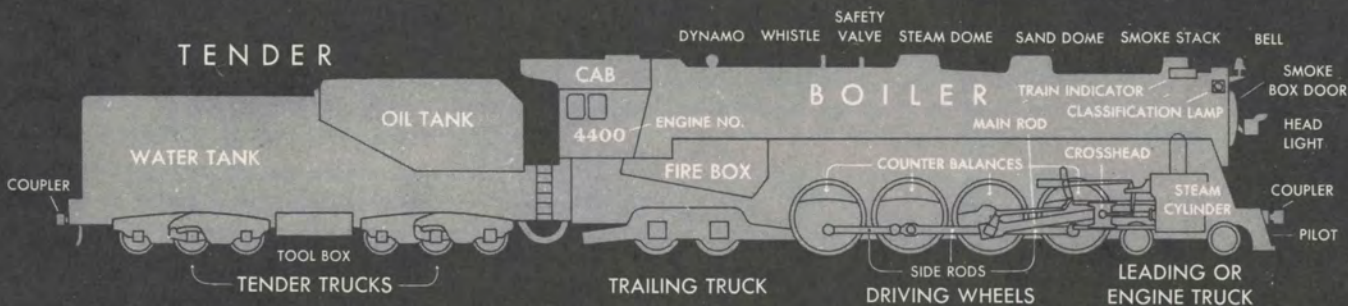


Southern Pacific TRAIN PRIMER



A LITTLE BOOK ABOUT OUR LOCOMOTIVES AND WHAT THE SIGNS AND SIGNALS MEAN

GREETINGS FROM SOUTHERN PACIFIC

Most people, I think, get a thrill when they see a giant locomotive thunder by. Certainly all railroad men do. For even when you work every day on the railroad, the glamor of engines and trains and tracks never dies out.

In this little booklet we take you behind the scenes on Southern Pacific showing you how to tell our locomotives apart and what the signs and signals mean.

There is a good reason for every sign, signal, rule and regulation on Southern Pacific, and most of them are based on safety. "Safety First" is drilled into every one of us from the very first day we start in the service.

You may think of a railroad in terms of trains and tracks. Actually the Southern Pacific Company is 60,000 men and women. The trains and tracks are only the tools with which we work.

For example, a locomotive is simply a machine controlled by men. These men know that hundreds of people on the train behind are depending upon them for a comfortable trip, smooth starts and stops. They take more pride in doing this job well than you can possibly imagine, unless you've been an engineer yourself.

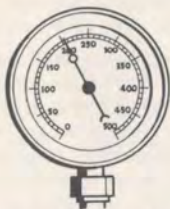
Boys who are sufficiently interested in railroading to read this book may wish to be one of our "Junior Engineers." Full information about the "Junior Engineer's Club" is available from the engineer on duty at the "Southern Pacific Roundhouse," Vacationland Building, Golden Gate International Exposition.

Sincerely,

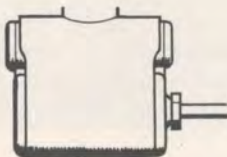
A handwritten signature in dark ink, appearing to read "J. H. Dyer". The signature is fluid and cursive, with a long, sweeping underline that extends to the left.

J. H. DYER,
Vice-president in Charge of Operations,
Southern Pacific Company

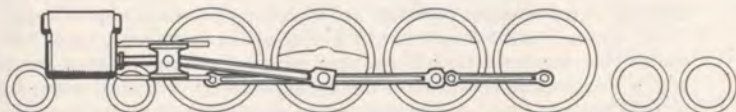
HOW TO TELL OUR LOCOMOTIVES APART



1. STEAM PRESSURE GAUGE



2. THIS IS A STEAM CYLINDER



3. THIS IS THE WHEEL ARRANGEMENT OF A 4-8-4 LOCOMOTIVE

The easiest way to tell locomotives apart is to count the wheels. For example, some wheel arrangements look like this on each side: $\infty\infty\infty\infty\infty$. By doubling this number you get a total of 4-8-4. So it is called a "4-8-4" type locomotive. Counting back from the front, this locomotive has 4 leading truck wheels, 8 driving wheels and 4 trailing truck wheels. (See figure 3.) The wheels on the tender are not counted. All locomotives of the same type have the same wheel arrangement.

The wheel arrangement, however, is not the only big difference between types of locomotives. There are differences in length, weight, horse power, tractive power, boiler pressure (figure 1), size of cylinders (figure 2) and diameter of drivers (figure 4). All these things make a difference in the power of the locomotive.

