Previous Publications Concerning New York Labor Laws

Compilations and reviews of the laws enacted in individual years similar to those in this Bulletin have been published as follows:

1886 and 1887 — In annual report of Bureau of Labor Statistics for 1887.
1888, 1889, 1890 — In annual report of Bureau of Labor Statistics for 1889.
1898, 1899, 1900 — In annual reports of Bureau of Labor Statistics for each of those years.

1899 to 1913 — In June Bulletins of each year except 1911 when they appeared in the September Bulletin. Similar compilations and reviews were published also in the report of the Commissioner of Labor for 1903 and 1904.

1914 — In Bulletin No. 62.
1915 — In Bulletin No. 72.
1916 — In Bulletin No. 78.
1917 — In Bulletin No. 84.
1918 — In Bulletin No. 88.
1919 — In Bulletin No. 94.
1920 — In Bulletin No. 99.

Bills relating to labor introduced in the Legislature were reprinted for 1903 and 1904, and indexed for 1905 to 1913, in the reports of the Commissioner of Labor for those years except 1913 when the index was published in the June Bulletin. The index for 1914 was published in Bulletin No. 62; for 1915 in Bulletin No. 72; for 1916 in Bulletin No. 78; for 1917 in Bulletin No. 84, and for 1918 in Bulletin No. 88. The indexes for 1919 and 1920 are not printed.

Compilations of all New York labor laws in force have been published as follows:

1884, 1895, 1897 — In annual reports of Bureau of Labor Statistics for those years.

1902 — In annual report of the Bureau of Labor Statistics for 1901.
1905 to 1914 — In annual reports of the Commissioner of Labor. These compilations were partly annotated.

1915–1920 — In separate pamphlets.

A historical review of Labor Legislation in New York, by A. F. Weber, was published as a separate monograph (30 pp.) in 1904.

Of the above publications, files of which may be found in many public libraries, the Department can now supply *only* the following:

Annual reports of Commissioner of Labor: 1904, 1905, 1907, 1910 and 1913.
Separate pamphlets: Only the latest edition (for 1920) is now available.
Bulletins: June, 1908; September, 1911; June, 1912.

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STATE OF NEW YORK

DEPARTMENT OF LABOR

SPECIAL BULLETIN

Issued Under the Direction of

THE INDUSTRIAL COMMISSION

EDWARD F. BOYLE, Chairman
JAMES M. LYNCH — FRANCES PERKINS
HENRY D. SAYER — CYRUS W. PHILLIPS
EDWARD W. BUCKLEY, Secretary
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No. 101

DECEMBER, 1920

ASPHYXIATION IN GARAGES AND OTHER AUTOMOBILE ACCIDENTS

Prepared by
THE DIVISION OF INDUSTRIAL HYGIENE
BUREAU OF INSPECTION

INTRODUCTION

The rapid march of modern progress in mechanics has brought about many radical changes in power production, one of the conspicuous examples being the use of gasoline, kerosene, and benzine as fuel. Among the more important places in which these substances are so used may be mentioned steamships, submarines, aeroplanes, automobiles, small private lighting plants and small power plants in factories, mercantile establishments and private homes. The most important factors in such use are the necessity of using a very powerful engine with but little weight, particularly for aeros and autos; the great necessity of saving valuable floor space in restricted quarters; cheapness of the installation; facility with which the fuel may be obtained; the large amount of fuel which may be stored and carried in a comparatively small space; and the economy in labor and other outlay required to operate and maintain such system.

Those engines which may, or necessarily must, be operated in an enclosed space, or indoors, are of great importance from the standpoint of safety and sanitation.

From time to time there appears in the newspapers, medical journals, safety magazines and other periodicals reports of persons having been prostrated, or killed, by the fumes emanating from the combustion of gasoline in engines in which this product is used as fuel, fanciful names as "petromortis," etc., being sometimes given to this pathological condition. The specific factor which produces this ill effect is carbon monoxide, a colorless, odorless gas formed by the incomplete combustion of the gasoline.

In addition to this information, reports of occupational diseases arising from this cause, and reports of the dangerous conditions surrounding workers in garages led the Bureau of Inspection of the Industrial Commission of New York State to direct the Division of Industrial Hygiene to make an extensive survey of garages in the State of New York for the purpose of determing what, if any, remedial measures were required and to place the necessary orders, so far as possible, under the Labor Law to correct any dangerous conditions found.

EXTENT OF THE INDUSTRY AND THE SURVEY

In the State of New York there are 459,350 licensed automobiles; 138,349 or 30.1 per cent being located in New York City; and 321,001 or 69.9 per cent in the remainder of the State; 1308 garages and auto repair shops were visited, 341 of which were located in New York City and 967 in the remainder of the State. These were situated in 140 cities, villages and towns, representing every one of the sixty-two counties of the State. There were housed or stored in the garages investigated 33,293 cars, being 7.2 per cent of the total number of cars licensed by the State. Thirteen thousand nine hundred and eighty-one of these were housed in New York City and the balance 19,312 throughout the remainder of the State. Nine hundred and thirty-three or 71.3 per cent of these garages were engaged in making repairs, some having machinery installed, while in others the making of repairs was done without the use of machines. In New York City 188 or 14.3 per cent were engaged in repair work; while in the other parts of the State 745 or 57 per cent were so engaged. There were employed in the garages visited 5,906 men, 2,406 being employed in New York City and 3,500 in the portion of the State outside of New York City. In 988 garages, waterclosets were installed, the remaining 320 depending on toilet facilities located outside of and remote from the buildings. Wash basins or sinks were provided in 591 garages, while 717 depended on running water located inside or outside of the building. Seven hundred and twenty-two garages were equipped with wash racks for washing cars. A wash rack is that portion of the garage floor on which the cars are washed. This portion of the floor is depressed enough to carry the surplus wash water to a trap situated in its center and connected with a sewer. Its name is derived from wooden racks originally used for this purpose. Twenty-four and five-tenths per cent or 321 garages were found with dirty and greasy floors. It was found to be much easier to keep clean the new and modern buildings constructed especially for garage purposes than the old remodeled buildings and barns.

