Maricopa Live Steamers

STACK TALK

July, 2021

The official newsletter of the Adobe Mountain Railroad in Phoenix, Arizona.
Operated by the Maricopa Live Steamers Railroad Heritage Preservation Society.

President's Page

There will be no Board or Membership meetings in July. Enjoy the summer, and we will get back together in August.

I'm still looking for anyone willing to help Ken with the newsletter. He has suggested a maximum of six hours per month per person if 4 or 5 members would be kind enough to volunteer to help with the newsletter under his guidance. He tells me that it isn't difficult to learn. If you are interested, please send an email to MLSnewsroom@Gmail.com. **THANK YOU.**

Safety first!
Perry

COVID-19 RESTRICTIONS are relaxed but are still in place.
For members' and visitors' health and safety, follow the new rules.

If you wish to be removed from this email distribution list, please "REPLY" to this email with a request to "UNSUBSCRIBE." Please, DO NOT tag this email as JUNK.

Departures:
the Last Founding Member of the MLS

Senior Master Sergeant Roger William Netz has been cleared for take off.

Departure: June 16, 2021

Destination: The Wild Blue Yonder.

Consist: His and my hearts.

May this journey be as eventful for him as this last one was.

Roger, sir, straight ahead and safe flight into eternity and save me a seat.

10-4. Babe!

From the Desk of: Jerry Grundy

Subject: **Jerry's Train is For Sale in preparation for Jerry's and Sandra's Travel Plans**

Have a Great Trip!

Delivery needs to be discussed with Jerry. 623-628-5523. Thank you.

I want to sell my 1/8th scale Dash 9 train, cars, trailer and container.
I am asking $45,000 for the entire package.

PHOTO

- **A:** 2 Vip Riding cars (they hold 2 adults **+** 1 child)
- **B:** 1 1/2 Gondola **/** 1/2 Flat Car (has air brakes)
- **C:** 1 Flat car (Bomb Car) was a Lumber Car
- **D:** 1 Wooden Caboose (damage to right front step)
- **E:** 1 Santa Fe Box Car (tool car without tools)
- **F:** 1 Santa Fe Caboose
- **G:** 1 Coke Zero Tanker
- **H:** 1 Cattle Car
- **I:** 2 Gondolas
- **J:** 1 Orange Flat Car

1 Dash 9 with Cable Control Panel **/** with Engineer Riding Car

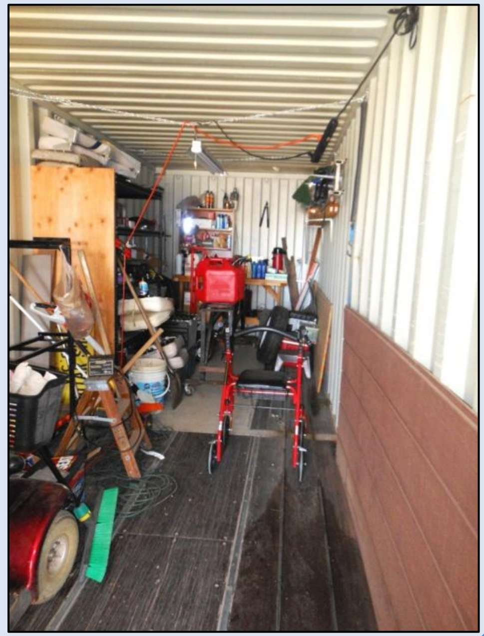
1 12 ft. Trailer with Racks on each side. The Engine goes in the center. Due to the size of the Cars, they will not all fit in the Trailer. I have had the 2 Vip Riding cars, 1 Box car (tool car), 1 Gondola, Caboose and Engine with Engineer Car in the Trailer at one time.

1 40 ft. Container Has 3 levels on the left side. Empty Space in center. There is only 1 level on the right and that is where the Engine goes. Another level could be added above the engine, if wanted.