"Tractive power" is the "pull." This comes from boiler steam pressure, size of cylinders, the weight of the locomotive upon the driving wheels and the size of driving wheels. The weight is very important, or the driving wheels will slip.

"Horse power" is the power a locomotive develops to pull a train when it is moving. This comes from the size of the boiler and firebox, the boiler pressure, the temperature of the steam and the size and design of the cylinders. For high speed steam locomotives the driving wheels must be large. For pulling freight on steep grades, they should be smaller.

All locomotives have many safety devices for the protection of the crew and passengers. They help make railroad travel safe. For example, "safety valves" keep steam pressure from going higher than it should (figure 5).

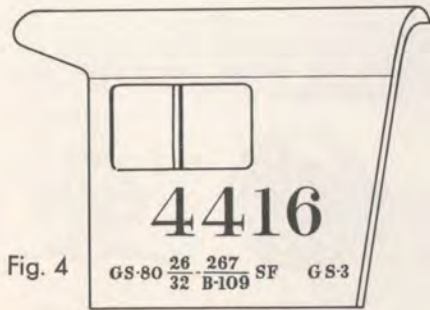
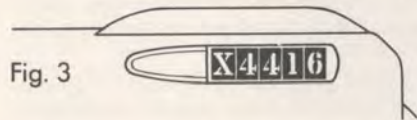
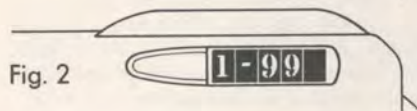
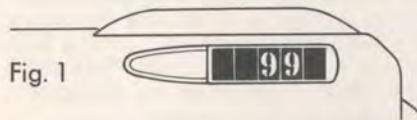


4. DRIVE WHEEL



5. SAFETY VALVE

WHAT THE NUMBERS ON OUR LOCOMOTIVES MEAN



On either side of the smoke stack there are lighted numbers. These are "train numbers" (See figure 1). All our trains carry such numbers.

All trains going *toward* San Francisco are called "westward" trains and are odd-numbered such as 1, 3, 5, and so on. All trains going *away* from San Francisco are called "eastward" and are even-numbered such as 2, 4, 6, and so on. A train going north from San Francisco is an "eastward" train, while a train going north from Los Angeles is a "westward" train because it is going to San Francisco. Figure 1, for example, shows 99 as the train number which is the number of the streamlined *Daylight*, northbound.

In order to carry all the people wishing to ride on the same train, it is sometimes necessary to operate the train in two or more separate parts, which are called "sections." When a train is operated in sections, the first section carries a "1" preceding the train number as shown in figure 2. The second section carries a "2" preceding the train number etc. Special trains or "extras" carry the locomotive number preceded by an "X" (See figure 3).

On the sides of our locomotive cabs there is a group of letters and numbers that give much information about the locomotive. Take the example at the left (figure 4). Here is what the numbers mean:

4416—Serial number of the locomotive GS-3—Class of locomotive

GS-80 $\frac{26}{32}$ $\frac{267}{B-109}$ SF

This looks hard. But it isn't. It tells quickly the important facts about the locomotive. "GS" is short for "Golden State" type. "80" tells you that the driving wheels are 80 inches in diameter. "26" is the diameter of the cylinders in inches. "32" is the stroke of the pistons in inches. "267" means that the weight on the driving wheels is 267,000 pounds. "B" means that this locomotive is equipped with a "booster," a small steam engine attached to the wheels of the trailing truck to give extra power for smooth starting. "109" means that there are 109,000 pounds weight on the trailing truck wheels. "SF" means that the engine is equipped with a "super heater" and a "feed water heater."