CAUSE OF CASES OF CARBON MONOXIDE POISONING

In every garage, small and large, public or private, there are times when it becomes necessary to run the engine of a car as a result of which there are exhausted from the engine products of combustion, if the proper mixture of air and gasoline were used, water vapor and carbon dioxide would be formed. These are harmless products, unless the quantity of carbon dioxide is of sufficient quantity to cause suffocation. But during cold weather, owners, tenants and employees of these garages are known to have run and do run the engines of the machines without opening the doors, windows, skylights or without making use of other means provided for the ventilation of the buildings, with the result that numerous cases of poisoning have resulted caused by the inhalation of carbon monoxide gas, which is formed by the incomplete combustion of the gasoline in the engine. The formation of carbon monoxide gas is due to the lack of a proper amount of oxygen in the combustion process. Perfect combustion is never secured owing to a number of factors, among which may be mentioned: The gasoline is not thoroughly vaporized and properly mixed with the air; the extent to which the mixture is diluted with unexpelled exhaust gas; the quality and quantity of gasoline used; the speed at which the engine is running; and whether the engine is cold or "warmed up," the former condition giving rise to a greater amount of the poisonous gas. The average gasoline automobile engine, running under ordinary conditions will produce an average of 2½ cubic feet of carbon monoxide per minute, but, according as the conditions change, this may vary from zero to 12 cubic feet per minute.

OPINION OF VARIOUS AUTHORITIES AS TO TOXICITY OF CARBON MONOXIDE

There is a wide difference of opinion among authorities as to the amount of carbon monoxide necessary in the air to produce harmful and fatal effects. Some give rather a low percentage, while others place a fairly high limit.

One authority states that "harmful effects can occur when carbon monoxide reaches 0.3 per 1,000 parts of air, but it requires

one-half hour for the blood to absorb sufficient of this gas to be detrimental."

The following tabulation is given by another writer, the figures being based on a normal person breathing for one and one half hours in repose, viz:

0.25 per 1,000 will cause unpleasant symptoms.
0.5 per 1,000 will produce debility and vertigo.
0.9 per 1,000 will render walking impossible.
1.5 per 1,000 will cause death to supervene.

Haldane states that "0.5 per cent of carbon monoxide in pure air is just sufficient to produce, in time, very slight symptoms of poisoning in man; 0.1 per cent may cause a slight headache or palpitation of the heart in one hour or less; and 0.2 per cent is very dangerous."

Burrell, in an experiment upon himself, was rendered very ill for a period of eight hours after exposure for twenty minutes to air containing one fourth of one per cent of carbon monoxide.

Rule 719 of the New York State Industrial Code provides:

> Every workroom in which carbon monoxide is emitted or created in or in connection with any process of manufacture shall be provided with such ventilation that the carbon monoxide shall not exceed one half part in ten thousand volumes of air in any occupied part of such workroom.

Kober and Hanson state:

> Gruber says the limit of toxicity is 0.2 per cent. A volume of air containing 0.1 per cent. may cause distress, headache, nausea and other phenomena. Others say that symptoms will be produced when 0.05 per cent of the gas is present. The point of toxicity will vary in individuals; this has been accurately proved by Haldane in humans and animals.

Lanza (United States Public Health Service) holds that carbon monoxide should be considered dangerous when it is known and believed to be present *in any quantity.*

Schumacher and Apfelbach of Chicago (according to Kober and Hanson) made a series of analyses of gas collected from the exhaust pipes of motor cars, the samples being taken after the motor had been warmed up, a condition which is even less productive of carbon monoxide gas (CO) than when the motor is

cold. This series of tests gave the following average composition of gas from the exhaust:

Content	*Per cent*
Carbon Dioxide (CO_2)	6.7
Carbon Monoxide (CO)	9.3
Oxygen (O)	1.4
Illuminants	0.3
Nitrogen (N)	82.2
Hydrogen (H)	0.0

It was found that headache, dyspnoea, attacks of vertigo, nausea and other symptoms were common in chauffeurs in large taxicab garages, these conditions being more prevalent in cold weather.

Five analyses, by the same workers for carbon monoxide (CO) alone in motor garages gave the following percentages: 0.02; 0.13; 0.04; 0.00; 0.02; — or an average percentage for the five garages of 0.042.

The Hudson River Traffic Tunnel which is about to be constructed to connect New York and New Jersey will according to the Scientific American March 8, 1919, be ventilated on the assumption that the dilution of the carbon monoxide (CO) to 6.5 parts in 10,000 parts of air will render it non-injurious, and that the dilution of the carbon dioxide (CO_2) to 50 parts per 10,000 parts of air will also render it non-injurious. The proposed ventilation of this tunnel is based on assumed traffic conditions with 100 cars on the deck between the two ventilating towers, placed 4,000 feet apart, and 100 more cars on the ramps. It is further assumed that each car will produce 86 cubic feet of gas per minute, making a total of 8,600 cubic feet of gas discharged between towers per minute; 12 per cent. of this gas, 1040 cubic feet per minute, will be carbon dioxide, while 3 per cent. or 258 cubic feet per minute, will be carbon monoxide. As carbon dioxide (CO_2) is denser than air, being in the proportion of .123 to .08, 1,040 cubic feet will be reduced to 680 cubic feet which will require 136,000 cubic feet of fresh air per minute to dilute it to the determined standard of 50 parts per 10,000 parts of air, while the 258 cubic feet of carbon monoxide (CO) will require 400,000 cubic feet of fresh air per minute to dilute it to the fixed standard of 6.5 parts per

10,000 parts of air — a total of 536,000 cubic feet of air per minute to take care of both carbon dioxide and carbon monoxide.

