ganism. The administration of high concentrations of oxygen, especially when combined with mild fever therapy, to increase the rate of circulation, proved very beneficial in a case of tetany.

There are many other organisms that probably become less pathogenic when exposed to a high concentration of oxygen; as yet, this field has been explored little but the results will justify further investigation.

SUMMARY AND CONCLUSIONS

Use of the oxygen inhalation apparatus devised in conjunction with my associates, Dr. Lovelace and Dr. Bulbulian, will greatly reduce the cost of oxygen therapy to the patient. It will increase its availability because it is equally as suitable for use by the family physician in the patient's home as it is in large well equipped hospitals. Furthermore, the scope of oxygen therapy is enlarged because the oxygen can be given in any concentration up to the inhalation of pure oxygen thus enlarging the field of treatment to include diseases that are benefited by high concentrations of oxygen and which do not respond much, if any, to lower concentrations. These high concentrations have been found not to cause pulmonary irritation if their administration is not continued for more than one or two days and lower concentrations of oxygen are used as the patient improves. The use of high concentrations of oxygen will be of especial value in treatment of shock and traumatic injuries and therefore will be extremely important in military surgery. Our inhalation apparatus also meets the need of oxygen administration in aviation.

OXYGEN FOR THERAPY AND AVIATION:
AN APPARATUS FOR THE ADMINISTRATION OF OXYGEN AND HELIUM BY INHALATION

W. R. Lovelace, II, M.D., Fellow in Surgery, The Mayo Foundation: As a consequence of the unusually rapid development in the construction of airplanes and airplane engines, as well as in the aviation industry as a whole, it will soon be possible to operate commercial airplanes efficiently and economically at elevations of 15,000 to 25,000 feet (4.5 to 7.6 km.) Military and mapping airplanes are already operating at and above these altitudes.

Since the experiments of Bert1 summarized in 1878 diminution of barometric pressure has been known to affect human beings only when the partial pressure of oxygen is so decreased that incomplete saturation of the arterial blood with oxygen results. Anoxemia can be prevented as long as the inspired air is sufficiently rich in oxygen to maintain a normal partial pressure of oxygen.

SYMPTOMS

McFarland2 lists the most common subjective complaints in anoxemia as follows: headache, respiratory changes and difficulties, excessive sleepiness, vertigo or dizziness, difficulty in concentrating, sensory impairment, lassitude, indifference and fatigue.

The symptoms of anoxemia are often compared with those of alcoholic intoxication because of their close similarity in many respects. In both instances the individual always is convinced that he is rational, seldom
October 12, 1938      STAFF MEETINGS OF THE MAYO CLINIC      647

lacks confidence and soon loses his capacity for self-criticism. Some individuals become euphoric, others morose and still others pugnacious and unwilling to listen to advice.

Barach's paper\(^4\) on the relationship of anoxemia to pilot error vividly called the attention of the medical profession and individuals connected with commercial aviation to the dangers that could arise from oxygen want and the possibility of accidents arising therefrom.

We fully agree with Graybiel and his co-workers\(^5\) and Levy, Barach and Bruehn\(^6\) that patients who are known to have cardiac disease are in definite danger from anoxemia, such as occurs in airplanes. We wish to emphasize that many types of cardiac and respiratory lesions may exist among individuals intending to fly which these individuals may not know they have. It is perfectly safe for such passengers to fly if they are supplied with oxygen in an efficient and comfortable manner, so that the alveolar oxygen is maintained the same as at sea level.

Too little attention was paid to Monge's description\(^7\) of high altitude disease from the standpoint of aviation, and to the fact that the place where the pilot stays, when making a routine flight away from his home, may be at a much higher elevation than that at his home base. In a normal individual tissue anoxemia begins when the oxygen pressure of the inspired air is equivalent to approximately 14 per cent of that at sea level. This circumstance occurs at an altitude of 10,700 feet (508.5 mm. of mercury).

McFarland and Edwards\(^7\) concluded that the airmen they studied maintained a high degree of mental and physical efficiency throughout a prolonged flight at an average altitude of 9,460 feet (2.8 km.). The effect of being just above the critical level at which tissue anoxemia occurs in normal individuals was studied by Captain Armstrong and Dr. Heim.\(^8\) They recommended that the flying personnel take oxygen at all times when flying at or above 12,000 feet (3.6 km.). There is no question in our minds but that the flying life of pilots operating at altitudes in excess of 10,000 feet at frequent intervals is unnecessarily shortened, unless they use oxygen in an efficient manner.