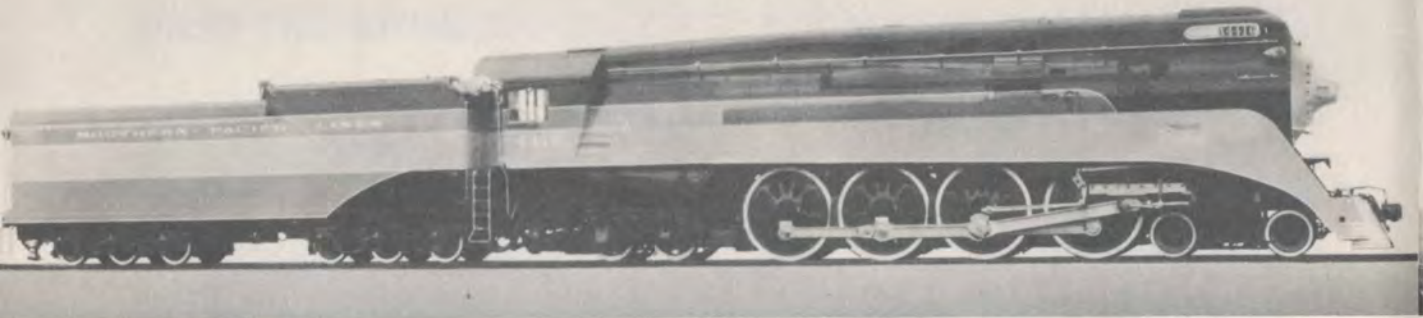


No. 1

This is the *C. P. Huntington*, Southern Pacific's No. 1 locomotive. It is one of the pioneer locomotives of the Central Pacific that came around Cape Horn by boat. It arrived in 1864. For many years it was used in passenger service, later in switch service. The *C. P. Huntington* withdrew from use when freight and passenger service became too heavy for it to handle. Now the locomotive is on permanent display in front of S.P.'s Sacramento station.

The *C. P. Huntington* is a wood-burner. It is 32 feet in

length and weighs 39,000 pounds. It has a 4-2-4 wheel arrangement. Its tractive power is 3,570 pounds, and it can develop about 250 horse power. The cylinders are 11 inches in diameter with a stroke of 15 inches. It has a boiler pressure of 125 pounds to the square inch. The drivers are 54 inches in diameter. It could haul four cars weighing 22 tons each at 35 miles an hour up a grade of 26 feet to the mile, which is a grade of one-half percent. S.P.'s largest locomotives, the AC-7 class, are about 4 times as long and 35 times more powerful.



This is a Streamlined "Golden State" Type Locomotive

4-8-4 ○○ ○○○○ ○○

The 4-8-4 locomotives are called the "Golden State" type ("GS" for short). Some people call them the *Daylight* type, because they are used on the *Daylight* streamliner. They are numbered from 4400 to 4429.

Most of these locomotives are streamlined and are painted red, orange and black like the *Daylight*. When they were built, they were the largest streamlined steam locomotives in the world. And, probably they still are.

The 4-8-4 wheel arrangement is a growth from the 4-8-2 or "Mountain" type locomotive. By adding a pair of extra wheels on the trailing truck under the cab, there is space for a larger boiler and larger fire-box, which helps the locomotives develop greater power at high speed. These locomotives can go 106 miles per hour!

The 4-8-4 locomotives have many other improvements to

increase their speed and safety. For the safety of the public they have an air horn in front in addition to a whistle. The horn can be heard a long way and warns everyone to watch out.

These streamlined locomotives are used on the famous *Daylight* and some of the other fine passenger trains running between San Francisco and Los Angeles, including the *Lark* and the *Sunset Limited*. Sometimes they are used on the fast *Overnight* freight train, too.

Facts about the "Golden State" type locomotive:

Length of engine and tender: 110 feet $3\frac{3}{4}$ inches.

Weight of engine and tender loaded: 833,000 pounds.

Horse power: 5,000. Tractive power: 76,650 pounds.

Size of cylinder: diameter 26 inches; stroke 32 inches.

Boiler pressure: 280 lbs. Diameter of drivers: 80 in.



This is One of Southern Pacific's Famous "Cab-in-Front" Locomotives

4-8-8-2 ○○ ○○○○ ○○○○ ○

Some people call the 4-8-8-2 locomotives "back-up" locomotives. Others call them "cab-in-front" locomotives. Their real name is "Articulated-Consolidation" and their nickname is the "A-C" type. They are numbered from 4100 to 4176.

Southern Pacific is the only railroad in this country using steam locomotives with the cab in front. We use them because the engineer and fireman can see farther down the track. This makes for greater safety around curves and through tunnels and snowsheds in the mountains.

The 4-8-8-2 locomotives are really two engines combined in one. They have one boiler which serves two sets of cylinders driving independent groups of wheels. "Consolidation" is the name of an older type of freight locomotive having eight driving wheels.