That the deadly effects of motor exhaust gas are not entirely unknown to the laity is well demonstrated by the following copies of newspaper clippings containing news items from two very widely separated parts of the United States:

Clever Rat Exterminator

Beatrice, Neb., June 6.—J. C. Boyd, a farmer of Virginia, Neb., has a new way of destroying the rats which had been feasting on his corn crib. Backing his tractor up to the crib, he turned on the exhaust pipe through an extension under the crib. When the job was done, his "crop" was a tub full of dead rodents.

Gassed the Woodchucks

Winstead, Conn., June 18.—Gassing woodchucks is the latest method of exterminating them. Elbert L. Fargo of New Marlboro, Mass. was bothered by groundhogs. Elmer King motored to Fargo's farm, attached a hose to the exhaust of his automobile engine, ran the pipe far down a woodchuck hole and started the engine, using a liberal mixture of gas. This operation was repeated at all the woodchuck holes found. Not a woodchuck has been seen since on the farm.

Carbon monoxide poisoning as it usually occurs may be divided into two types, acute and chronic, according to the amount of the gas present in the inspired air and the symptoms produced by it.

Acute poisoning is usually accompanied by headache, ringing in the ears, epigastric distress, nausea, vomiting, weakness of the legs, staggering gait, first slowing and then rapidity of the heart action, and hallucinations. In the more severe cases, death may occur almost immediately, or there may be produced the following symptoms: Cyanosis or bluish discoloration of the skin, spasmodic or labored respiration, slow pulse, subnormal temperature, convulsions, coma and death from asphyxia or suffocation. Some of the persons affected are able to get to the open air while others become unconscious immediately.

Broncho-pneumonia, mental disturbances, neuritis, cerebral hemorrhage, and various forms and degrees of paralysis may follow acute carbon monoxide poisoning.

The symptoms of chronic monoxide poisoning, due to the continued inhalation of small quantities of the gas are headache, dizziness, gastric disturbances, evidenced by coated tongue, nausea,

vomiting and loss of appetite, loss of weight, anaemia, rapid heart action, weakness of memory and general debility.

As many of the cases do not present the typical picture given in the ordinary text-books, it may be well to quote here two cases personally described by the victims of the gas in the Travelers Standard, May, 1916:

1. Last fall I spent one evening working in my garage — a good-sized double garage, with the two doors and four windows closed. After making some minor adjustments I started the engine, intending to make further adjustments in connection with the carburetor and the throttle. I probably ran the car about twenty minutes or half an hour, using at times an extremely rich mixture. I notice a pungent odor, but attributed it more particularly to what I thought to be an excess consumption of oil. I also noticed a slight but not specially uncomfortable smarting of the eyes.

While sitting in the driver's seat with a 16-candle-power extension light hooked in the steering wheel and making some adjustments, the room suddenly became black. I thought when I arrived home that I had turned out the light, but on returning to the garage next morning I found it still burning. Immediately after the enveloping darkness came on, I felt extremely dizzy. Getting out of the car at once, I remember picking up my overcoat from the rear seat and my electric flash lamp from the running board, feeling my way out of the garage, and closing the door. The seeming darkness persisted all the time so far as I am able to recollect, though the light was in fact still burning, as I have said before.

My only thought at that time was to reach the sidewalk, where I was sure some one would find me if I became wholly unconscious. As a matter of fact I apparently *did* lose consciousness before I reached the sidewalk, for the next morning I noticed that the knees of my trousers were considerably soiled from the dirt of the driveway. I do not recall falling. I walked immediately to the home of a physician, a distance of 200 yards, feeling extremely cold all the time, and very dizzy, but not greatly nauseated. It was not an especially cold night, the temperature being probably about freezing. From the fact that I felt so cold I should judge that I was out-of-doors for about ten minutes from the time I shut the garage door until I arrived at the physician's home. After leaving the doctor, I continued to suffer from the dizziness, but I walked home still a little unsteady on my feet, retired after drinking a glass of brandy, and went to sleep. The next morning I was apparently none the worse for the experience.

The physician who attended this patient made the following statement:

The patient arrived at my house, probably within ten minutes from the time he left the garage. He exclaimed "What is the matter with me"? and was somewhat incoherent. He was trembling, staggered when he walked into the house, and was apparently very weak, his chief complaints being dizziness and inability to get enough air into his lungs. His general

appearance indicated fear. His face and hands were cyanosed and covered with a cold perspiration; the pupils of the eyes were dilated and did not react readily to light. The pulse was very rapid (140), small and soft, and his respirations were very shallow and rapid, numbering about 45 to the minute. The shallow respirations were frequently interrupted by an attempt at a full, deep inspiration, evidently produced by the desire for more air. After about twenty minutes the cyanosis partly cleared up, and the pulse and respiration also dropped. At this time, I advised him to go home, which is a short distance. As he left the house he was still apparently weak and walked with a swaying motion and an evident effort. I prescribed plenty of fresh air and a reasonable dose of stimulant, and the next morning he was apparently enjoying his usual health.

2. This man left his automobile engine running while washing his car in a small garage, with all of the doors and windows closed. He was overcome by the poisonous exhaust fumes and fell to the floor in such a position that his head landed in a puddle of snow and water. This partially revived him, so that by grasping the running board of the car he was able to get to his feet. He immediately fell for a second time however, and when he attempted to get up he was unable to do so, and started to crawl to the door. Fortunately, a chauffeur who lived nearby, came to the door of the garage just at this time, saw the man lying on the floor, and went in and helped him out-of-doors, and later assisted him into the house. No physician was called in this case as the victim did not realize that he had been poisoned. He drank hot stimulants, took a hot bath and such other precautions as occurred to him, and then went to bed. He was unable to get to sleep for a time but finally did so, and the next day was apparently none the worse for his experience.