Boycott and Haldane\(^9\) in 1908 mentioned the possibility of the occurrence of caisson's disease if too rapid an ascent was made to a high altitude. Experiments should be carried out to determine the margin of safety.
the rate of decompression and also the length of time necessary for the preliminary respiration of pure oxygen in order to make it safe for aviators to ascend rapidly.

INHALATION APPARATUS

A new type of inhalation apparatus for efficient, simple, comfortable, safe and economical administration of oxygen or oxygen and helium in any desired concentration to aviators or to patients was designed (fig. 1). The nasal type of mask is used for nose breathers and the oronasal mask for mouth breathers. Three parts of the inhalation apparatus (fig. 2) are (1) the mask proper, which may be of either the nasal or oronasal type, (2) the connecting and regulating device which joins the mask to (3) a reservoir-rebreathing bag. The hollow tubes on the nasal mask pass on each side of the mouth and unite over the lower part of the chin into a single tube. These tubes are in open communication with the reservoir-rebreathing bag at all times by means of the connecting and regulating devise.

Between the reservoir-rebreathing bag and the mask is the connecting and regulating device, the superior portion of which is provided with three small holes. Over this is mounted a rotary sleeve which has three similar ports, one or more of which may be brought into registry with the previously mentioned openings by turning the sleeve. If so desired, all the holes can be closed. The sleeve is held in the position in which it is set by a small steel finger, the free end of which fits into appropriate notches on the rotating sleeve.

On the front of the connecting and regulating device is an expiratory valve with a spring under slight tension which permits the escape of any excess of expired air over and above that just sufficient to distend the bag without causing any appreciable resistance to expiration. By adjusting the portholes on the connecting and regulating device, the wearer or the attendant is able to regulate the proportion of atmospheric air admitted to the inhalation apparatus which in conjunction with the appropriate flow of oxygen gives the desired mixture of the respired gases.

When the inhalation apparatus is in use, oxygen, after passing through a reducing valve and flowmeter, enters the oxygen inlet and is delivered through a tube into the lower end of the reservoir-rebreathing bag. It passes up into the nose chamber through the connecting and regulating device and is inhaled by the wearer. The exhaled gases pass down through the tubes and the connecting and regulating device, where a small portion of the gas passes out through any holes that may be open in the rotary sleeve. The remaining portion passes downward into the reservoir-rebreathing bag where it is mixed with the incoming oxygen. When the bag becomes distended with the mixture of expired air and the incoming oxygen, the slight pressure then produced permits the excess of the expired air to escape
through the expiratory valve. The expired air escaping through the expiratory valve will be from the latter part of the expiration and will contain the most carbon dioxide and the least oxygen. Thus, the most undesired part of the expired air passes out into the air; conversely that part of the expired air which passes into the bag first contains the least carbon dioxide and the most oxygen and is available for rebreathing, thus helping greatly to increase the efficiency of the apparatus. On the next inhalation, the mixed oxygen and expired gases further admixed with atmospheric air entering through the porthole are again drawn in. The desired amount of atmospheric air is gained by the proper adjustment of the ports.

In the case of aviators at an elevation slightly above 30,000 feet (9.145 km.) all the portholes would be closed and only pure oxygen admixed with a slight amount of the expired air would be inspired; up to 15,000 feet (4.572 km.) two holes would be open, and from 15,000 to slightly above 30,000 feet only one hole would be open.

In the case of patients of average size an alveolar concentration of more than 40 per cent oxygen can be maintained with two portholes open and a flow of 3 liters per minute; an alveolar concentration of 55 to 60 per cent with a flow of 4 liters per minute and two portholes open, and with all portholes closed an alveolar concentration of 90 to 95 per cent with a flow of 6 to 8 liters per minute, depending on the respiratory minute volume of the individual.

The bag must be of such a size that its volume will be slightly less than the volume of air from one expiration, under the conditions in which the apparatus is being used, in order to utilize the oxygen with greatest efficiency and also to prevent the presence of an excessive amount of carbon dioxide in the bag. The respiratory tidal volume for an average adult man is approximately 500 c.c. under conditions of slight activity with a small amount of rebreathing. However, for very large or very small individuals the capacity of the bag can be altered to produce the most economical efficiency either by using different sized bags or by having snaps between the infolded portions on the two sides, which can be fastened together. If economy is not a paramount consideration the standard sized bag can always be used but this would necessitate the use of approximately 1 liter more per minute of oxygen in individuals having an abnormally small or large respiratory minute volume.