MORE PHOTOS on PAGES 6 & 7

Trailer
(Left)

Container
(Below and Right)




Santa Fe


Santa Fe
3943


X28


A

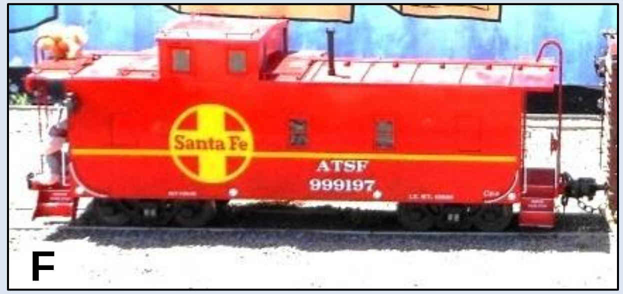

A


B
3439


C
U.S. ARMY
RED LAKE SOUTHERN
RLS 4344


D
RED LAKE SOUTHERN
RLS 0108

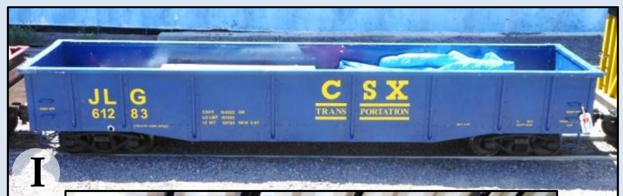

E
Santa Fe
A.T.S.F.
12813
The Chief
FAMOUS DAILY STREAMLINER
West


F
Santa Fe
ATSF
999197


G
CCCX
COCA-COLA COMPANY
24688
Coca-Cola
zero


H
MKT


I
4339


I
JLG
612 83
CSX
TRANSPORTATION


J


Santa Fe


Santa Fe

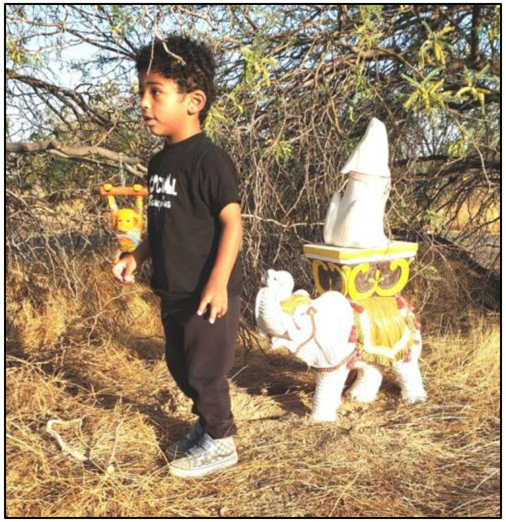

Santa Fe

MEMBER CONTRIBUTIONS!

stories and photos by Hank Gallo

Mike and Judy were making new concrete ties for track repair.

Dakota and John were displaying their newest creation, bulkhead flat cars.



Za'vion visited the elephant and monkeys.

Another Trip to the Park for Za'vion

stories and photos by Hank Gallo

He chose the Mad Dog Mining train for this trip and it ran great.

Who can resist picking up the phone to make a call**?**

Member Donna's Rock Family Reunion property.

Just above the last car of the train is Shelby's Lollipop Factory, still standing after the fire. Seems like steel was a good choice all those years ago for that building.

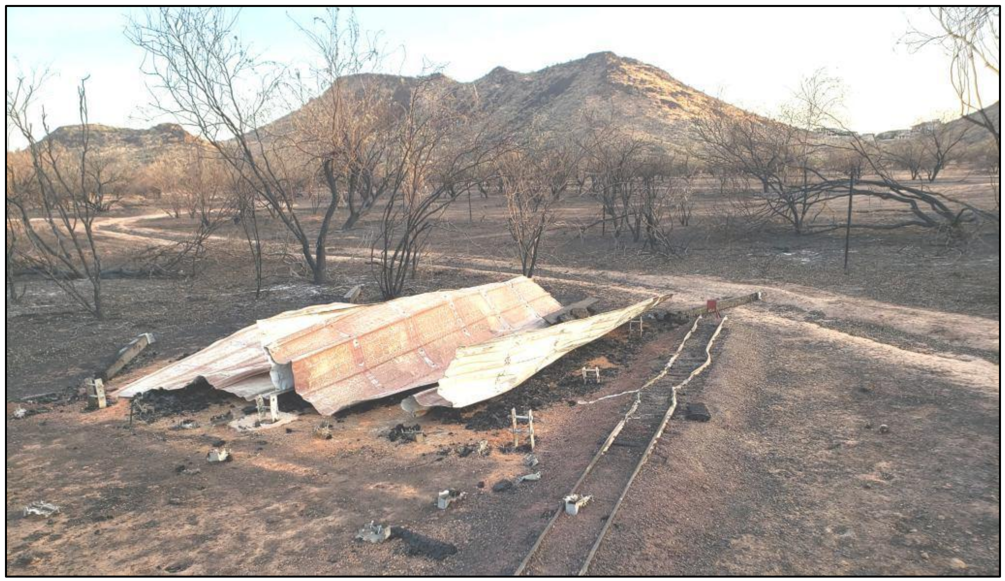
Sunset, we must hurry back to the barn, since we didn't plan to stay out this late.

