration by the administration of artificial respiration, provided it was given immediately. Indeed, I have a strong impression that during the first minute after the cessation of breathing, the administration of manual artificial respiration is more effective than that by means of a pump or bellows, the reason apparently being that a slight assistance is given to the heart and circulation by the manual method which is not afforded by mere changes of air pressure in the lungs. Certainly both in the laboratory and operating room, in the great majority of cases the immediate application of manual artificial respiration is effective in restoring normal breathing. On the other hand, a delay of even two or three minutes has usually resulted in the failure of the efforts applied thereafter; and if the animal has been left without measures of resuscitation for five minutes after the cessation of spontaneous breathing, the subsequent efforts at revival have never been successful.

In the large majority of the reports of alleged restorations effected with apparatus, the statement that the apparatus was telephoned for and was rushed to the spot is a significant item. A telephone lineman touches a wire which has been crossed with a power line, and falls to the ground unconscious and apneic. A man who went to bed drunk in a cheap hotel is found in the morning with the gas turned on. A man in a trench in the street over a leaking gas pipe is overcome. A longshoreman falls into the harbor and is hauled out and laid limp on a wharf. Suppose that in such cases the rescuer runs to the nearest telephone. Apparatus is "rushed to the spot." If it arrives after the tenth minute (and it will seldom arrive so soon) the man is dead, and the vigorous working of the apparatus for the next hour succeeds at most in producing an emphysema in the corpse. Even in the unusual case in which the apparatus arrives and is applied in six or eight minutes, the chances of resuscitation are not nearly so good as they would be if the prone pressure manual method had been begun within thirty seconds after the accident.

In those cases in which apparatus was not applied until twenty or thirty minutes after the accident or after the patient was found — and such cases form the large majority of alleged cures — it is practically certain that the patient never ceased to breathe spontaneously, and that the apparatus contributed nothing material to his recovery. This was true of practically all the cases investigated by the Resuscitation Commission, and it is true of a number of cases which I myself have attended (as an observer) since the commission made its report. It is significant that the attending physician in some of the latter cases was inclined to attribute to the effects of apparatus recoveries which were clearly and solely the result of nature.

From these facts it seems fair to advise that breathing apparatus should be provided in those fields of work in which it can be at hand when an accident occurs, but not for cases in which it must be sent for. A reliable air pump for artificial respiration is an important part of the equipment of a mine rescue crew — not so much for the men rescued from an exploded or burning mine as for use on members of the rescue party who may be overcome. Artificial respiration apparatus could advantageously be kept at bathing beaches. It might also sometimes be useful for the men in a city fire department. In nearly any hospital it is likely sooner or later to prove useful. Apparatus suitable for use on new-born infants should be introduced into every maternity ward. It does not appear, however, that *unless the employees of a gas, electric light or telephone company have been drilled in manual methods and warned not to wait for apparatus,* the purchase of apparatus will appreciably decrease the likelihood of fatalities outside of the central works. An apparatus kept at police headquarters to be sent in an ambulance is a waste of money and a probable increase of the hazards of life. The general training of policemen, firemen, and especially schoolchildren in the prone pressure method would save more lives than the purchase of any amount of apparatus.

As a means of partially counteracting the tendency to exaggerate the value of apparatus, the Bureau of Mines recommends that the directions which go with every piece of apparatus should include the description of the prone pressure manual method as given in Miners Circular No. 8, and that there should also be printed on the outside of the case containing the apparatus, in prominent characters, words to the following effect:

> If spontaneous breathing has ceased and this apparatus is not already on the spot, administer artificial respiration by manual methods without the loss of a moment, and continue to do so until the apparatus is brought. Otherwise, life will be extinct before the apparatus arrives. Except to remove the patient from a locality containing irrespirable gases, never carry him to the apparatus; he will be dead before he gets there.

Finally, attention should be called to the value of oxygen inhalation apart from artificial respiration for men who have been "gassed" or overcome by smoke nearly or quite to the point of unconsciousness, but not of respiratory failure. For this purpose the method of feeding the oxygen through a funnel suspended some inches above the patient's face, as is done in some hospitals, especially in pneumonia and illuminating gas cases, is entirely inefficient and wasteful. Most of the gas blows or diffuses away, and the air inhaled is enriched by only 3 to 5 per cent. of oxygen. The proper administration of oxygen requires an apparatus similar in type to that by which nitrous oxid is usually given, except that there should be no rebreathing. It consists of a tank of compressed oxygen connected by a tube to a rubber bag of from 5 to 10 quarts' capacity, and a mask with an inspiratory valve connected with the bag and an expiratory valve to the outside air. An appliance of this sort is sold by some of the manufacturers of mine rescue apparatus, and should be included with all apparatus for artificial respiration. The gas tank, rubber bag and mask are obtainable in any large city, and are easily combined.[4] Such apparatus would spare many a city fireman a bad headache and sometimes a weakened heart.

CONCLUSIONS

1. Universal training in the prone pressure manual method of artificial respiration will accomplish more for resuscitation from drowning, electric shock, and asphyxia than is possible by providing any amount of apparatus.

2. Artificial respiration with apparatus is superior to the manual method, in that the apparatus is capable of giving a normal volume of pulmonary ventilation while the manual method is not.

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4. Illustrations and description may be obtained by application to the Bureau of Mines.