Enough moisture remains in the apparatus from the wearer’s previously exhaled air to provide for a sufficiently high and comfortable humidity.

The B.L.B. oxygen inhalation apparatus is highly efficient; in fact, throughout the entire range of oxygen concentration it is essentially 100 per cent efficient, as shown by the fact that the observed percentages of alveolar oxygen under almost all conditions are equal to the maximal calculated percentage of oxygen obtained in the alveolar air at different minute volumes of respiration when varying amounts of oxygen are added to the inspired air. To a small extent this is accounted for by the slight amount of rebreathing that occurs. There is always less than 1 per cent of carbon dioxide in the inspired air.
EXPERIMENTS

The apparatus, from the standpoint of aviation, was subjected to severe tests: first, in the laboratory; second, in the low pressure chamber at the Army Experimental Station at Wright Field (fig. 3), with the cooperation of Captain Armstrong and Dr. Heim; third, by actual flight tests.

The major practical test of the apparatus, from the standpoint of aviation, was carried out during a round trip flight between Minneapolis and Los Angeles in a Lockheed Zephyr plane furnished through the courtesy of Northwest Airlines. During a portion of the trip an altitude of 31,000 feet was reached, and normal alveolar concentrations of oxygen and carbon dioxide were maintained on an oxygen flow of only 1.8 liters per minute (S. T. P. D.). There were no symptoms of anoxemia among the six individuals who were on this portion of the trip. Mr. Howard Hughes, with a crew of three, recently made a record transcontinental flight for transport planes at an average altitude of 17,000 feet while using the B.L.B. inhalation apparatus.

Fig. 3. High altitude experiment at Wright Field using B.L.B. respiration apparatus in low pressure chamber.

MEDICAL AND SURGICAL USES OF OXYGEN THERAPY WITH THE NEW APPARATUS

During the past five months 125 patients have been given oxygen or oxygen and helium therapy by means of the inhalation apparatus devised by Boothby, Lovelace and Bulbulian. This form of treatment has been used with gradually increasing frequency. Naturally the efficiency of such therapy has also increased appreciably over this period as a result of improvements in the apparatus and in the knowledge of its best use. So far a large series of cases of any one type has not been studied. We have attempted first to gauge its possibilities.
one case and the stay in the hospital was appreciably shortened. In this connection it should be pointed out that tanks containing 100 per cent helium should never be used because an inexperienced individual might turn on the helium and forget to turn on the oxygen. As a consequence, dangerous or even fatal anoxemia could be produced and in a very sick patient there might not be any evidence of such anoxemia to warn the attendant of the danger. Patients who have asthma are all given a mixture of 80 per cent helium and 20 per cent oxygen from a single tank at first; as improvement occurs, the percentage of helium and oxygen from this tank is gradually decreased, and the flow of oxygen from another tank containing pure oxygen is increased.

A middle-aged woman who had had frequent, severe attacks of asthma, underwent cholecystectomy for acute cholecystitis. Shortly after the operation a severe attack of asthma developed which failed to respond to doses of epinephrine and the usual forms of therapy. It was possible to relieve most of her cyanosis and appreciably to diminish the dyspnea by the use of helium and oxygen.

Patients with status asthmaticus who are resistant to epinephrine will frequently become sensitive to epinephrine within four to six hours after helium and oxygen therapy is instituted.

The administration of 1:1000 concentration of epinephrine to asthmatic patients could be carried out by having a mixture of 80 per cent helium and 20 per cent oxygen pass through a very fine vaporizer containing a solution of epinephrine. It then is carried into the lungs with the helium and oxygen.

Marked stridor developed after a thyroidectomy for a recurrent type of exophthalmic goiter, performed at the Clinic on an elderly woman, who after her first thyroidectomy had had to have a tracheotomy. The patient was unable to take fluids and complained of difficulty in breathing because of a feeling of obstruction in the larynx. Within a short time she became apprehensive, slightly cyanotic and raised considerable thick mucoid material. Almost immediate relief of the stridor and an appreciable diminution in dyspnea occurred when a mixture of 80 per cent helium and 20 per cent oxygen was given. Fluids were taken easily the next day and her colitis subsequently was uneventful. This form of therapy would be especially valuable after the removal of large and deep substernal goiters.

Any form of respiratory obstruction could be treated temporarily by the administration of a mixture of oxygen and helium. For instance, in respiratory difficulty resulting from the presence of a foreign body in the trachea or bronchi, partial relief of the symptoms could be accomplished until the patient reached a hospital and preparations for bronchoscopy could be made. In a case of metastatic carcinoma to a bronchus dyspnea was relieved temporarily by helium and oxygen.

