



HOLMES SAFETY ASSOCIATION

BULLETIN

JANUARY 2001



CONTENTS: Holmes Safety Association Bulletin

Mining Deaths Drop Overall in 2000, MSHA
Says.....3
Don't Be Hauled
Out!.....5
Truck Drivers–Vehicle
Capabilities.....6
Truck Drivers–Dump
Sites.....8
Mine Safety Lamp Collection on Display at the National Mine Health and Safety
Academy.....10
Wellness: Guidelines for Aerobic
Exercise.....17
Our Mining
Heritage.....21
19th Annual South Central Joint Mine Health & Safety
Conference.....23

The Holmes Safety Association Bulletin contains safety articles on a variety of subjects: fatal accident abstracts, studies, posters, and other health and safety-related topics. This information is provided free of charge and is designed to assist in presentations of groups of mine and plant workers during on-the-job safety meetings. For more information visit the MSHA Home Page at www.msha.gov.

Please Note: The views and conclusions expressed in Bulletin articles are those of the authors and should not be interpreted as representing official policy or, in the case of a product, represent endorsement by the Mine Safety and Health Administration.



Cover: Cover art; Oil on Canvas, “The Miner, Pittsburgh, PA” by Roy Hilton (1891-1963); The Pennsylvania State University, The Steidle Collection, College of Earth & Mineral Sciences, Palmer Museum of Art. Inside photo, page 25; “The Alamo,” San Antonio Convention and Visitors Bureau Photographer, Robert W. Bone. If you have a potential cover photo, please send an 8”x10” print or digital image on disk at 300 dpi resolution to Donald Starr, Holmes Safety Association Bulletin, National Mine Health and Safety Academy, 1301 Airport Road, Beaver, WV 25813-9426.

Mining Deaths Drop Overall in 2000

Article from News Release No. 2001-0104
 Mine Safety and Health Administration

Fatal injuries at mining operations in the United States last year decreased nearly six percent from the previous year, according to preliminary data from the U.S. Department of Labor's Mine Safety and Health Administration.

Eighty-five miners died in on-the-job accidents in 2000, compared with 90 in 1999.

In the nation's metal and nonmetal mines, 47 miners died in fatal accidents during 2000 compared to 55 in 1999. In spite of an overall decrease in deaths, fatalities rose in the coal sector, with 38 in 2000 compared to 35 in 1999.

Preliminary data show that of the 38 accidental coal mining deaths last year, 18 occurred in underground coal mines. The leading causes of all



Illustration by Duran

mining fatalities were powered haulage and machinery, each accounting for 10 deaths, followed by four fatal accidents caused by slips and falls.

Eight of the 47 metal and nonmetal fatalities occurred at underground mining operations, while the remaining accidents occurred at surface mines. Powered haulage was the leading cause of accidental

deaths, claiming the lives of 18 miners. Machinery mishaps resulted in 11 fatalities, the second highest cause of accidental deaths.

Kentucky had the highest number of fatal coal mining accidents with 13. West Virginia followed with 9. Nevada led the

(See next page)

JANUARY

nation in metal and nonmetal mining with six fatalities. Texas was next with 4. (State data attached.)

Additional mine injury statistics released by MSHA for the first three quarters of the year 2000 follow: Rate of Fatal and Nonfatal Mining Injuries (Coal)—The rate of fatal injuries in coal mining was .040 per 200,000 employee work hours through the third quarter of 2000. This compares with .038 through the third quarter of 1999, and .026 through the third quarter of 1998.

Twenty-nine miners were killed on the job through September of this year; compared to 30 for the same period in 1999; 35 for all of last year, and 22 through third quarter of 1998.

The rate for nonfatal coal mining injuries involving lost work time through the third quarter of 2000 was 5.18 injuries per 200,000 employee hours, up from 4.97 in the same period of 1999, 4.85 for all of 1999, and down from 5.50 through the third quarter of 1998. The rate for all types of injuries in coal mining was 6.86 per 200,000 work hours. This compared with 6.63 for the same period of 1999, 6.44 for all of 1999 and 7.40 through the third quarter of 1998.

Employment and Production Figures (Coal)—Coal miners worked a total of 143.8 million hours through the third quarter of 2000 compared to 156.1

million for the same period of 1999 and 167.8 million through the third quarter of 1998. The average employment through the third quarter of 2000 was 105,377 compared to 111,659 through the third quarter of 1999 and 118,490 through the third quarter of 1998. Coal mines produced 801.2 million tons of coal through September of this year, a decrease from 823.5 million tons produced during the same period of 1999 and down from 838.3 million tons through the third quarter of 1998. Rate of Fatal and Nonfatal Mining Injuries (Metal/Nonmetal)

The rate of fatal injuries in metal and nonmetal (non-coal) mining through the third quarter of 2000 was .023 per 200,000 employee-hours worked, compared to .023 through the third quarter of 1999, .025 for all of 1999, and .027 through the third quarter of 1998. Thirty-eight metal and nonmetal miners died in accidents through September of this year compared to 38 for the same period of 1999, 55 for all of last year, and 44 through the third quarter of 1998.

The rate of nonfatal lost-time injuries at metal and nonmetal mines was 2.84 through the third quarter of 2000 compared to 2.92 for the same period of 1999, 2.79 for all of last year, and 3.03 through the third quarter of 1998. The rate for all types of metal and nonmetal

mining injuries through the third quarter of this year was 4.45 compared to 4.63 for the same period of 1999, 4.44 for all of last year, and 4.88 through the third quarter of 1998.

Employment and Production Figures (Metal/Nonmetal)

Metal and nonmetal miners worked a total of 323.9 million hours through September of this year compared to 324.5 million for the same period of 1999 and 325.4 million through the third quarter of 1998. Average employment for the period was 236,589 compared to 233,290 through the third quarter of 1999 and 233,696 through the third quarter of 1998.■

**Article from News Release
No. 2001-0104
Mine Safety and Health
Administration
Contact: Amy Louviere
Phone: (703) 235-1452
Released Thursday, January
4, 2001**



**Underground
Powered
Haulage Safety for
Coal Mines**

**DON'T BE
HAULED OUT!**

Powered haulage accidents continue to be a leading cause of mine fatalities.