More views of the Fire Damage

stories and photos by Hank Gallo

Brush fire North-West of the park Saturday evening.

This was the Wieboldt's Woods pavilion.
At the bottom of the photo the fire burned over the aluminum rails, but at the top it deformed them and caused a section to turn into a puddle due to the heat of pavilion burning.



STEAM LOCOMOTIVES
BOILER
Stokers

by Dave Griner

Hello, Folks . . . . Here we are in the midst of a full-on AZ summer . . . . and who's not excited about that!!!

Anyway, let's continue discussing stokers using the following material . . . . :

SCIENTIFIC THEORY OF GOOD FIRING

Chemistry of Combustion

38. While it is not necessary that an engineer or fireman should be thoroughly familiar with the chemistry of combustion in order to attain a high standard of efficiency, yet if any man would combine a knowledge of the theoretical part of any subject with the practical, he is bound to get better results than he would with the theoretical alone or practical alone. If he can know when he throws a shovelful of coal into the fire-box what takes place from the time the coal strikes the bed of fire until the results from it are indicated by the pointer on the steam gauge, surely he can come nearer complying with the conditions necessary for better results than can be obtained in the absence of that knowledge.

39. Chemically, everything in the world and about us comes under one of two great heads or divisions of matter. called ELEMENTS and COMPOUNDS.

40. An ELEMENT is a substance that cannot be decomposed or broken up into separate substances by any known means. Some of the more common elements are oxygen, hydrogen, nitrogen, carbon, sulpur, tin, lead, iron, copper, zinc, gold, silver, etc. Of these the first four are the chief constituents of air, water, coal and wood and are the ones that will be here considered.

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41. A COMPOUND is formed by the chemical combination of two or more elements and therefore can always be decomposed into separate substances or elements. Examples of compounds are water, wood, salt, lime, etc.

42. Another class of substances are called MIXTURES. The difference between a MIXTURE and a COMPOUND is that a compound is formed by the chemical combination, while the mixture is simply mixed together mechanically two or more elements or compounds. Air is a mixture, not a compound, for the reason that the two elements, oxygen and nitrogen, are not chemically combined. Coal is a mixture of several compounds and elements.

Air

43. The atmosphere consists of a gas called AIR, that completely surrounds the earth to an estimated height of about 50 miles. It is held in place by gravity. The weight of the atmosphere is such that it exerts a pressure of 14.7 pounds per square inch at sea level. This pressure is sufficient to force the air into all crevices and porous substances, so that it penetrates the earth to a considerable depth, its density increasing with the depth. Air is the most familiar mixture with which we deal. It is composed of two elements, *i. e.*, OXYGEN and NITROGEN.

Oxygen

44. Oxygen is one of the principal parts of the air, although not the largest, forming only about

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one-fifth of it by volume. Nitrogen is the other and forms about four-fifths of it. When any other element for which oxygen has a liking or affinity is surrounded by the air, the oxygen will leave the nitrogen and chemically combine with the other element. If this combination takes place slowly without rise in temperature, it is called slow oxidation or rusting. If it is rapid and generates heat or light, this chemical action is called COMBUSTION.

Nitrogen

45. Nitrogen, which forms about four-fifths of the atmospheric air, plays no active part in combustion. It is not chemically combined with oxygen, but only mixed with it mechanically, so it is easily separated.

It acts as a diluent in the air, and renders burning less active than it would be in oxygen alone. It is well that it does; for in an atmosphere of pure oxygen, combustion would be so rapid and temperatures would be so high that it would be impossible to maintain a fire-box, and grates would burn up almost as readily as our fuel.

The nitrogen in the air absorbs heat from the fire; and in passing through the flues gives up a large part of its heat in the same manner as the gases of combustion.

Elements that Make up a Fire

46. The nature of fuel, the composition of the air that fans the fire, the character of the gases formed by the burning fuel and the proper

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proportions of air to fuel for producing the greatest degree of heat, are the principal things to be known in studying the laws of chemistry relating to combustion.