The value of high concentrations of oxygen was well illustrated by a young man on Dr. Bargen's service who had severe, acute ulcerative colitis.

He had marked secondary anemia, persistent elevation of temperature and pulse rate, frequent bloody stools, anorexia, and progressive weakness, and was running a rapid downhill course. Within two hours after administration of 100 per cent oxygen was begun, the pulse rate and temperature decreased. The temperature continued to spike a little each day and he gradually gained strength and at present is able to be out of bed.

Surgical uses.—The most interesting surgical cases have been those in which 100 per cent oxygen was administered for the treatment of gaseous distention.

The inhalation of 100 per cent oxygen has been used at the Clinic in sixteen cases for the deflation of distended intestines, with or without the simultaneous use of Wangensteen's suction. The distention has been the result of paralytic ileus, intestinal obstruction or postoperative distention of unknown etiology. In the majority of instances application of heat to
Medical uses.—High concentrations of oxygen (approximately 100 per cent in the inspired air) given by means of the inhalation apparatus have been employed in the treatment of congestive heart failure. In the early stages of coronary thrombosis these concentrations of oxygen have relieved dyspnea and apprehension and, in one case, moderately relieved pain. It was frequently possible either to abort an attack of angina pectoris or to confine the distress to the precordium. The relief of the pain of angina pectoris is compatible with the view that acute distress is a result of anoxemia of the myocardium. In the case of congestive cardiac failure, the patients almost uniformly stated that they were relieved of dyspnea and insomnìa.

A diagnosis of acute rheumatic fever was made in the case of a youth aged seventeen years. The temperature (Fig. 4) had been between 104° and 105° F. and the pulse around 140 beats per minute for three days preceding oxygen therapy. In addition the patient was delirious at times and unable to take nourishment. At Dr. C. W. Mayo’s suggestion administration of 100 per cent oxygen was started and the temperature and pulse rate lessened almost immediately. The patient began gradually to improve, and it was possible to discontinue administration of oxygen at the end of the week, at which time he was only receiving 50 per cent concentration.

Cases of postoperative pneumonia are especially suitable for this type of oxygen treatment as it relieves the anoxemia and permits adequate postoperative care, such as dressings, application of lights to, and care of wounds, and good nursing care. It is an advantage to be able to begin treatment in such cases with administration of 100 per cent oxygen and as improvement occurs, gradually to reduce this concentration. The best indication found so far for the diminution of concentration of oxygen in the inspired air has been a lessening of the pulse and respiratory rates. Patients often volunteer the information that it is easier for them to raise sputum and that it gradually becomes less thick and tenacious.

Treatment has been given in one case of massive atelectasis of the lung following a gastric resection.

This patient was markedly dyspneic, cyanotic and apprehensive. Within five minutes after administration of 100 per cent oxygen was started there was complete relief of apprehension, a noticeable diminution in the degree of cyanosis, and a decrease of 10 beats per minute in the pulse rate. It was possible to discontinue the use of oxygen at the end of twenty-four hours. Use of helium would sometimes be of value in such cases.

A woman, fifty-two years old, who had thrombophlebitis of the right leg after a thyroidectomy, had an otherwise uneventful convalescence for two weeks. At the end of that time, while stooping over to take a drink of water, she suddenly experienced a feeling of constriction in the thorax and marked dyspnea. Examination revealed marked dyspnea and cyanosis, a weak rapid pulse and respiration. Soporamine (opium atropine preparation), 2 c.c., was given; the respiration immediately became even more rapid and shallow and there was generalised flushing of the skin. At the same time administration of 100 per cent concentration of oxygen was started and within three to four minutes the respiratory rate dropped from 40 to 24, cyanosis cleared up and the patient was able to talk.