The following cases were actually located and investigated by those assigned to conduct this investigation:

1. During the extremely cold weather, a number of men were at work on the fourth floor of a five-story garage, all of the doors and windows being tightly closed in order to maintain a comfortable degree of temperature; this was during a coal shortage when there was but little steam heat furnished. One of the men was seen suddenly to collapse and fall unconscious to the floor; he was partly cyanosed, his pulse was weak and rapid, and respiration was rapid, shallow, and labored. He was quickly removed to a hospital where he recovered within twenty-four hours, but remained very weak for a few days. Patient remembers nothing of his fall and was surprised to find himself in a hospital bed when he recovered consciousness.

2. Three chauffeurs who had been "joy-riding," arrived at a large public garage in the early hours of a bitterly cold morning and had hurriedly to prepare their cars for their daily routine. The cars were taken to a room on an upper floor where they closed all of the doors and windows on account of the bitter cold weather. Some time later the night watchman, while making his rounds, discovered the three men lying unconscious on the floor, and had them immediately removed to the open air where they quickly recovered.

3. In a garage where a number of large trucks were stored, eight chauffeurs were rendered unconscious while they were "tuning up" their cars on a

very cold morning with all doors and windows of the garage closed. Removal to the open air was quickly followed by complete recovery.

4. A contractor entered his private garage several blocks from his home, with a small car about one o'clock in the afternoon, closed the doors and windows, and began working on the car; neighbors heard the engine running all afternoon and all night, but from ignorance did not think anything of it. Becoming alarmed by the failure of his father to return home that night, a son began searching for him and reached the garage at about eight o'clock the next morning. Upon opening the garage door, he was met by a rush of smoke and gas generated by the engine which was still running although the gasoline tank was nearly empty; when the smoke had partly cleared away so that the son and an officer could enter the garage, they found the father lying dead on the floor beside the car, the cause of death being acute carbon monoxide poisoning.

The garage was abount twenty feet by thirty feet by twelve feet, giving an air capacity of about 7,200 cubic feet; the engine had been running for about twenty hours during which time, taking as an average the generation of 2.5 cubic feet of carbon monoxide per minute — 150 cubic feet per hour, it was capable of generating 3,000 cubic feet of carbon monoxide in a garage which when entirely empty had a total air space of only 7,200 cubic feet.

5. One of the medical inspectors of the Division of Industrial Hygiene of the Bureau of Inspection received a call at about one o'clock in the morning to attend a young man who had suddenly "fainted." The man was found practically unconscious, slightly cyanosed, with a rapid and weak pulse, shallow respirations, and his entire body covered with cold perspiration. Under the influence of heart stimulants and fresh air, he quickly recovered consciousness, but remained so weak and dizzy that he had to be assisted to bed. Recovery was apparently complete within twenty-four hours.

The following history of the case was elicited:

The man worked in a poorly ventilated garage where he began work about noon. He felt "queer" during the afternoon and was slightly unsteady on his feet. When he reached home for his evening meal, he was so hilarious and his conduct was so unusual that, although he did not use intoxicants, his family thought he had been indulging in "strong drink." He returned to his work after his meal and reached home again after midnight. He complained of feeling ill and nauseated, he started for the bathroom, but fell over unconscious before he had taken many steps. There was no history or evidence of his having partaken of intoxicating liquor.

6. A man was at work in a small private garage when he suddenly fell over in an unconscious condition, and, in falling, injured his head and shoulder so badly that he was unable to work for about two weeks. On account of the head injury it was impossible to determine the length of time he was actually affected by the gas.

7. An oil separator was found installed in a large garage, this separator being placed in a pit about five feet below the floor level. It became clogged very readily and required cleaning at frequent intrvals. Every time the men went into the pit, they became ill with dizziness, nausea, and vomiting, but in this case it would seem that the ill-effects were probably due to the

inhalation of the unburned gasoline fumes instead of the effects of carbon monoxide. The ill-effects of the inhalation of the vapor of gasoline and benzine are well known, but that phase of the subject is outside of the scope of this report.

In addition to the above, there has been reported by Dr. R. P. Albaugh, Director of the Division of Industrial Hygiene, Ohio State Department of Health, the following interesting instance of wholesale carbon monoxide poisoning from the fumes of a gasoline engine exhaust:

In a small two-story hotel there was installed, in a small basement room, a 14 h.p. gasoline engine with a generator for the private electric plant. A three-inch exhaust pipe led from the engine out underground through an alley and into a silencing drum made of two twenty-four-inch sewer tiles; from this drum, the exhaust pipe continued and came to the surface about twenty feet from the building. The engine was operated by the night clerk who made several trips to the engine room each night, the last visit being at midnight to shut down the engine and close the building. On one of these visits, he became extremely dizzy, very weak, especially in his legs, and was forced to sit down several times on the steps leading from the basement, but he immediately went into the open air and had fully recovered in the course of half an hour. The same condition occurred to a greater or less degree each time he visited the engine room during the next few nights. About two weks after the beginning of these experiences, he went in, as usual, at midnight and stopped the engine, but while in the basement, he became so weak and dizzy that he could not stand and was forced to crawl on his hands and knees to the first floor. In attempting to ascend the steps leading to the second floor, the dizziness and weakness increased, a violent headache ensued, and he fell over unconscious, after calling for help. There were nineteen other persons in the hotel and as they came out into the corridor (all on the second floor) in response to the clerk's call for help, they all became so weak and dizzy that they were compelled either to sit or lie down; one man was able to call a physician who decided they had eaten poisoned food, and accordingly administered to each warm milk, emetics, and later a dose of magnesium sulphate. All complained of the same symptoms (dizziness, muscular weakness, throbbing temporal headache, palpitation of the heart and shortness of breath), three were in a comatose condition, four suffered with nausea, and two gave some evidence of the existence of relaxation of the sphincters. While some of them were ill for a day or two, all recovered in a very short time.