Most powered haulage accidents occur as a result of:

- Operating unsafe equipment.
- Not properly maintaining equipment.
- Unsafe operation of mobile equipment.
- Not properly blocking machinery/equipment in a raised position when performing maintenance.
- Impaired visibility of operators of mobile equipment.
- Improper hand/body positioning.
- Inadequate training of equipment operators.

To avoid powered haulage accidents, miners should:

- Never operate unsafe equipment. Pay particular attention to brakes, panic bars, controls, and steering. Report unsafe conditions to mine management.
- Keep equipment clean. Make sure all lighting systems, warning devices, and permissibility requirements are maintained.

- Always face the direction of travel and use speeds consistent with roadway conditions.

- Use warning devices.

- Always solidly block machinery that is in a raised position when performing maintenance.

- Always deenergize equipment before performing maintenance.

- Use lights in direction of travel.

- Stop before proceeding through runthrough check curtains.

overloading haulage equipment.

Here is brief summary of the types of fatal powered haulage accidents which have occurred in recent years:

A scoop operator was fatally injured while hauling stopping blocks to a section. The accident occurred because the victim apparently failed to observe how close he was to the coal rib and inadvertently positioned himself between the machine and the rib.

A scoop operator was using a scoop to clean loose coal beneath and around a mobile



- Be alert to the presence of others in travelways.

- Use reflective material.

- Maintain communications.

- Keep hands and body in operator compartment. Avoid pinch points. Be aware of changes in clearance.

- Keep training updated.

- Know equipment's capabilities and limitations.

- Not restrict visibility by

bridge section of a continuous haulage system. During the process, the scoop trammed under the bridge section and the scoop operator's head struck the mobile bridge, resulting in fatal injuries.

A laborer was fatally injured while rock dusting an area outby a dumping point, using a battery tractor and

(See next page)

JANUARY

pulling a slinger duster. He was out of the tractor preparing to rock dust when the tractor began to roll down the grade and pinned him under the front of the tractor.

A shuttle car operator was fatally injured when two shuttle cars collided in an intersection inby the dumping point in a belt entry.

A plant foreman was fatally injured while installing a connector link in a shuttle car conveyor drive sprocket chain. Electrical power was not removed from the conveyor drive motor before repairs were begun.

A laborer and a coworker were transporting a longwall equipment sled along the track to the longwall setup area. The load shifted, causing fatal injuries to the laborer. The accident occurred because the longwall equipment sled loaded onto two haulage vehicles was not secured in a manner that would prevent its movement.

DON'T BE HAILED OUT!



Truck Drivers – Vehicle Capabilities

In recent years, there have been fatalities in the mining industry involving surface haulage.

Over half of these fatalities involved **TRUCKS**.

Some of the causes of these fatalities are: loss of control of the vehicle; faulty brakes or other defective equipment; driving too fast for conditions; the truck being overloaded; use of unsafe dumping practices; and use of parking procedures which did not hold the truck. These types of accidents can occur if an operator is not familiar with the capabilities and limitations of the truck, or doesn't perform a proper preoperation examination.

Another cause of accidents has been persons on foot getting run over by trucks, or pinned between two vehicles.

BEFORE driving a truck a driver should:

- ✓ Be familiar with the Manufacturer's Performance Specifications for the truck.
- ✓ Know the rated capacity and the proper load height.

Know the braking capability of equipment:

(See next page)



- Stopping distance;
- Maximum grade; and
- Gear/speed/grade information.
- ✓ Be sure to perform preoperation inspection procedures.
- ✓ Be aware of whether the vehicle ran normally during the last shift. Are there deficiencies that need to be corrected?
- ✓ Be familiar with the maintenance requirements and records. Has the necessary maintenance been performed?
- ✓ Be sure you understand the vehicle's instrumentation and gauges, the normal operating ranges, and the alarm conditions.
- ✓ Be sure that you are familiar with the controls; controls may differ on each piece of equipment.
- ✓ If so equipped, understand the use of electrical retarder systems.
- ✓ Be aware of the vehicle's blind spots.
- ✓ Check blind spots on walkaround.
- ✓ Sound horn and follow established procedures before moving the vehicle.
- ✓ Don't park in another vehicle's blind area.
- ✓ Know the traffic patterns in use.
- ✓ Know safe parking procedures.

JANUARY

Many haulage accidents have occurred at truck-built stockpiles. Often the cause of these accidents was that the area near the edge of the slope or pile, especially near a steepened slope, was not strong enough to support the weight of the loaded haul truck. Discussions with miners indicate that a large number of nearmisses also occur.

MSHA Job Safety **Truck Drivers — Dump Sites**

SOME DO'S AND DON'TS . .

DO realize that the area near the edge of a steep slope may not support the weight of a loaded haul truck.
DON'T dump over the edge of a pile in an area where the pile has been loaded out at the toe, or otherwise oversteepened.

DO dump back from the edge of the slope. A good rule of thumb used by some operators is to dump at least the distance of one truck length back from the edge of the pile.

DO wear your seat belt.

DO check the dump area before dumping for cracks, for slopes steeper than the material's angle of repose, and for other signs that it may not support the weight of the haul truck.

DON'T drive on questionable areas.

DO maintain adequate berms or bumper blocks.

DON'T use a berm or bumper block to stop the vehicle.

DO back up slowly and come to a gradual stop at the dump point.

DON'T come to an abrupt stop.

DO keep the top of stockpiles sloped so that trucks are backing up a slight grade to reach the dump point.

DO back up perpendicular to the edge of the slope or bumper block.

DO remember that trucks going over stockpiles continue to be a common cause of injuries and fatalities.

**DON'T be the next
accident victim.**



WORKING IN CONFINED SPACES



A confined space is defined as any space or structure which by design has limited openings for entry and exit, and which is not intended for continuous employee occupancy. A confined space has poor natural ventilation. Confined spaces include storage tanks, pits, silos, vats, boilers, ducts, sewers, pipelines, and other structures found at metal/nonmetal mines. A confined space which is immediately dangerous to life or health (IDLH) includes those with oxygen deficiency, explosive or flammable atmospheres, or high concentrations of toxic substances - and requires the most demanding protective measures. Any operation which generates toxic contaminants within a confined space, without proper control measures and precautions, may be dangerous to life within a short period of time.