Ten cases of severe asthma have been treated with a mixture of helium and oxygen. The duration of the attacks was reduced in all but
the abdomen, repeated enemas and duodenal drainage had failed to give relief. There were six cases of acute intestinal obstruction. In one of these cases the abdomen became fairly flat within twenty hours after oxygen therapy was begun and the patient began to pass flatus and no longer complained of colicky pain and nausea. The attack was apparently the result of a temporary obstruction and it was unnecessary to perform operation. In all but one of the remaining five cases of acute obstruction it was possible to deflate the intestines. As a direct result of reduction in distention it was much easier to find the source of obstruction at the time of operation and to perform the necessary surgical procedures. When the Wangensteen type of suction was used, at first a large amount of gas and fluid drained, but by the end of eight to ten hours there was almost invariably a marked reduction in the amount of drainage and gas from such suction, and the drainage consisted mostly of bile. The suction method of drainage is important in that it prevents the entrance of swallowed air into the intestines and also serves to remove a large amount of liquid during the first eight to ten hours of treatment. Reduction of the amount of drainage through the duodenal tube makes it much easier to maintain the chemical balance of the body. Intestinal intubation with the Miller-Abbott tube can also be used in conjunction with the inhalation apparatus. The first symptom to disappear as a rule is nausea and shortly after that there is a reduction or complete disappearance of abdominal cramps. Naturally, as the distention is reduced, the pressure against the diaphragm is also reduced and respiration becomes slower, deeper and easier.

Patients who require major surgical procedures on the colon, usually as a result of malignancy, often have severe secondary anemia and hence little reserve. If edema develops, there would naturally be anoxemia at the site of operation and a vicious circle might result. Surgical shock results in generalized anoxemia because of the fall in blood pressure and the poor circulation. If a stormy convalescence is anticipated after a major operation on the colon, the use of oxygen is indicated and almost always proves of great benefit.

Through the co-operation of Dr. Adson, 95 per cent oxygen has been used on the neurosurgical service in ten cases after encephalograms have been made. In one case the headache was relieved completely except at the site of a former craniotomy. This form of therapy failed in one case. In the remaining eight cases the nausea and emesis were relieved without exception; the severest part of the headache generally cleared up within thirty minutes after oxygen was started and in the majority of instances the headache had disappeared completely within four to eight hours. Any recurrence the next morning was of a mild nature and could be relieved in a short time by the further use of oxygen. The loss of the injected air from the subarachnoid space and the ventricles was revealed clearly in two cases by roentgenograms taken four hours after oxygen therapy was started. Use of oxygen instead of air for encephalography would not be of great benefit because nitrogen and carbon dioxide from the blood would soon come into equilibrium with the injected oxygen.

As Dr. Lundy has frequently pointed out, the inhalation of pure oxygen generally will stop any nausea from spinal anesthetic during the operation.
One case of severe postoperative spinal headache was relieved by the inhalation of 100 per cent concentration of oxygen.

**SUMMARY**

The following points concerning the medical and surgical use of the inhalation apparatus and also the use by aviators should be especially emphasized: (1) a low initial cost of apparatus; (2) low cost of maintenance; (3) an efficient and therefore economical use of oxygen; (4) ability to give therapeutically any desired concentration of oxygen between that in air and pure oxygen, and (5) the mechanical simplicity and ease of operation which will permit of its extensive use in the smaller hospitals, by the family physician in the patient’s home and by aviators.

The ability to administer high concentrations of oxygen economically opens up an entirely new field for oxygen therapy; many types of conditions hitherto not materially helped by the ordinary concentrations of oxygen available in oxygen tents have been definitely benefited by high concentrations of oxygen.

**REFERENCES FOR DRS. BOOTHBY AND LOVELACE’S PAPERS**


**DESIGN AND CONSTRUCTION OF THE MASKS FOR THE OXYGEN INHALATION APPARATUS**

A. H. Bulbulian, D. D. S., Director of the Museum of Hygiene and Medicine: For this apparatus two types of interchangeable masks have been designed: (1) a nasal type which leaves the mouth free, a decided advantage when used by aviators or when used by patients for prolonged periods, and (2) oronasal type which meets the requirements of cases in which breathing through the nose alone is not possible. One of the two sizes of each of these two types, the small or the large one, will fit practically all normal adults.