3. Nevertheless, the immediate application of a poor method is far more important than the application of a perfect method after a delay of even five minutes. The knowledge that apparatus is available is liable to result in a neglect of immediate manual treatment in order to have the apparatus brought from a distance.
4. Apparatus should be provided only in places in which it will be immediately available.
5. Since all that any apparatus yet invented affords is artificial respiration with air more or less enriched with oxygen, it should be of a simple type so as not to produce exaggerated ideas of its efficiency.
6. Oxygen inhalation should be used immediately in gas and smoke cases, but the apparatus employed should be such as will allow the oxygen to reach the patient's lungs in efficient concentration. Such apparatus should go with every artificial respiration device.
7. Investigation of the use of artificial respiration apparatus in asphyxia neonatorum is needed.

A STUDY OF OPHTHALMOSCOPIC CHANGES IN NEPHRITIS *

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In this paper the tabulated histories which make up its major portion are abstracted from a series of observations made in the clinic of ophthalmic surgery of the University of Michigan, and are arranged in parallel columns in juxtaposition with the medical diagnosis and an abstract of the laboratory findings in each case. While some of the cases might possibly have been somewhat differently classified, the fact that the diagnosis was made in the clinic of internal medicine in connection with the symptoms and with the many other features which could not be presented within the limits of this paper has seemed to be a sufficient reason for accepting the medical diagnosis without question.

The conclusions and summaries are based exclusively on the tabulation of the features observed. While this study has been carried on with a full knowledge that the ground has already been repeatedly covered, the excuse for presenting it is that it has been stimulated by a desire for a grouping of the several features of fundus changes as seen in nephritis, with reference, first, to the pathologic changes in the retina as compared with those found in the kidney; second, to ophthalmoscopic features of diagnostic value, particularly with regard to early diagnosis; and third, to the differential diagnostic value of the ophthalmoscopic fundus lesions found in the different forms of nephritis. As a control, several cases of hypertension and a few miscellaneous cases presenting fundus lesions suggesting nephritis have been included.

An interesting didactic discussion of the fundus lesions seen in the various forms of nephritis and a digest of the literature of this subject have been recently made by Dr. A. E. Bulson[1] of Fort Wayne, Ind. In this paper Dr. Bulson mentions the fact that Sutton and Gull, Herrick, Edwards, Kelly, Rodner and others classify chronic nephritis as a part of a general angiosclerosis. This series of studies does not seem entirely to support this classification or the idea that radiating macular changes are common or frequent features of interstitial nephritis.

The cases included in this report have been divided into five classes, as follows: A, chronic interstitial nephritis; B, chronic nephritis; C, acute nephritis; D, hypertension, and E, miscellaneous cases.

Taking up the ophthalmoscopic notes, we find edema present in 93 per cent. of the cases. The fact that it was found in all cases of hypertension and in 96.7 per cent. of the cases of chronic interstitial nephritis seems to indicate a vascular rather than a nephritic origin. In the few cases of acute nephritis examined it was the least frequent, which tends to support such a conclusion. Its relation to the blood pressure does not appear, as it was present in the cases of chronic nephritis with lower blood pressure, quite as regularly as in other chronic cases of either parenchymatous or interstitial type: in the cases of acute nephritis when the blood pressure was low it was present in but 75 per cent., and in addition it was present in the one case showing rather high arterial tension. Congestion and slight swelling of the disk were present in 39.7 per cent. of the cases, being rather more frequent in chronic than in acute nephritis, but most frequent in hypertension.

All of the cases of chronic interstitial nephritis with swollen disks of 1 D. or more occurred in cases of marked increase in blood pressure. Especially is this

* Read before the Section on Ophthalmology at the Sixty-Seventh Annual Session of the American Medical Association, Detroit, June, 1916.

1. Bulson, A. E.: Ophth. Rec., December, 1915.

ILLUSTRATIVE CASES FROM TABLE 1.—SERIES A: CHRONIC INTERSTITIAL NEPHRITIS

Medical Findings and Diagnosis	Sex	Age	Vision		Ocular Findings
			O. D.	O. S.	
3. C. J. 12/2/12.................................. Diagnosis: Chronic interstitial nephritis; uremia; dilated heart; hydrothorax; radial and temporal vessels sclerosed. Urine: Large amount of albumin; granular and hyaline casts. Phenolsulphonephthalein elimination, 7 per cent. in two hours. Blood: B. P., 150 to 190; R. B. C., 3,800,000; W. B. C., 12,700; **Hgb.**, 45 per cent.; blood urea, 1.34 gm. liter.	F	48	5/10	5/6	O. D. Marked endarteritis; arteriovenous compression dilatation. Marked retinal edema; flame-shaped hemorrhages; exudative changes. Minute exudative spots in the macula. O. S. Rounded hemorrhages; glistening white spots, a few exudative changes and slight pigment change in the macula. Tortuosities of the macular vessels, one macular vessel silver wire. Otherwise same as O. D.
23. A. B. 3/15/15.................................. Diagnosis: Chronic interstitial nephritis; uremia; arterial sclerosis; hypertension. Urine: Large amount of albumin; many hyaline, granular and epithelial casts. Phenolsulphonephthalein, no elimination in two hours. Blood: B. P., 175 to 180; R. B. C., 2,650,000; W. B. C., 8,800; **Hgb.**, 31 per cent.; blood urea, 3.59 gm. per liter. Wassermann neg.	M	47	5/10	5/15	O. D. Disk swollen 3 D., edematous and markedly congested. Arteries much contracted; arteriovenous compression. Retina markedly edematous; deep and superficial hemorrhages about the disk and macula. Macula edematous. O. S. Disk is swollen 3 D.; marked edema with congestion, inflammatory infiltration and hemorrhages. Arteries are very small. Retina shows marked edema with numerous round, flame-shaped and superficial hemorrhages. Macula shows chorioretinitis with edema.