The following day there was begun an investigation to try to determine the cause of the wholesale poisoning. During the course of this investigation, the gasoline engine was started and, within a very few minutes, all of the five persons in the room were conscious of dizziness, general weakness, and palpitation of the heart. The exhaust pipe was dug up and it was found that one of the twenty-four-inch sewer tiles had given way and that supposed silencing drum was almost completely filled with water and dirt so that the exhaust pipe was almost totally choked, thus forcing, at each cylinder discharge, the entire charge of exhaust gas back into the poorly-

ventilated basement from which it found it way, through the stairway, into the entire building. Being lighter than air, this large quantity of carbon monoxide gas rapidly permeated the entire building and quickly produced its ill effects on all of the occupants.

It was found that most garage workers were totally ignorant of the dangerous and even deadly properties of the gas from the exhaust; that others knew the gas contained "knockout properties," but did not realize that serious and even fatal results might follow its inhalation; and, that some believed they acquired immunity and could not be injured after working in a garage for a certain period.

There is one fact which cannot be too strongly emphasized and impressed upon these men, viz: *Carbon monoxide gas is colorless, odorless, and tasteless, and its presence cannot be determined by the sense of sight, taste, or smell; the smoky appearance and the peculiar odor of ordinary gas from the exhaust is due to other contained substances.*

While it is true, as usually stated, that the greatest danger usually exists in the small private garages with their small air space and lack of ventilation, there is also present the same element of danger, in a greater or less degree, in every garage, regardless of size, unless adequate provision is made for ventilation of such efficiency as will keep the carbon monoxide content of the air diluted below the admitted danger point. This may be accomplished either by natural or artificial means, or, by a combination of both.

Seventy-six of the garages investigated were poorly ventilated, through lack of a sufficient number of properly located doors and windows, or because the doors and windows were so located that they would never be opened during the cold weather.

The investigation revealed the fact that one hundred and thirteen cases of asphyxiation had occurred within two years, twelve being in Greater New York and one hundred and one in the remainder of the State. There were also found one hundred and fifty persons suffering from headaches, which they alleged was due to breathing the impure air in garages.

In addition to the cases noted above, the investigators found four hundred and forty-three cases of illness not directly traceable to carbon monoxide fumes, although constantly breathing small

quantities of this gas might have made them more susceptible to the inroads of the various diseases from which they suffered.

Eminent authorities claim that individuals who are constantly breathing small quantities of carbon monoxide gas will show even more serious organic changes than those who are acutely poisoned. Of the above cases of sickness seven resulted in death.

MEANS OF VENTILATION FOUND IN VARIOUS TYPES OF GARAGES

In one case the garage proprietor required the engine of the automobile to be stopped as soon as the car was inside of the garage; if any repairs or adjustments were to be made, the car had to be backed into the street and all such work performed out-of-doors.

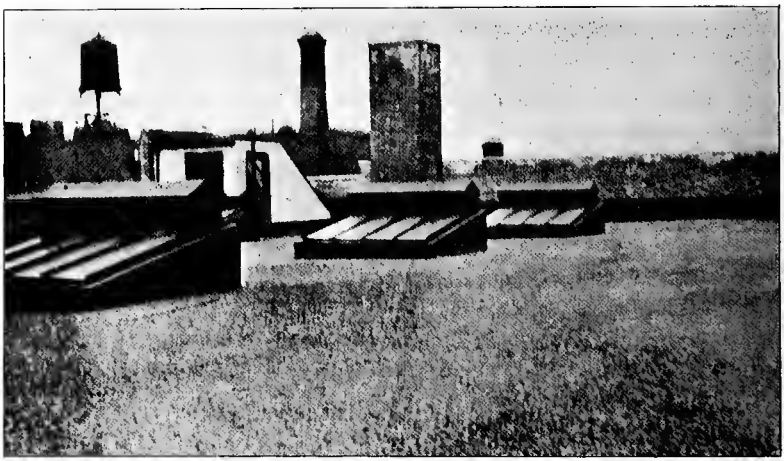

Figure No. 1
A good example of louvered skylight on garage roof.

Some garages, one story in height, have louvered skylights or skylights which can be readily opened and closed, the draught being created by leaving the doors and windows open; many garages are equipped in this manner.

In larger garages, more than one story in height, open stairways and elevator shafts create a ventilating draft which is passed through the building, the foul or spent air escaping by means of open windows or skylights. These windows and skylights are usually so constructed and placed as to prevent the closing of all outlets so that it becomes almost impossible to raise the carbon

monoxide content of the air above the average conceded danger point.

Numerous three story garages have open inclined runways leading from the street to the upper floors, with skylights capable of being opened, situated in the roof above the top floor. Foremen of these garages, it was learned, had been instructed to keep the ventilators of the skylights open, but unless this is done ventilation cannot be maintained.

Thirty-six garages were equipped with flexible metal hose connected with the exhausts from the automobiles, which, when attached formed a continuous piping system capable of exhausting the products of combustion from the automobile engine to a point out-of-doors.

Figure No. 2

Stationary pipe, terminating in a Y for connecting flexible hose to exhaust of automobile engine; two-inch static suction is maintained on this line for exhaust.

In all cases, except where systems of piping are connected with exhaust fans, flexible hose of suitable length to reach from the exhaust of the car through an opening in a door, window or wall, should be used. In several instances it was noted that the exhaust lines were attached to leader pipes leading through the roof.