In designing the nasal mask, the essential requirements were as follows: 1. The mask had to be so constructed that when held in position, with slight pressure, it effectively would exclude atmospheric air except through special openings provided for this purpose and also prevent escape of exhaled gases except through openings provided for this purpose. 2. For the sake of compactness and lightness, the mask had to be as small as possible and at the same time provide in its inner surface directly around the alae nasi a sufficient air chamber to allow their free movement during breathing. 3. It could not obstruct vision when in position because of its use by aviators. 4. Two openings had to be placed somewhere toward the front or side of the mask, one for the purpose of attaching the connecting device for the supply of oxygen, and another one for attaching a regulating device with a series of portholes. 5. To avoid making many sizes, it had to be as universal as possible.
With these points in mind, the first step in designing the mask was to analyze not only the contours of the tissues of the face on which the proposed mask was to rest, but also to consider the bony structures immediately below these tissues. We were convinced that if the shape of the mask, in its basic design, conformed more to the less variable underlying bony structures, instead of to the more variable overlying soft tissues, a more universal type of mask could be obtained; for variations in bony structure are not as great as those of the soft tissues. Furthermore, we also realized the fact that the efficiency of the sealing effect to be obtained by the flat surfaces of the periphery of the mask and the face was greatly increased by the counterpressure exerted by the bony structures beneath the soft tissues when the mask was held against the face. A plaster cast of a normal male face was made and on the cast the part was marked which would be in contact with the periphery of the proposed mask, the form of which was partly determined. In marking out this area, points adjacent to the nose, which lay directly over a definite bony structure were chosen.

![Fig. 1. Anatomic considerations in designing the mask.](image)

We intended to have the mask rest, (1) superiorly, on the arch formed by the right and left nasal bones and the tip of the frontal processes of the right and left maxillary bones, (2) laterally, on the anterior lateral surfaces of the maxillary bones, and (3) inferiorly, on the arch formed by the anterior portions of the alveolar processes of the right and left maxillary bones (fig. 1a and b).

A pattern of a mask with peripheral surfaces bearing on these points was modeled first in clay, and from this a rubber replica was made for experimental purposes (fig. 1c). Although this first model fulfilled most of the previously mentioned requirements, it failed in one respect. When the connecting device, the regulating device and the tubes were attached to openings 1 and 2 (fig. 1c) respectively, the added weight of these was sufficient to tip and displace the mask (fig. 1d). It was obvious that a projecting appendage could not be attached to such a small mask.

A convenient solution for the problem was reached however. Instead of having the two openings, 1 and 2 (fig. 1c), one on each side of the mask, it was decided to do away with them, and instead to add a tubular extension to each lower corner of the mask, at the site of the holes, 1 and 2. These tubular extensions were made to curve around the corners of the mouth and unite in front of the chin below with a common tube (fig. 1e) which has a slight forward tip. The oval-shaped ring formed by these
tubular extensions lay flatly against the face and left the mouth free for
purposes of communication. It also gave the mask added stability. The
regulating device containing the portholes was then brought down and in-
corporated in the connecting device to make a new single unit; hence, in
the newer model, it is referred to as the connecting and regulating device.

The oronasal type of mask for mouth breathers is constructed essen-
tially the same as the nasal mask in so far as the upper portion is con-
cerned. It is made so that it covers the nose as well as the mouth. Its
central dependent tubular portion which is attached to the lower portion
of the mask fits snugly into the sulcus formed between the upper lip and
the chin.

DISCUSSION

C. W. Mayo, M. D., Division of Surgery; Dr. Boothby has presented
to you some of the fundamental facts on which the use of concentrated
oxygen has been based. Dr. Lovelace has brought before you the instances
of the practical application of high concentrations of oxygen. Dr. Bul-
bulian has presented the means by which oxygen can be given in concen-
trated form efficiently and reasonably.

Ever since Priestley, in 1744, discovered oxygen, workers in many
countries and in many fields, medical and otherwise, have contributed to
progress in the realm of oxygen therapy. In aviation oxygen has long
been recognized as an essential to high altitude. Medically, it has been
used in high concentrations prior to this time. Great credit must be given
to Fine and his co-workers in Boston for their work with it in intestinal
obstruction.

It is not with the idea of priority that this presentation has been
made. It is simply to call attention to the progress that has come about
in this particular field in the last few years and especially in the last few
months. The problem vitally concerns advancement in aeronautics and
its solution will do much to increase the safety of that means of transpor-
tation.

At the Clinic, perhaps, we are more concerned with those clinical con-
ditions which may be benefited by the therapeutic application of oxygen
in concentrated form. An entirely new field, with many open doors for
investigation, has been introduced. Just as oxygen, in combination with
helium, has proved beneficial in the asthmatic type of case, so other gases
will be found which, in combination with oxygen, will form a basis of
reasonable therapy in diseases in which inhalation therapy has not as yet
been used. It is possible too that administration of oxygen may play an
important rôle in the treatment of patients suffering from the invasion
of anaerobic types of bacteria.

To Drs. Boothby, Lovelace and Bulbulian and to those workers in the
various laboratories who supplied technical assistance, great credit must
be given for their contributions to the subject of administration of oxygen.
The work is a splendid commentary on co-operative effort.