When work is planned within a confined space, the supervisor and the miner who is to carry out the work should have an understanding as to the work to be done, the hazards that may arise, and the necessary protective measures to be taken. A work permit which contains this information in writing is highly recommended.

This will provide authorization for the work, and requires that the supervisor and employee review the operation,

hazards and control measures and precautions before entry and before the operation is started.

Protective and precautionary measures for work in confined spaces should involve as a minimum, the following:

1. Atmospheric testing and monitoring. Prior to entry, initial testing of the atmosphere should be carried out from the outside. Such tests should include those for oxygen content, flammability, and toxic contaminants. In accordance with MSHA regulations, the oxygen content shall be at least 19.5%. If it appears that an atmosphere immediately dangerous to life may develop, it is essential that a safety belt or harness and a lifeline be worn by the person in the confined space. A standby person must be in attendance.

2. Training of personnel. Employees who are to work in confined spaces should be adequately trained. Such training should include understanding of the hazards, control measures and precautions involved, entry and exit procedures, safety equipment, emergency first aid, control measures such as ventilation, use of appropriate respirators if

(See next page)

JANUARY

required, and proper work practices.

3. Standby person. When work is conducted within a confined space, a standby person should be stationed on the outside. This person should be trained in emergency rescue and first-aid procedures, and should have communication equipment as necessary for contact with those working inside, and for immediate contact with medical, ambulance, fire fighting, and other rescue personnel if needed. MSHA regulations require that such person be present if the atmosphere in the confined space exceeds the Immediately Dangerous to Life and Health (IDLH) level. The standby person should be familiar with and have available appropriate respiratory protection equipment.

4. Safety equipment and clothing. Employees working in confined spaces must have available and use appropriate safety equipment and clothing - such as eye and face protection, proper gloves and full-coverage work clothing where indicated, and safety belt or harness with lifeline in dangerous atmospheres. MSHA regulations have specific requirements for such safety equipment and clothing. Hearing protection in the form of ear plugs or muffs is required where noise levels exceed MSHA standards. Personal respiratory protection may be necessary if ventilation

is not sufficient to control contaminants to the permissible exposure limits. This may be in the form of supplied-air respirators or self-contained breathing apparatus and is recommended where contaminants from welding, painting, solvent cleaning or other operations generating toxic contaminants are involved.

5. Warning signs. Warning signs of a confined space and the hazard should be posted near entrances. When work is not in progress, the entrance should be blocked. When work is in progress, the standby person should ensure that unauthorized persons do not enter the restricted area.

6. Purging and ventilation. Purging of the confined space to remove contaminants should be done before entry by means of a high rate of general ventilation. Atmospheric testing is then in order. The main environmental, or engineering, control of suspected or known contaminants during operations is general ventilation. Design of the system will vary.

Continuous general ventilation is recommended for most operations where contaminants are generated. This may be supplemented or replaced by local exhaust ventilation. Personal respiratory protection may be required in addition to general and/or local exhaust ventilation. Monitoring of contaminants during operations is indicated if there is doubt

about the effectiveness of controls.

Attention to the protective and precautionary measures outlined above is essential for assurance that exposures within confined spaces are controlled.

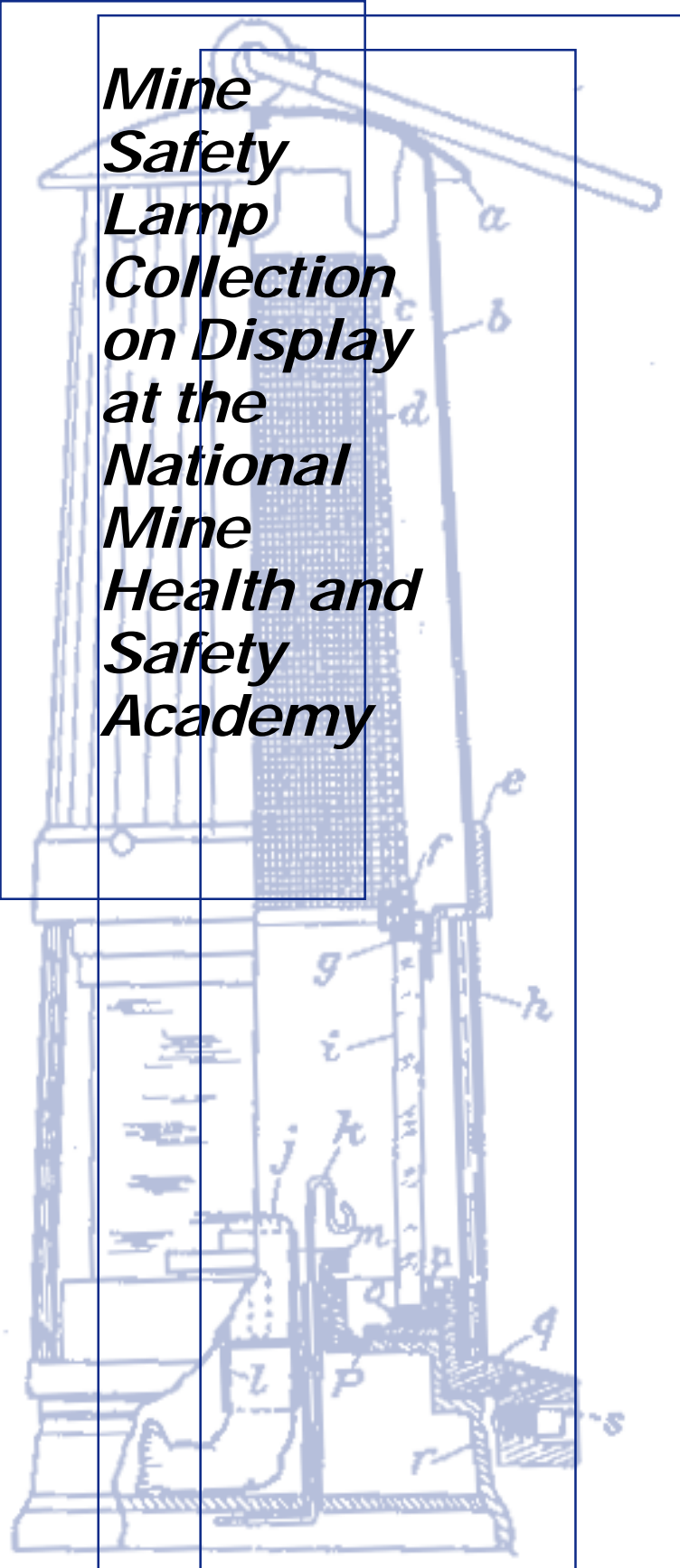
If you have any questions about this or any other occupational health matter, feel free to ask us. **Our job is protecting your health.■**