One of the best systems found was in use in a large five story garage in which the principal repair work was done on the first and third floors. This system consisted of a number of Y-con-

nections with flexible hose sufficiently large to fit snugly over the end of automobile exhaust pipes, it being possible to connect two automobiles to each Y; these Y's were in turn connected to a two inch pipe which was gradually expanded to six inches and connected with a large suction fan placed on the roof of the building. In attempting to determine the power of this fan, a U-tube which would ordinarily register three inches of static suction was used, and, when it was attached to one of the Y's on the first floor, every drop of water was almost immediately drawn out of the tube. Working conditions here were found to be excellent.

A similar device on a larger or smaller scale, according to the size of the garage and the number of cars contained therein, could be readily installed in every garage at a nominal cost.

ACCIDENTS

There were found to have occurred, during the past year 208 accidents, 53 in New York City and the remaining 155 in other sections of the State. A number of these accidents could have been prevented had the proper precautions been taken and safeguards installed.

The following peculiar accidents were noted:

In a small country village, a farmer had converted an old wooden barn into a garage, and while vulcanizing a tire in the garage with a hand vulcanizer connected to which was a small tank containing gasoline, the tank was knocked to the floor and the contents becoming ignited, set fire to the floor. The owner, being alone in the garage, endeavored to smother the fire with a small fire extinguisher, which proved ineffectual. He then attempted to stamp the fire out with his feet. His underclothing caught fire, beneath his heavy trousers, which acted much as a flue and served to intensify the flames. He ran from the building and buried his limbs in a pile of soft sand, which had been dumped in front of the garage, which extinguished the flames, and in all probability saved his life. He was confined to his bed for several weeks and now carries deep scars as a result of this unfortunate accident.

A poster calling attention to the danger of fire from gasoline together with a recommendation for pails, containing dry sand to be kept handy for use in emergencies of this kind, would in all probability have been effective in preventing this accident.

In another small village, the proprietor of a garage, located in a converted barn, attempted to weld a seam in a gasoline tank

partly filled with gasoline and attached to a large traction machine; the gas within the tank exploded, killing the man and destroying the garage.

In this particular case, had rules been posted calling attention to the explosive nature of gasoline and gasoline vapors, another life might have been saved.

In a garage near Greater New York a chauffeur was killed while cranking a car which was in contact with an electric car, the batteries of which were being charged. It is believed that the chauffeur touched some metallic part of his car and received a shock of electricity of sufficient voltage to cause death. The police surgeon said death was caused by heart failure due to electric shock. This shows the necessity of exercising care in all places where an electric current is used.

In another case a chauffeur crawled under his car with a lighted lantern. Gasoline dropping on the latern from the tank ignited the gasoline in the tank which exploded, burning the chauffeur on the head, back and arms.

The 208 accidents reported arrange themselves into 58 classifications of injury. Of these, 45 accidents were caused while cranking cars, resulting in 21 broken arms, 7 broken wrists and 1 broken rib; the remainder being of less serious nature.

Cranking accidents could be avoided by using a suitable safety clutch or installing self starters in the cars.

A large number of minor accidents, such as cuts, bruises, lacerations and scratches, some of which resulted in infection, could only have been avoided by due care on part of the employees. First aid kits should be placed in all garages, irrespective of the number employed.

Fires were reported as having occurred in 27 or two per cent of the garages, due to a great many different causes, some of which could have been avoided.

A large hotel in the Adirondacks, with all of its surrounding cottages, was burned to the ground by a fire caused by the explosion of a vulcanizer in the nearby garage.

In New York City, $100,000 damage was done in a garage by a fire caused by a broken tail-light igniting the gasoline vapor thrown out in a back fire of a car which had been backed into the garage. It is said that a large quantity of gasoline was stored in

the cellar of the building, which if ignited would have caused an explosion of great magnitude.

Sometimes, gasoline escaping from garages directly into sewers, becomes ignited and results in an explosion, damaging the streets, endangering the lives of pedestrians and people in nearby buildings. This danger could be averted by the installation of oil separators or traps to prevent the volatile, inflammable oils flowing into the sewers. Some cities have ordinances prohibiting the leakage of gasoline and other inflammable liquids into sewers.

Some of the investigators have reported many cases of smoking in garages practised by both proprietors, employees and the public; also some cases of open forge fires were noted. It should be made unlawful for any person to smoke or carry a lighted cigar, cigarette or pipe within a garage or any room or enclosed place in which any volatile inflammable liquid is kept.

No stove, forge, boiler, torch, flame or fire, and no electric or other appliance, which is likely to produce an exposed spark, should be installed in such garage or room. If necessary to install any of the above appliances, the same should be placed in a separate fireproof compartment.

A further study of the accidents occurring will show the following resulting injuries: two broken arms, one broken knee cap, one broken rib, two burned backs, one sprained ankle, a severed finger and a head badly bruised and cut on account of slippery floors, which forcibly brings to the attention the necessity of rules and regulations governing this type of building used in connection with the storing, repairing and housing of automobiles.

CONCLUSION

A thorough study of the conditions found results in the conclusion that there is only one adequate remedy for the prevention of carbon monoxide gas poisoning in garages and that is *proper and sufficient ventilation at all times.*

This can be enforced under Rule 719 of the New York State Industrial Code *only* in workrooms connected with garages. In garages which are neither factories nor mercantile establishments under the law, special rules should be adopted, or laws enacted to enable the State Industrial Commission to control all hazardous conditions which might occur.

It is recommended that in all garages and automobile repair shops, according to the size thereof and number of cars used therein, there be required the installation of one of the following ventilating systems, viz:

1. Provision of a suitable flexible hose of sufficient length to permit one end to be attached to the automobile exhaust pipe while the other free end is placed outside of the garage to permit the discharge of the exhaust gas directly into the open air for as many machines as is deemed necessary, or the ends could be attached to pipes which lead through the roof of the building.