Carbon

47. Carbon is the chief constituent of coal. It forms the larger part of the solid portion which remains on the grate after the volatile matter has been driven off; and also forms part of the volatile matter.

In the volatile matter, it is in combination with hydrogen in different proportions, forming a series of what are known as hydro-carbons. Under the influence of heat, these hydro-carbons are driven off in the form of gas, and as they are very inflammable, burn readily when mixed with oxygen. If mixed with large quantities of air, these inflammable gases are completely burned with a transparent blue flame, producing carbonic acid and steam. When raised to approximately a red heat before being mixed with sufficient quanity of air for perfect combustion, they disengage the carbon in fine powder, and the higher the temperature, the greater is the proportion of carbon thus disengaged. This disengaged carbon maintained at a red or greater heat gives the inflammable gas the red, yellow or white flame. If, however, the carbon is maintained at the temperature of ignition and supplied with sufficient air, it burns while floating in the gas. On the other hand if this disengaged carbon is cooled below the temperature of ignition before coming

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Please keep reading . . . two more pages follow. Am putting the closing here as there is no room for it on the last page.

We'll stop here for now, picking it up next month.
Yes, it is rather extensive, but wanted to give a good presentation regarding firing.
Take care,
Dave

(*continued next page*)

STOKERS (cont'd)

in contact with oxygen, it constitutes, while floating in the gas, smoke; and when coming in contact with cold surfaces, deposits on them and gradually builds up an insulating layer of soot.

Hydrogen

48. The most of the hydrogen contained in coal exists in combination with carbon, forming the hydro-carbon series. A part of the hydrogen also exists in combination with oxygen in the proportion to form water, which part adds nothing to the heat value of the coal. There is very little hydrogen contained in coal, but the heat value of hydrogen is very high—about 62,100 heat units per pound.

Composition of Fuel

49. The heat value of fuel depends upon the fixed carbon and upon the volatile matter of an inflammable nature it contains. Following is a table giving the principal constituents of the leading coals burned in the United States, also the number of heat units that ought to be generated for each pound of coal burned. The quantity of water evaporated from tank temperature to boiler pressure varies from 4 to 10 pounds per pound of coal:

	Average Fixed Carbon	Volatile Matter	Average Heat Units Per Pound
Anthracite			
Average of 4 districts	83.77	3.86	13,160
Semi-Bituminous			
Average of 6 districts in Pennsylvania and West Virginia	73.75	18.15	14,673
Pocahontas	74.39	21.00	15,070
Bituminous			
Average in 18 districts in Pennsylvania, Ohio, West Virginia, Kentucky, Tennessee, Illinois	52.25	34.75	13,000
Highest of above	60.99	35.65	14,450
Lowest of above	37.10	32.53	10,490
Illinois Bituminous			
37 districts	48.02	35.58	12,210

The remainder of the percentage is made up of ash moisture and sulphur.

Burning

50. "Burning," as it is popularly called, is a very rapid combination of oxygen of the air with any combustible material, producing both heat and light. Oxygen has a strong affinity for most elements, and especially for carbon, with which it combines very rapidly whenever they come in contact with each other at a sufficiently high temperature. The more rapid the combination, the greater the quantity of heat given off in a unit of time, and, consequently, the higher the temperature produced.

51. The combustible substances in coal are CARBON and HYDROGEN. The combustion of fuel, therefore, **is the rapid chemical combination**

of the carbon and hydrogen in the fuel with the oxygen of the air. Carbon combines with oxygen in two proportions, forming distinct substances having different chemical properties. One atom of carbon may combine with two atoms of oxygen and form CARBON-DIOXIDE, represented by the formula CO_2; or, one atom of carbon may combine with but one atom of oxygen and form CARBON-MONOXIDE, whose formula is CO. When carbon and oxygen combine to form carbon-dioxide, COMPLETE COMBUSTION is said to have been procured. When it combines with oxygen and forms carbon-monoxide, there is said to be INCOMPLETE COMBUSTION.

52. Carbon-dioxide is formed when carbon is burned in a sufficient supply of air, that is, when the oxygen is present in such quantities that each atom of carbon can have two atoms of oxygen with which to combine. Carbon-monoxide is formed by burning in an insufficient supply of air. (See paragraph 62.)

53. When green coal is heated, the hydro-carbon gases are driven off. This action begins with a temperature of about 300° F.; and most of the gases are driven off when a temperature of 1100° F. is reached. On issuing from the coal, the gases readily ignite if a supply of oxygen is available, at a temperature of 1100° F or higher.