Contact:

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***Mine
Safety
Lamp
Collection
on Display
at the
National
Mine
Health and
Safety
Academy***

A collection of mine safety lamps is being loaned for display at the National Mine Health and Safety Academy in Beaver, WV. It is being loaned to the Academy by the Comer Museum, located in the West Virginia University College of Engineering and Mineral Resources at West Virginia University, Morgantown, West Virginia.

The collection of 49 lamps reflects the changes in mine safety lamp equipment used both for lighting and for detecting gas over the past 100 years. Jim Dean, director of the extension and outreach unit of the college, says the college has been collecting the mining lamps for more than 50 years and now has about a hundred of them. "There's a wide variety of manufacturers of these lamps. Some date back into the late 1800s." "There are a number of different lamps, some from Belgium, from France, England, Germany," Dean said. The collection will be on display at the National Mine Health and Safety Academy, Beaver, West Virginia, for the next two years.

Safety Lamps—Past and Present

In the early days of mining in this country bunches of resinous wood are believed to have been used for lighting the outcrop workings. If firedamp was found, owing to the fact

(See next page)



JANUARY

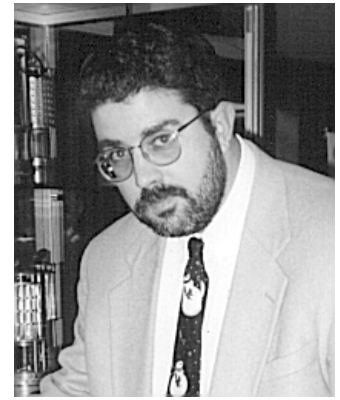
that marsh gas requires a certain proportion of air to be mixed with it before it becomes explosive, the danger in these early days was not as great as might be supposed, because at that time there was little, if any, circulation of air in the workings. On the continent earthen oil lamps were used at first, and later the fear of explosions led to the use of dried fish skins, from the scales of which fish skins a faint phosphorescence was emitted. It is obvious, however, that such a method must have led to mining work being carried on practically without light, as, indeed, no doubt it frequently was. Tallow candles were afterwards used both for the works and for searching out gas. A small candle (30 to 40 to the lb.) was carried in a wet lump of clay, and the flame reduced in size by placing clay at its lower extremity near the exposed portion of the wick.* The candle was raised from the floor very gradually in an upright position with one hand of the observer held palm outwards towards the light to shield it entirely from view except the very tip of the flame. As it was raised an appearance of 'top' or 'cap' of blue flame above the candle flame indicated the presence of gas in the air. As soon as this appeared the candle would be quietly lowered, the searcher would withdraw with as little disturbance as possible, and some means would then be resorted

to for dispersing the gaseous mixture. Where the quantity of gas was small attempts were sometimes made to get rid of it by beating it out with a coat or piece of brattice cloth. Before commencing to do this the man would retire to a distance, choosing a position away from the outgoing currents. His candle would be left here in a refuge of safety out of reach of the passing firedamp. Another plan of disposing of gas believed to be present only in a small quantity was to set fire to it. This was done at night after the withdrawal of the colliers from the working faces by a special operator with a good nerve, and sometimes in a suitable dress. The dress was of wool or leather well damped, the face and head being further protected by a mask and a hood. Provided with a long stick, to the end of which his lighted candle was attached, he



Director Jim Dean inspects the display

would crawl for the last few yards before reaching the



"There's a wide variety of manufacturers of these lamps. Some of them date back into the late 1800s."

Jim Dean, Dir. of the Extension and Outreach Unit, West Virginia University, College of Engineering and Mineral Resources.

explosive mixture previously discovered and at the moment of firing it, would keep his candle the length of the stick in front of him, taking care to keep his body and head down on the floor that air might reach him during the passage of the explosion flame. When this had passed, in order that he might avoid the carbonic acid gas left by the explosion, he would immediately stand upright, or as nearly upright as the height of the road would allow. This officer of the colliery was called a 'fireman' in this country, a name which is still retained to the present day for the man who searches for gas. In some countries he was called the 'penitent', on account of the resemblance of his dress to that of certain religious orders in the Roman Catholic Church. In many instances, in spite of all precau-

tions, the fireman fell a victim to the explosion he thus caused.

The first apparatus for producing light was Spedding's Steel Mill, patented in 1760. It consisted of a spur wheel and steel disc placed in a small steel frame, at the end of which the operator held a piece of flint. The continuous succession of sparks emitted by the rotation of the disc against the flint gave warning of danger by indicating the presence of firedamp. The faith in the mill was rudely shattered by a serious explosion at the Wallsend Colliery in 1785. About this time attempts were made to light collieries by sunlight reflected by mirrors down the shaft.

The first attempt to use a lamp was made by Humboldt in 1798, but it would not burn impure air. It was thus of no use in a coal mine.

The first person to demon-

strate that a steady light could be employed in coal mines without the danger of explosion externally, was Dr. William Reid Canny, of Sunderland. On May



20, 1813, he announced his discovery at a meeting at the Royal Society of Arts in London, when he presented the Society with the first miner's 'Safety Lamp'.

The first colliery in which a safety lamp was used was the Herrington Mill Pit, now the property of the Earl of Durham. The date was October 16, 1815. It was Dr. Clanny's modification of his first safety lamp. For this lamp he was awarded a medal by the Society of Arts in May 1816. In 1848, two years before his death, he was presented with a public testimonial in recognition of his services as the constructor of the very first safety lamp that ever was invented. This lamp consisted of a metal case containing a candle. It was fitted with a semicircular glass, and the air was fed by a pair of bellows.