2. Provision of air inlets at the floor level with air outlets near the ceiling, the latter consisting of louvres in the wall, windows or ventilating skylights. These should be so constructed as to prevent their being tightly closed and keep a continuous movement of air through the room.

3. In the large garages where a great number of engines are being "tried out" at the same time, a mechanical ventilating system should be installed operated by an exhaust fan of sufficient capacity to remove all poisons gases and vapors. Connection with this exhaust system could be made by means of flexible hose attached to the muffler exhausts of the engine.

In numerous instances it was noted that inexperienced people had opened public garages in old barns, buildings and stables which were poorly constructed, which could not be adequately ventilated or adapted to the business of garage work. Fire hazards were numerous and the proprietors did not know or realize the dangers relating to the handling of gasoline and its inflamable nature. Many of the accidents described clearly demonstrate the inexperience of the people conducting these places.

It is also recommended that warning posters to be supplied by the New York State Industrial Commission be posted in all garages.

These posters should call attention to the dangers of poor and insufficient ventilation and carbon monoxide poisoning, stating the means for reviving and caring for any possible victims.

The following information in poster form is suggested and should be displayed in every garage. This should be prepared and posted by the Industrial Commission:

ATTENTION — WARNING
OWNERS AND CHAUFFEURS AVOID DANGER

Automobile engine exhaust gas contains a very poisonous agent known as carbon monoxide gas which is ordorless, colorless and tasteless.

Daily inhalation of very small quantities of this gas will undermine your health, while a larger quantity will at once make you ill and may cause your death. **Remember It May Kill You Without Warning!**

There is a larger quantity of carbon monoxide gas formed when you start a "cold engine" than when the engine is "warmed up." This is also true when you use a "rich" mixture or "race" the engine.

Adjust your carburetor to get a "*Proper Mixture*" so that combustion will be complete. The engine should never be run over a pit used in repairing cars, unless the muffler exhaust is connected by flexible hose to the outer air, as the pit may otherwise soon become filled with deadly exhausted fumes.

Remember that the symptoms of this poisoning are headache, dizziness, throbbing in the temples, weakness of the knees, palpitation, and loss of appetite. **Get Into the Open Air at Once. Never Take a Chance,** if you feel any of the above symptoms.

Poisoning by this gas may be avoided by strictly observing all of the following precautions:

The smaller the garage, the greater the danger.

Provide plenty of fresh air in the garage at all times.

Do not close doors, windows or ventilating devices while you are at work.

Do not run a motor in a closed garage.

If you must run the motor, back the car to an open door, or attach the metal hose or other device to the exhaust pipe to carry the poisonous gases out of the garage.

FIRST AID

Immediately remove the victim to the open air, send for the doctor, and begin to perform artificial respiration, after loosening tight garments. Continue respiration without interruption until natural breathing is restored, or for at least three hours or until a physician takes charge. If natural breathing stops after being restored, use artificial respiration again. Do not give any liquid by mouth until victim is fully conscious. Keep the victim flat. If after being partly recovered he must be moved, carry him on a stretcher. It is dangerous to make an ill person sit up or stand. To make him walk may cause death. Telephone to fire or police station for a pulmotor to produce artificial respiration.

DESCRIPTION OF PRODUCING ARTIFICIAL RESPIRATION

When a person is apparently gassed or overcome by gas disengaged from the exhaust from automobiles, the following steps should be taken:

Throw the doors open and remove the patient to fresh air as quickly as possible. If a tank of oxygen and a breathing mask is at hand, and he is breathing, administer oxygen through the mask for twenty minutes. If not breathing, give artificial respiration by the prone pressure or Schaefer method. Place the patient in a position that his nose and mouth are free. One arm should be placed straight out beyond his head; the other under his head.

METHOD OF RESUSCITATING PERSON FROM CARBON MONOXIDE POISONING

If possible remove the person to the pure air; if not, then open doors and windows thus affording a good current of air. Do not allow others to stand around and thereby shut off the fresh air.

Send for a physician immediately but do not delay operations until he arrives. Begin at once. If the person is still breathing, and a tank of oxygen and a breathing mask are at hand, administer oxygen through the mask for half an hour. If the person is not breathing, give artificial respiration as follows:

Lay the person flat downward on his belly with the head turned to one side, so that the nose and mouth are free. Loosen all clothing about the neck, chest and waist. Have an assistant draw the person's tongue forward and hold it in that position with a handkerchief. Place one hand of the sufferer under his head and the other straight out, beyond his head. Kneel down, straddling the person's thighs and facing his head. Place the palms of your hands with the thumbs nearly touching each other, over the small of the patient's back and your fingers over his lower ribs; swing slowly forward, so that the weight of your body bears lightly on the patient's. Remain in this position about two seconds. Then with your hands in the same position, sway your body backward thus releasing the pressure and remain so about two seconds and then return to the former position. Repeat these actions, bending forward and backward, a complete respiration of four seconds, about fifteen times during a minute. Keep the

patient warm with well covered hot bricks or hot water bottle but do not burn him.

Continue these artificial respirations until natural breathing is restored, if not then for at least three hours. If natural breathing stops after having been restored, then resume artificial respirations.

Do not give any liquid by mouth until the patient is conscious. When he is restored, do not allow him to sit up or stand. Keep him flat. If moving is necessary use a stretcher; by no means allow him to walk.

SAFETY SUGGESTIONS

Keep the floors clean and free from slippery oils and grease; also free from obstruction such as tools, machine parts, buckets, boards, etc., to prevent slipping, tripping or falling and thus reduce the possibility of broken arms, limbs or other serious injuries.

Place fire buckets filled with dry sand in convenient places to use in case of fire.

Provide self closing metal cans in which shall be kept all inflamable waste material.

Do not smoke in a garage or in any room or enclosed place in which volatile inflamable oil is kept.

No volatile inflamable liquid should be carried about or remain uncovered in a garage.

First aid kits should be installed in all garages.