The hydro-carbon gas, methane (CH_4), is the one generally present in the largest quantity; and is the one responsible for the ignition of the coal. In the presence of sufficient oxygen, the

hydrogen burns, forming water; and giving off 62,100 heat units per pound of hydrogen burned.

The carbon is set free, and floating in the gas, at a high temperature, gives the flame its bright, luminous color. If sufficient oxygen is present, the fine particles of carbon are burned completely to carbon-dioxide. If there is not sufficient oxygen available, fine particles of carbon escape through the stack, causing smoke; or, coming in contact with the comparatively cold heating surfaces, they deposit on them and gradually build up an insulating layer of soot.

This hydro-carbon, methane (CH_4), has a heat value of 23,850 B. T. U. To burn it completely requires 17¼ pounds of air per pound of gas; or 9⅓ cubic feet of air per cubic foot of gas.

As this hydro-carbon is distilled from green coals thrown in on top of the fire, it is very evident that in order to burn it successfully, a supply of oxygen above the fire is absolutely necessary. On account of the high heat value of this gas, the escape of even a small portion of it, unburned, means quite a fuel loss, and also is the reason why some volatile coals, even with a high percentage of ash, have a higher heat value than the burning of pure carbon.

This is another important reason why a light, level fire should be carried at all times—in order that sufficient air may pass up through it, to completely burn the hydro-carbon gases; and is another good reason why "the banking method" of firing should not be used—since placing a bank of green coal across the back end of the fire-box will cause a large volume of these gases

to be driven off at one time, and in such a manner as to prohibit their mixing intimately with the oxygen that might be available, and being burned before they escape from the fire-box.

When the fresh coal is scattered uniformly over the level fire, the gases are distilled off uniformly, and have a much better chance of coming in contact with the oxygen required for combustion.

Air Required for Complete Combustion

54. The proper supply of air to the fire is one of the most important factors connected with economical firing. It takes about 250 cubic feet of air to supply the oxygen for the complete burning of one pound of ordinary soft coal, and as one shovelful of coal weighs about 15 pounds, it will take 3,750 cubic feet of air to supply the oxygen necessary for its complete combustion, for every particle of carbon and hydrogen must be embraced by a liberal supply of oxygen to get results. An ordinary box car contains about 2,300 cubic feet, which will give you some idea of the vast amount of air that must pass through the fire-box for proper combustion. As this supply of air comes into the fire-box when the door is shut, at a uniform rate, it may be readily seen that the coal should be supplied at a uniform rate. If the coal is supplied faster than the proper amount of air can get to it, the fire will cool off instead of getting hotter.

55. In addition to having the air and gases above the fire at the proper temperature, they must be mixed. Oxygen and hydrogen combine

during combustion in only one proportion, that is, two volumes of hydrogen and one of oxygen, and this combination gives an intense heat, over four times as hot as the same amount of carbon will make. Oxygen and carbon can combine in either of two proportions during combustion. If there is sufficient oxygen present where it can touch the carbon, one part of carbon will combine with two parts of oxygen and make an intense heat; if the supply of oxygen is not sufficient, the oxygen and carbon will combine in another proportion, one part of each, and makes less heat. It is very important that we understand that the amount of oxygen, or air supply, determines, in a manner, the amount of heat that will be produced. Oxygen is free to us; it costs us nothing excepting the work of drawing it into the fire, therefore it should be used in the best proportions.

56. There is another point to be mentioned in relation to the hydro-carbon gases, and that is, being a compound they must be decomposed or split up into their elements of free carbon and hydrogen before the oxygen will combine with either of them. The temperature at which they will separate is 1100° F., and unless this temperature is maintained, the volatile matter in the coal will not be burned.

Igniting Temperature

57. Oxygen does not combine with many substances at ordinary temperatures to produce combustion. Usually, before it will combine, the temperature of the substance must be raised to a certain degree, which varies for different

substances. Some substances require but a slight increase in temperature before they will combine with oxygen, while others require heating to a very high temperature. Phosphorus, for example, combines with oxygen at a temperature of only 150° F.; sulphur at 500° F.; wood at about 1000° F., and coal at about 1200° F. While the temperature at which substances combine with oxygen differ, yet it is always the same for the same substance; that is, a given substance always combines with oxygen at a certain temperature, called its IGNITING TEMPERATURE. In all commercial fuels, the igniting temperature is lower than the temperature produced by the combustion of the fuel.