The first safety lamp in which gauze cylinders were used and oil was burned, was

invented by Sir Humphrey Davy. He never claimed to be the inventor of the Miners' safety lamp. On the contrary, on November 9, 1815, when announcing to the Royal Society his discoveries on the nature and properties of firedamp, he gave a description of Clanny's lamp, which he had seen in use at a northern colliery. He described it as 'an ingenious arrangement for burning a candle supplied with atmospherical air by a bellows through water'. The first Davy Lamp was tried at Hebburn Colliery, January 1, 1816. Strictly speaking, the 'Davy' is not a lamp but a scientific instrument for detecting the presence of firedamp. All lamps of the present day embrace the principle of the Clanny and the Davy.

The first lamp made for George Stephenson was tried at Killingworth Colliery, Northumberland, October 21, 1815. It was a comparative failure. Stephenson's third lamp was more successful, and on December 11, 1815, he exhibited it to a number of colliery owners and officials at the Literary and Philosophical Institute, Newcastle upon Tyne. Gratification at this success was checked when he learned that Davy had also entered the field. Davy was the competitor he feared. Stephenson did not hesitate to adopt Davy's idea of



Jimmy Shumate inspects one of the lamps on display

(See next page)

JANUARY

the gauze cylinder nor did he regard it as piracy. In his pamphlet entitled 'A Description of the Safety Lamp invented by George Stephenson', published in 1817, he states that he regarded the substitution of a 'gauze cylinder for a perforated case' as 'merely a variation in construction'. Nor was he inclined to give Davy much credit for his discovery, declaring that 'the person who first constructed the perforated tin can lanthron in common use may, with great justice, claim the merit of having surrounded flame with a substance less liable to injury than glass', which he subsequently produced as the 'Improved Stephenson', or 'Geordie'. This lamp was practically a Davy Lamp with a glass cylinder inside the gauze; indeed, the Royal Commissioners, in their report dated March 15, 1896, stated, 'if the glass breaks the Stephenson Lamp becomes a Davy'. The 'Davy' and 'Geordie' have long since been relegated to the list of obsolete lamps.

Stephenson, however, frankly admitted his indebtedness to Dr. Clanny. In his pamphlet already referred to, he states, 'There can be no question upon the merit of the discovery, as there is no doubt that Dr. Clanny directed his talents to the subject and had constructed his original lamp, before I had reduced my ideas into practice.'

Continuing his experiments, and following up Davy's discoveries, Dr. Clanny, in conjunc-

tion with the late John Mills, to whom he granted the sole right of manufacture, eventually produced his 'Improved Clanny Lamp'. He adopted gauze cylinders but made them 2 inches shorter than Davy's. He used a circular glass for surrounding the flame but made it 3 inches shorter than Stephenson's.

Improved scientific methods of ventilation so greatly increased the velocity of air currents in coal mines, that in course of time, neither the Davy, Clanny, nor Stephenson lamps proved of practical ability in currents exceeding 400 to 800 feet per minute. In some cases their employment provided an element of danger, for among miners and officials there prevailed considerable ignorance on the question of noxious gas and the principles of the safety lamp. Thus it happened that for several years after the introduction of safety lamps explosions in coal mines were more frequent and more disastrous than they had ever been before. In Belgium and France, where the mines are deep and fiery, Governments made the use of safety lamps a question for the state, and they appointed Commissioners to decide the merits of the various lamps then in use. Both Governments decided in favor of the Mueseler, and the use of other kinds was prohibited. This, however, did not prevent the recurrence of appalling disasters, and the Mueseler, it

was found, was in certain circumstances, a more dangerous lamp than some of those it superseded. The Mueseler is a form of the Clanny with a chimney inside the gauze.

In 1884, the British Government appointed a Royal Commission, 'To inquire into accidents in mines, and the possible means of preventing their recurrence or limiting their disastrous consequences'. In the course of their investigation, they found that 'at least 60 percent of the average of the deaths resulting from accidents in connection with coal mines were caused by explosions of firedamp and from falls from the roof and sides'. It was clearly proved that, to a large extent, these disasters were due to the inefficiency, or to the defective construction of safety lamps. The committee, therefore, 'considered it their duty to give special attention to the subject of safety lamps'.

The Commissioners resolved to test practically every form of safety lamp then in use, and to decide which, in their opinion, most nearly fulfilled the essential qualifications. For this purpose they invited makers, inventors, and users of safety lamps in the United Kingdom, Belgium, France, and Germany to send them lamps to be tested and reported on. In response, upwards of 250 lamps were sent in. Mr. Ellis Lever, realizing the importance of the task which the Commissioners had undertaken, offered



a prize of £500 for 'the best safety lamp', the tests to be conducted at Woolwich Arsenal by a specially selected committee which included several members of the Royal Commission.

The principle which guided the Royal Commission was that adopted by the Belgian and French Governments—viz., that the safest lamp was that which would most effectually withstand the influence of a strong current of explosive air.

Before the Commissioners, or the Woolwich Arsenal Committee, had concluded their tests, a French mining engineer (M. J. B. Marsuat) proved, by a series of elaborate experiments, that the principle was entirely wrong. He clearly demonstrated that, as there was no uniform velocity in the air currents of a mine, a lamp constructed to burn safely in a strong current was a source of extreme danger when used in a stagnant atmosphere of explosive gas. His experiments proved that the gas entered the lamp, and remained there till the lamp was again brought into a current sufficiently strong to force it through. The confined volume of gas then ignited and caused an explosion. This, M. Marsuat stated, 'is an important key to certain accidents, hitherto ignored, assuredly very disquieting and which gives a key to certain accidents which have been difficult to explain'.

The Royal Commissioners frankly admitted their mistake.

In their report (page 87) they stated: 'The experiments conducted by M. Marsuat were so complete and so thoroughly established the truth of his observations that we thought it unnecessary to undertake a fresh investigation of the subject on an extended scale. We have, however, repeated a few of his experiments, and the results are in general accord with those obtained by him.' Thus the Royal Commission and the Woolwich Arsenal Committee found no lamp then in use entirely fulfilled the essential qualifications they had established. The 500 pounds has not been awarded.