It is recommended, in addition to the displaying of the above poster, that legislation be enacted to amend the Labor Law by including all public garages in the definition of factory (Section 2, Article I), which should enable inspection to be made of all public garages where one or more persons are employed at any kind of labor or manufacturing which will provide for the application of Article 6 of the Labor Law and the Industrial Code.

The recommendation as to fire prevention, previously described, should require the installation of traps and screens in sewer connections and the placing of all flame producing devices in fireproof compartments, separate from the room where the automobiles are kept.

All lights for artificial illumination in garages should be enclosed in vapor proof globes, supplied with keyless sockets, or where lights other than of the incandescent types may be used, they should be arranged to prevent fire from such source.

Pails of dry sand, fire extinguishers, or other devices should be provided for the extinguishing of fire in all public garages located in such parts of the State where no ordinances are in force requiring these fire extinguishing devices.

The electric wiring of all garages for motors and artificial lighting should be installed in accordance with the rules and regulations of the National Board of Fire Underwriters or municipalities in which the garages are located. The use of open knife switches should be eliminated, or be placed in such parts where volatile, inflammable gases cannot reach them.

Oil traps should be attached to all drains to arrest the flow of oil into sewers or cesspools and be so placed that they can be readily cleaned.

Special Bulletins. In 1914 [redacted]uarterly Bulletin, formerly published by the Department of Labor, was superseded by the present series of special Bulletins on particular subjects. The list of these Special Bulletins is as follows:

Year 1914

No. 57. Idleness of Organized Wage Earners on September 30, 1913 (7 pages). *Out of print.*
No. 58. Idleness of Organized Wage Earners in 1913 (53 pages). *Out of print.*
No. 59. Digest of the New York Workmen's Compensation Law (21 pages). *Out of print.*
No. 59. (Revised). The Workmen's Compensation Law (47 pages). *Out of print.*
No. 60. Statistics of Trade Unions in 1913 (145 pages). *Out of print.*
No. 61. Idleness of Organized Wage Earners in the First Half of 1914 (15 pages).
No. 62. New York Labor Laws of 1914 (100 pages). *Out of print.*
No. 63. Directory of Trade Unions, 1914 (104 pages). *Out of print.*
No. 64. Changes in Union Wages and Hours in 1913 (116 pages).
No. 65. Union Rates of Wages and Hours in 1913 (186 pages). *Out of print.*
No. 66. Strikes and Lockouts in 1912 and 1913 (139 pages).
No. 67. International Trade Union Statistics (24 pages).
No. 68. Statistics of Industrial Accidents in 1912 and 1913 (175 pages). *Out of print.*

Year 1915

No. 69. Idleness of Organized Wage Earners in 1914 (41 pages). *Out of print.*
No. 70. New York Court Decisions Concerning Labor Laws (118 pages).
No. 71. Government Labor Reports, October, 1913, to May, 1915 (29 pages).
No. 72. New York Labor Laws of 1915 (67 pages). *Out of print.*
No. 73. Idleness of Organized Wage Earners in the First Half of 1915 (16 pages).
No. 74. Statistics of Trade Unions in 1914 (146 pages).

Year 1916

No. 75. Statistics of Industrial Accidents, 1914 (77 pages). *Out of print.*
No. 76. European Regulations for Prevention of Occupational Diseases (77 pages). *Out of print.*
No. 77. Industrial Accident Prevention (54 pages).
No. 78. New York Labor Laws of 1916 (68 pages). *Out of print.*
No. 79. Anthrax (22 pages).

Year 1917

No. 80. Fatal Accidents Due to Falls in Building Work (26 pages).
No. 81. Court Decisions on Workmen's Compensation Law (406 pages). *Out of print.*
No. 82. Hoods for Removing Dust, Fumes and Gases (23 pages).
No. 83. Dangers in Manufacture of Paris Green and Scheele's Green (15 pages).
No. 84. New York Labor Laws of 1917 (63 pages). *Out of print.*
No. 85. Course of Employment in New York State, 1904-1916 (50 pages.)
No. 86. Dangers in the Manufacture and Industrial Uses of Wood Alcohol (18 pages). *Out of print*

Year 1918

No. 87. Court Decisions on Workmen's Compensation Law (394 pages).
No. 88. New York Labor Laws of 1918 (71 pages).
No. 89. Health Hazards of the Cloth Sponging Industry (24 pages).
No. 90. A Simple and Inexpensive Respirator for Dust Protection (10 pages).

Year 1919

No. 91. A Plan for Shop Safety, Sanitation and Health Organization (32 pages).
No. 92. Weekly Earnings of Women in Five Industries (21 pages).
No. 93. The Industrial Replacement of Men by Women (59 pages).
No. 94. New York Labor Laws Enacted in 1919 (72 pages).
No. 95. Court Decisions on Workmen's Compensation Law (402 pages).
No. 96. Health Hazards of the Chemical Industry (69 pages).

Year 1920

No. 97. Court Decisions on Workmen's Compensation Law (278 pages).
No. 98. Court Decisions on Workmen's Compensation Law, (114 pages).
No. 99. New York Labor Laws Enacted in 1920 (93 pages).
No. 100. The Telephone Industry (95 pages).
No. 101, Asphyxiation in Garages (23 pages).

Monthly Bulletins. In October, 1915, was begun the publication of a monthly Bulletin as the official organ of the Industrial Commission which now administers the Department of Labor. The purpose of this Bulletin is to give current information concerning the work of the Department and the official acts of the Commission. The issues for the first three years are for the most part out of print.

The Labor Market. In October, 1915, was begun the publication of a monthly Labor Market Bulletin, containing statistics compiled from returns of representative manufacturers and city building departments. The first issue contained figures for June to December, 1915. The issues for 1915, January to [redacted] 1916, and some issues of later date, are out of print.