Effect of a Shovelful of Coal in the Fire-Box

58. Since the tearing-down process absorbs heat from the fire-box, it is evident that the introduction into the fire-box of any compound which requires this tearing-down process will result in reduction of fire-box temperature.

Water is such a compound. When a pound of hydrogen burns, it combines with 8 pounds of oxygen and forms 9 pounds of water; and generate 62,100 heat units.

If this 9 pounds of water is introduced into the fire-box, either as self-contained moisture in the coal or as water sprinkled on the coal, it is broken down in the presence of the highly heated carbon, and absorbs 62,100 heat units—or the same amount of heat produced when the water was originally formed.

When this breaking-down process takes place in the presence of highly heated carbon, the oxygen combines with the carbon to form carbon monoxide (CO), while the hydrogen is set free.

If these gases are again brought into contact with a sufficient quantity of oxygen, at a high enough temperature, the (CO) burns to carbon dioxide (CO_2), and the hydrogen unites with oxygen to form water.

These two reactions give off heat equal in amount to that absorbed when the water was broken down. However, the water so formed passes out the stack as superheated steam, carrying with it an appreciable amount of heat, which is wasted.

At a front end temperature of 600° F., every pound of water escaping carries with it about 1300 heat units; or, a gallon of water so escaping will carry away about 11,000 heat units—or as much as is contained in a pound of many of our commercial coals.

It is evident that care should be used as to the quantity of water that we place in the fire-box. While it is necessary at times to sprinkle down the coal on the tender—in order to reduce the loss of fine coal passing out the fire-box unconsumed, as well as for the comfort of the engine crew—there is a point at which the loss due to the water on the coal will more than counterbalance the loss due to the escape of fine particles of coal unconsumed.

59. When fresh coal is placed in the fire, it begins to absorb heat at once, which reduces the

(*continued next page*)

STOKERS (cont'd)

amount of heat available for making steam. This fresh coal must be heated up to between 300° F., and 400° F., before the hydro-carbon gases begin to pass off as they are roasted out of the coal. The fixed carbon left begins to burn at 1200° F. If the supply of air is just sufficient for the fixed carbon and combines with it on the grates first, the gases that are roasted out of the coal will have no air for their share and will pass away without burning.

60. A temperature lower than 1200° F. in the fire-box will waste the gases, and as they form about 30% of the coal and a much larger percentage of its heating value, it will be seen that when a fresh charge of coal cools the fire-box temperature below the igniting temperature of the gases, that about one-half of the heat value of the coal is wasted. This is one of the reasons when the steam pressure drops when a heavy charge of coal is placed in the fire-box; it is also the reason why so much smoke passes away from a heavy fire. The fire-box temperature has been reduced by the loss of heat going into the fresh coal, so that it does not leave enough to ignite the hydro-carbons being expelled from the fresh coal. In addition, a heavy charge of green coal causes a large volume of hydro-carbon gases to be driven off, with an insufficient supply of oxygen available for combustion. The result is a dense volume of black smoke, high heat loss and drop in steam pressure.

61. One or two scoops of coal at a time will not reduce the temperature of the fire-box below the igniting point and will produce some heat in

a few seconds to be ready to warm up the next charge. A high fire-box temperature is absolutely necessary to promote a complete combustion of the bases; as soon as the temperature drops below their igniting point, the fixed carbon on the grates must alone be depended upon to produce the heat, while the hydro-carbon gases pass out of the stack unconsumed.

62. The most difficult part of the chemistry of combustion for the fireman to understand is that carbon and oxygen can combine in one proportion and produce heat, while the combination in another proportion will produce not quite one-third as much heat. Heat is measured by the effect it has on a certain quantity of water. A heat unit is the amount of heat necessary to raise the temperature of one pound of water at 39° F. up to 40° F., or one degree higher. When it is understood how heat units are measured, it is easier to understand how it may be determined that a pound of carbon contains a certain number of heat units. When sufficient air passes through the grates to give the burning carbon all the oxygen needed, each pound of carbon will produce 14,500 units of heat and will, of course, raise the temperature of the water correspondingly high; to do this takes two portions of oxygen and one of carbon. But if the supply of air is restricted so that the burning carbon does not get the necessary full supply of oxygen, it will combine in another proportion, one of carbon and one of oxygen. In the first instance, one part of carbon combines with two parts of oxygen and forms carbon-dioxide, which produces a