The Royal Commissioners, however, finally decided in favor of four lamps, 'in which the quality of safety, in a preeminent degree, is combined with simplicity of construction, and with illuminating power at least fully equal to that of the lamps hitherto in general use. These four lamps were: Gray's Lamp, Evan Thomas No. 7, Marsuat, and Mueseler bonneted. In our experiments the No. 7 has given, upon the whole, the best results.'

They reported, however, that the use of the 'Mueseler' was attended with a certain amount of danger; care must be taken to avoid a considerable inclination from the vertical direction, 'but with the Marsuat' they stated, 'there is no probability of the flame being extinguished under any circumstances attending ordinary use'. These

statements were fully substantiated by the Woolwich Arsenal Committee. On the recommendation of the Royal Commissioners certain improvements were made in the 'Marsuat' Lamps, viz., in the locking of the lamp's bottom and in fixing of the case. The illuminating power of the 'Marsuat' exceeds that of other kinds burning animal or vegetable oil.

An analysis of the Commissioners' report shows that, though 250-300 lamps were tested, they had all, in a greater or a lesser degree, essential points of resemblance. They classified the oil burning lamps under six types, three English and three Belgian. The English types were the 'Davy', 'Stephenson' and 'Clanny'; the Belgian types were the 'Mueseler', 'Boty' and 'Eloin'. Of the 'Eloin' (patented in 1850), they reported 'it is closely allied to the 'Stephenson' Lamp; of the original 'Boty' (adopted in 1881 by the Belgian Government) they stated 'it is a Clanny Lamp in general form'; and of the 'Mueseler' they reported 'it is derived from the 'Cranny''. Thus the safety lamps then so extensively used on the Continent were all adaptations of the three original English types.

A thoroughly efficient safety lamp is not a mere mechanical contrivance for giving light in a coal mine. It is an instrument

(See next page)

JANUARY

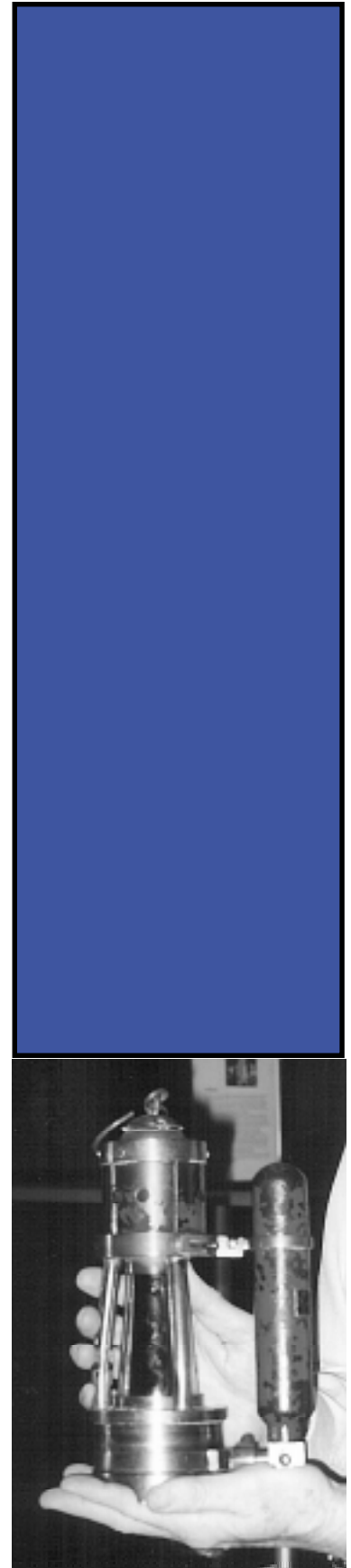
constructed in accordance with established laws of physical science. It ensures the burning of a protected flame in the presence of explosive gas, by regulating the necessary supply of atmospheric air, and by allowing the products of combustion to pass through without igniting the gaseous atmosphere. If the atmosphere is so heavily charged that noxious gas enters the lamp, its presence will be indicated by a change in the length and color of the flame, and (unless there are exceptional circumstances), the miner has sufficient warning to secure his safety.

The principles on which a thoroughly efficient safety lamp is constructed are practical, not theoretical. The component parts must all be in direct ratio. This ratio has been so accurately determined by practical tests, that any deviation from the established standards will adversely affect either the illuminating capacity of the lamp or its value as an indicator of danger. The reports of the Royal Commissioners on 'Accidents in Mines' (1886) and the Woolwich Arsenal Committee, show, however, that several inventors, and makers, who sent safety lamps for testing, or in competition, were either wholly ignorant of this fact and of the laws of physical science, or they did not regard them as of any importance.

The most flagrant deviation from established standards was in the case of the 'Scotch Davy',

a lamp made in direct violation of the laws of physical science. Sir Humphrey Davy stated, as the result of protracted experiments, that 'when a cylindrical gauze is used, it should not be more than 2 inches in diameter, for a larger cylinder the combustion of the firedamp renders the top inconveniently hot'. The 'Scotch Davy', however, was made from 2.9 inches to 3.3 inches in diameter. Davy restricted the height of his gauze to 7 inches; in the 'Scotch Davy' the height was 10 inches, exclusive of cap or top.

Portions of this article come from the E. Thomas & Williams, Limited, Cambrian (Miners') Lamp Works Aberdare, Mid Glamorgan "Original Types of Miners' Flame Safety Lamps", booklet; Article written for the Register-Herald, "Safe mining lamp display comes to mine academy," reporter, Neale R. Clark.



Wellness

GUIDELINES FOR AEROBIC EXERCISE

PHYSICAL CONDITIONING FOR CARDIOVASCULAR FITNESS

Some miners train very sporadically. They might exercise in preparation for an upcoming fitness test, but stop training once the test is over. However, physical fitness must be maintained year round, since the need to perform demanding inspection tasks may arise at any time.

To increase your level of cardiovascular fitness, you must undertake a regular program of sustained aerobic exercise. To be effective, this program must meet certain criteria. These criteria are collectively referred to as the "FITT Principle," standing for the important characteristics of the exercise program:

- ◆ Frequency
- ◆ Intensity
- ◆ Time
- ◆ Type of exercise

Frequency

Studies on aerobic exercise show that a positive training effect is received only if exercise is performed on a regular basis. Specifically, the aerobic exercise must occur a minimum of 3 days per week, every week. Exercise that is performed less frequently will not improve your level of cardiovascular fitness.