greater amount of heat—14,500 heat units—sufficient to convert 15 pounds of water into steam; and in the second instance, when one part of carbon combines with only one part of oxygen, instead of two, it forms carbon-monoxide, and gives off only 4,500 heat units, or just enough to convert 4¾ pounds of water into steam—less than one-third as much as when all the oxygen needed is supplied. When only half the necessary amount of oxygen is supplied less than one-third (⅓) of the work is done that would be possible with the full amount of oxygen supplied. In each case the same amount of coal will be used, but on account of the limited supply of oxygen, and the imperfect burning, less than one-third the proper amount of water will be turned into steam and steam is what is wanted. At the same time by having incomplete combustion, the carbon from the hydro-carbons (see paragraph 53) will cause an excessive amount of smoke, and smoke is not wanted.

NOW, DO YOU UNDERSTAND THE REASON FOR LIGHT, BRIGHT, LEVEL FIRING?

Instructions to Engineers

63. The instructions thus far have been devoted almost exclusively to firemen, but the engineer, who uses the finished or manufactured product, can, by close cooperation with and intelligent direction of the fireman, make it possible to obtain the best results, so he is an important factor in any scheme of fuel economy and elimination of the black smoke.

64. The engineer is in charge of the locomotive. *His instructions must be followed, for he is responsible for the economical use of fuel and other supplies used on the locomotive.* He will give suggestions to the fireman, based on his experience, and which, in his opinion, will produce the best results.

65. A large proportion of a good coal record can always be traced to the engineer, who, by intelligent interest in performing his duties, accomplishes smooth, steady running. On the contrary, if the engineer takes but little interest the fireman will soon be compelled to take things as they are and may be blamed for the lack of skill and carelessness of the engineer. This is especially important when an estimate is made of the saving that would be realized were each engine crew to save, say, twenty-five dollars monthly, or $300 yearly (which it is thought can easily be done), on an annual expenditure of about $4,200 per year, for the coal used by each engine crew.

Important Knowledge about Locomotives.

66. While the successful engineer does not entirely depend upon fuel saving to determine his value to the company employing him, yet fuel saving is considered one of his most important duties. The question of taking care of his engine, making proper inspection, both on line of road and at terminals, also seeing that suitable and intelligent reports of work needed on the locomotive are properly made on arrival at final terminal, are quite important and cannot be neglected.

67. Standing instructions provide that water gauge and column must be blown out and gauge cocks tried before each trip on a locomotive. It is particularly important that this be done and that it be repeated frequently on line of road with careful notice of the time it takes for the water to rise in the glass to the point at which it stood before the drain cock was opened. The gauge cocks should be tried frequently to be sure that the water glass and gauge cocks are functioning properly.

68. The most economical method of feeding the boiler is to leave the injector on continuously or as nearly so as possible and adjust the feed according to the conditions of the run.

69. Careful attention must be given to the use of the injector and the height of water level in the boiler. The proper handling of the injector is a very important matter in fuel economy. The best fireman cannot make a showing if the engineer does not carry his water at a steady uniform height in the boiler.

70. No one is qualified to operate a locomotive who does not know in advance what should be done and how to do it quickly, in every emergency in train service, because in case of accident or mishap there is not time to study up situations and remedies. Every engineer should be able to act instantly and should be familiar with the best methods of meeting any situation. He should studiously avoid the necessity of wiring the Road Foreman of Engines, Master Mechanic or Superintendent for information that he ought obviously to be posted about and able to act

upon without delay. However, he should ask for instructions whenever he feels he is not thoroughly conversant with the situation.

71. When an engineer does not know in advance what engine he is to run (when the locomotives are pooled), he should, upon taking charge, exercise special care to see that his locomotive is provided with the necessary tools and appliances.

72. Leaks have a very detrimental influence on fuel economy and should be stopped. Leaking valves, cylinder packing, piston rod and valve stem packing, flues, staybolts, etc., will receive prompt repairs when properly reported by the engineer upon arrival at the terminal.

73. Another matter which is not given the careful consideration and attention by many engineers that it deserves is the matter of slipping the driving wheels of the locomotive when starting a heavy train. Not only is this practice very hard on the machinery of the locomotive and on the rails, but it causes a waste of fuel by throwing unburned coal from the stack on account of the violent exhaust, and by the waste of steam, from which no useful work is derived. In addition to the above, the fire is badly torn up and disturbed and holes are often formed which require the fireman to throw in fresh fuel at the very time the doors should be closed. Also the adhesion of the driving wheels is very much reduced, so that the engine cannot possibly start as heavy a train when the wheels are allowed to slip as it can when care is exercised by the engineer to prevent the wheels from slipping.

74. Avoid dropping sand on the rails when the wheels are slipping, without first shutting off the throttle. The strain put on the machinery by the sudden grip of the wheel on the rail is very severe and is apt to twist the crank pins and tear off the rods, for all the strain comes from the wheel that first catches the sand. It is a good practice to drop sand on the rails while making a stop, in order that the start may be made without slipping. On engines equipped with rail washers, they are to be used enough to clean the rails at all times while the engine is in motion when hauling a train except when using the brake to make final stops and through interlocking plants in freezing weather.

Fuel Standards

75. A record is kept of the coal used on every trip by each engine. This amount is then placed on the engineer's and fireman's fuel record. A standard amount of fuel for every run and type of power has been determined from average amounts used. At the end of each month the total of actual and total of standard amounts are added and the total standard divided by the total actual amount. This figure will represent the fuel performance of the engineer or of the fireman. These fuel performance records will be posted on bulletins and copies retained and will be considered when men are proposed for promotion.

Instructions for the Operation of Superheater Locomotives

76. In general the same operating practice approved for saturated locomotives holds good

for superheater locomotives. The superheater is merely a series of steam tubes located in the large flues in order to deliver hotter steam to the cylinders. The fact that a superheater engine uses hotter steam in the cylinders than a saturated steam locomotive is the only essential difference between the two. The best economy of steam and coal will be obtained when the locomotive is worked with full throttle where conditions require and the speed regulated by changing the reserve lever until a cut-off of about 30 per cent. is reached, provided that the cut-off should not under any conditions be shortened enough to result in excessive compression, causing the rods and boxes to pound and the engine to ride hard. Any reduction in speed after that proper operating cut-off has been reached should be made by reducing the throttle opening. In drifting down grade or in slowing down for a stop, enough steam must be admitted to the cylinders to prevent air and smoke-box gases from being drawn into the cylinders to destroy the lubrication. This should be done by cracking the throttle when drifting or by the use of the drifting valve.

77. In the operation of a superheater locomotive, the following suggestions should be carried out:

(a) The lubricator should be started at least fifteen minutes before moving locomotive in order that the valves and cylinders may be thoroughly lubricated when starting on the trip. The oil supply to the cylinders should be constant, as the superheater locomotive, due to the higher temperature

Union Pacific Dispatchers Answer the Calls to Safety

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When there's an emergency and you pick up the phone to report, you always hope there's a hero on the other end of the line who knows the next step. At Union Pacific, those heroes are the Response Management Communications Center's (RMCC) critical call dispatchers who are ready to respond to emergencies 24/7.

From hazmat to trespassers to derailments, the dispatchers field just about every call one can imagine when it comes to the rail industry, according to Kalab Johnson, critical call dispatcher, RMCC, Law. Johnson is part of a crew of 41 individuals who put their daily focus on responding to calls quickly and efficiently to ensure safety on and around the tracks. "Every call yields a different response, but our protocol is very refined through years of practice," Johnson said. "It really just depends on the incident, but our calls are always a step in making the situation safer."

The team averages 1,000 calls daily. Critical call dispatchers answer emergency calls within 7 seconds on average, exceeding the national standard by 3 seconds. While not all calls require critical responses, RMCC employees agree that it's always important to call if there seems to be a problem on or around the tracks. Johnson says one won't always know the severity or potential risks, so he and his teammates encourage the public and employees to make those calls and "report first" if they see a safety risk, because the public is crucial in maintaining safety as well. Johnson, who's been with the RMCC since 2017, says some calls are speculation, but one recent event he responded to was unlike anything he'd experienced in his time at UP.

An Oregon sheriff's deputy called reporting that a boulder "bigger than an automobile" had landed on the tracks and had taken out part of a public highway above the tracks. Upon inspection by a UP track inspector, the boulders had taken out two main tracks. Johnson contacted train dispatchers to halt train traffic over a 3-mile span, which included a nearby train. "First and foremost, we prevented employee injury, prevented damage to our property and delay to customers," Johnson said. "Through our actions, we help do what the railroad does, and that's move trains." By doing what he does, his quick actions don't go unnoticed.