Intensity

The most critical factor for improving the cardiovascular system is the intensity of the activity. Exercise carried out at a low intensity is ineffective for causing an improvement in cardiovascular fitness (no effort, no gain). Conversely, exercise carried out at too high an intensity does not let you sustain the exercise session long enough to be effective (see "Time" below). Thus, moderate exercise intensity is optimal—not too easy, not too hard—for the entire exercise session.

Time

The activity must be sustained at this moderate intensity for a minimum of 20 minutes to effectively challenge the cardiovascular system. Aerobic exercise sessions of shorter duration will not produce a training effect.

Type of Exercise

The most effective exercises for producing an improvement in cardiovascular fitness are those that are performed continuously while using large muscle groups. These exercises cause an increased volume of blood to be pumped throughout the body. Activities that meet this criteria include jogging, brisk walking, cycling, stair climbing, rowing, rope skipping, aerobics, cross-country skiing, swimming, etc. As long as you keep moving at an adequate intensity for a sufficient period of time, the type of exercise you choose is really not that important.

PROGRESSION

A vital element of an effective cardiovascular exercise program is progression. After several weeks of regular sustained aerobic exercise, your cardiovascular system will adapt by improving itself somewhat, bringing you to a slightly higher level of cardiovascular fitness.

To improve further requires that you do one or more of three things: exercise more frequently, exercise a little longer during each workout, or exercise at a slightly higher intensity. By making incremen-

(See next page)

JANUARY

tal changes in your workout every few weeks, your level of cardiovascular fitness will steadily increase. Once you stop making these increments, your level of fitness cannot improve any more—no further stimulation means no further adaptation.

Increments in exercise intensity must occur gradually. The body cannot adjust instantly to sudden leaps in workload, which often result in injury. Improving your level of fitness should be approached as a long-term project that requires dedication, discipline, and patience.

With respect to increments in intensity, you'll notice as the weeks go by that you have to exercise at a slightly higher intensity just to maintain the same "feel" to your workout. In other words, the level of intensity you once maintained no longer feels very difficult; thus, you naturally exercise a little more intensely to get the same effect. This is a sure sign that you're getting in better shape!

The greatest amount of improvement in cardiovascular fitness is usually experienced in the first six to eight weeks of the exercise program. After this initial time period, improvements continue to occur, but at a slower rate. Remember: most machines wear out

with repeated use. The human body is the only machine that gets better with use. Regular exercise keeps the body youthful and functioning well.

WARM-UP AND COOL-DOWN

Any exercise workout should include an effective warm-up and cool-down period. A wide variety of activities, including walking and flexibility exercises, are appropriate for this purpose.

Warming Up

Warming up prior to aerobic exercise is critical for two reasons. First, warming the muscles helps reduce the chance of injury. Second, it is important to realize that the aerobic system cannot instantly meet a sudden increase in the demand for fuel. Your body must gradually "gear up" to a higher capacity, and this process takes several minutes. Thus, warming up allows the aerobic system to keep pace with the gradually increasing demand for fuel and oxygen. Otherwise, the anaerobic system must make up the difference. This situation, referred to as "oxygen deficit," usually leads to early exhaustion.

Cooling Down

Just as it is important to warm up prior to exercise, allowing your body to make a gentle transition into an active state, it is equally vital to end the exercise session gradually.

During aerobic exercise, the

repeated contractions of large muscle groups act as a secondary pump to circulate blood throughout your body. If you stop exercising suddenly, the secondary pumping action of the muscles ceases abruptly, leading to "pooling" of blood in the extremities and lower body. This means less blood returning to the heart and head, which can result in passing out or fainting. Thus, after exercising, it is important to **keep moving**, gradually slowing down your movements over a period of several minutes.■



Exhibit 1

SAMPLE AEROBIC EXERCISE PROGRAM

Week 1-2	Week 3-4	Week 5-6	Week 7-8
15 min.	20 min.	25 min.	30 min.

Exercise at moderate intensity.

Week 9-10	Week 11-12	Week 13-14
30 min.	30 min.	30 min.

Week 15-16

30 min.

Gradually increase the intensity of each workout.

Beyond Week 16

Maintain the program you've established at the end of Week 16. By then, you will have been exercising for nearly four months, and your fitness level will have improved significantly! Small increases in duration or intensity can be made occasionally, especially on days when you feel extra good and want to do a bit more than your usual workout.

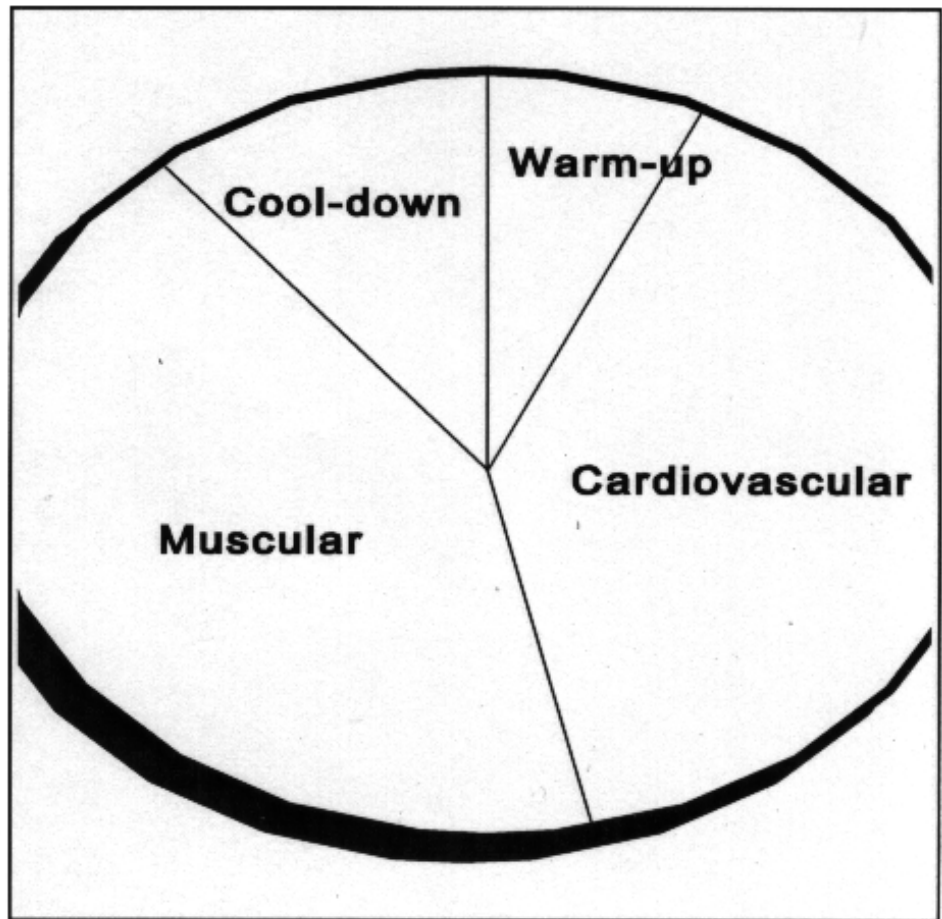
(See next page)

20

JANUARY

HOLMES SAFETY ASSOCIATION

*Workout
Components*



Our Mining Heritage



Immigration to American Mines

*(Excerpts taken from
Bureau of Mines
Technical Paper 252
Metal Mine Accidents in
the United States by
Albert H. Fay 1920.
IMMIGRATION TO
AMERICAN MINES)*

During the decade previous to the year 1880 (as well as in earlier years) the greater part of the employees in the coal and metal mines were Americans or representatives of the English, Scotch, Welsh, German, and Irish races. The majority of the men of foreign birth had been in this country for some years previous to the great expansion of the mining industry, which began about this time. English speaking miners continued to immigrate and to find employment in the mines in large numbers until about 1890. Since that year, comparatively few immigrants from Germany and Great Britain have entered this industry, although Swedes and other Scandinavians have been consistently employed since the early eighties.

The employment in the mining industry of immigrants from southern and eastern Europe began about 1880.

(See next page)

JANUARY

The Slovaks were the first arrivals and immigrated in considerable numbers. They were followed within a year or two by a few Magyars, and the number of immigrants of this race gradually increased each year. The Polish immigrants began about 1890, although individual members of the race had been coming for a period of nine or ten years. After the year 1890, Poles and Slovaks arrived in great numbers. A few Italians were employed before the year 1895, but the immigration of this race did not begin on a large scale until about 1900. They were at first engaged in railroad construction and maintenance-of-way work and gradually drifted into the mines. Croatians were employed in some sections before 1890, and Serbians began to arrive in small numbers in the early nineties. The great bulk of all the immigration from southern and eastern Europe, however, has occurred within the past 18 years. Russians, Bulgarians, Romanians, Ruthenians, Syrians, Armenians, Macedonians, Croatians, Serbians, as well as Poles, Magyars, Slovaks, and Italians have been among the recent arrivals. The races of southern and eastern Europe have continued, up to the time of the war, to find employment in the mines in increasing numbers in almost every important mining district in the eastern states and the lake district. Many of these recent

immigrants have found their way to the central and western states. As a result of the rapid expansion in the mining industry, many mining communities have been founded, the populations of which are largely made up of immigrants who have arrived during recent years.

The pioneer American, English, Irish, German, Scotch, and Welsh miners are thus outnumbered and their positions are filled by more recent immigrants. It is not difficult to account for this racial change which is still going on. The former operatives and their descendants had opportunities to secure more congenial and safer work in other industries. Many of them advanced in the industrial scale, becoming foreman and attaining other responsible positions. A large number have abandoned the occupation of miner for positions as day or shift men. Many also migrated and settled in the Middle West and western states. Many of the former miners who left the industry entirely because of change in mining methods or the employment of immigrants entered mercantile, clerical, mechanical, or more pleasant work of other kinds. Many of the business and professional men in the mining towns were formerly mine workers. Their places were filled without difficulty with recent immigrants who were content with wages and working conditions which

prevailed in the mines. The wages paid in American mines seem very attractive to the recent arrivals of agricultural laborers from southern Europe.

Statistics given herein are from *Immigrants in Industries*, a report of the Immigration Commission, 1911. ■





The Department of Labor, Mine Safety and Health Administration along with management, and associations such as the Holmes Safety Association and the University of Texas are coordinating the 19th Annual South Central Joint Mine Health & Safety Conference, February 6-8, 2001, in Oklahoma City. The conference will feature presentations on mine safety and health topics, by discussion groups made up of various representatives from the mining industry. The conference will have motivational speakers, and workshops on topics ranging from miners' rights to personal protection equipment.

One of the highlights of the conference is the Sentinels of Safety Award luncheon. The luncheon features a safety award ceremony, which mining operations are honored for their outstanding safety records.

***19th
Annual
South
Central
Joint Mine
Health &
Safety
Conference
Scheduled
for the
Month of
February***

The Sentinels of Safety Awards Program is sponsored by MSHA and the National Mining Association. The operations are recognized for achieving the greatest number of employee work hours without an injury that resulted in lost workdays. To qualify, a company had to compile at least 30,000 employee work hours during the year without a lost-time injury or fatality.



24

JANUARY

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HOLMES SAFETY ASSOCIATION

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Make Plans Now!

**The 2001 National Holmes
Safety Association Meeting**

June 5, 6 and 7

San Antonio, Texas

**Look for more details in the next issues of
your Holmes Safety Association Bulletin!**

26

HOLMES SAFETY ASSOCIATION

JANUARY

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NOTICE: We welcome any materials that you submit to the Holmes Safety Association Bulletin. For more information visit the MSHA Home Page at www.msha.gov. If you have any color and black/white photographs that you feel are suitable for use on the front cover of the Bulletin, please submit them to the editor. We cannot guarantee that they will be published, but if they are, we will list the contributor(s). Please let us know what you would like to see more of, or less of, in the ***Bulletin***.

Reminder: The District Council Safety Competition for 2000 is underway - please remember that if you are participating this year, you need to mail your quarterly report to:

**Mine Safety & Health Administration
Educational Policy and Development
Holmes Safety Association Bulletin
P.O. Box 4187
Falls Church, Virginia 22044-0187**





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