The 4-8-8-2 locomotives are very long and very heavy. They are very powerful, too. They are the largest and most powerful locomotives in use on the Southern Pacific. For their size they are very fast. They can go 70 miles per hour! These big, fast, powerful locomotives are used to haul heavy freight and passenger trains over the steep grades in the Sierra and Cascade Mountains. On the Overland Route they pull the *Overland Limited*, *San Francisco Challenger*, and *Pacific Limited* up the Sierra.

Facts about the big "A-C" type locomotive:

Length of engine and tender: 125 feet 6 inches.

Weight of engine and tender loaded: 1,028,700 pounds.

Horse power: 6,000. Tractive power: 124,300 pounds.

Size of 4 cylinders: diameter 24 inches; stroke 32 inches.

Boiler pressure: 250 lbs. Diameter of drivers: 63 in.



This is a Well-Known "Mountain" Type or 4-8-2 Locomotive

4-8-2 ○○ ○○○○ ○

The 4-8-2 locomotives are called "Mountain" type. When first built they were thought to be very big and very powerful. They were used in mountain country.

Locomotives of this type are numbered from 4300 to 4390. On the side of the locomotive cab are the letters "Mt" meaning, of course, "Mountain."

The 4-8-2 locomotives are a growth from the smaller 4-6-2 "Pacific" type locomotives that were widely used when the trains were not as long and heavy as they are today.

By adding one extra pair of driving wheels the 4-8-2 locomotives became heavier than the 4-6-2. This meant more tractive power. The extra drivers made space for a larger boiler. This gave the 4-8-2 locomotives more power.

Now the Southern Pacific uses the 4-8-2 or "Mountain"

type locomotives to pull heavy passenger trains and fast freight trains. On the Sunset Route they pull the famous *Sunset Limited* and the *Argonaut*. On the Golden State Route they pull the *Golden State Limited* and *Californian*.

On the Shasta Route between California and Portland they haul the fast *Cascade*, and other passenger trains. On the Overland Route they pull the *Forty-Niner* streamliner.

The 4-8-2 locomotives are also used to pull fast freight trains where the grades are not steep.

Facts about the "Mountain" type locomotive:

Length of engine and tender: 97 feet, 8½ inches.

Weight of engine and tender loaded: 659,000 pounds.

Horse power: 3500. Tractive power: 67,670 pounds.

Size of cylinder: diameter 28 inches; stroke 30 inches.

Boiler pressure: 210 lbs. Diameter of drivers: 73 in.



This is a Powerful "Southern Pacific" Type 4-10-2 Locomotive

4-10-2 ○○ ○○○○○○ ○

The 4-10-2 locomotives are called the "Southern Pacific" type. They were given this name because the Southern Pacific Company was the first road to use them. The nickname for these locomotives is, of course, the "SP" type.

When the 4-10-2 locomotives were built several years ago they were the most powerful locomotives of their type in the world.

Locomotives of this type are numbered from 5000 to 5048. The 4-10-2 type locomotive is a growth from the 2-10-2 type. One pair of extra leading truck wheels were added to give more space for a third cylinder. (Most regular type locomotives have only two cylinders.) This third cylinder is placed inside the frame and cannot be seen easily from the side of the locomotive.

The 4-10-2 locomotives are used on Southern Pacific's Sun-

set and Golden State Routes through Southern California, Arizona and New Mexico. The mountain grades in this part of the country are not as steep as those over the High Sierra.

Most of the time, these locomotives are used to pull long freight trains of refrigerator cars. The "reefers" are filled with Western fruits and vegetables for the people in the East to eat and enjoy.

Facts about the "Southern Pacific" type locomotive:

Length of engine and tender: 101 feet 2 inches.

Weight of engine and tender loaded: 736,000 pounds.

Horse power: 4100. Tractive power 96,540 pounds.

Size of cylinders: diameter 25 inches; stroke of outside cylinders 32 inches (inside, 28 inches).

Boiler pressure: 225 lbs. Diameter of drivers: 63 inches.



This is a 2-10-2 Type Locomotive. It is Used to Pull Freight Trains

2-10-2 ○○○○○○

The 2-10-2 type locomotive looks like a very powerful locomotive, and it is. These locomotives were designed several years ago to pull heavy freight trains.

Before the 2-10-2 type was built, the 2-8-2 type locomotives were used to pull heavy freight trains. They were not strong enough to pull the freight trains as they became longer and heavier. So one pair of driving wheels were added to the 2-8-2 wheel arrangement to make the more powerful 2-10-2 type.

The one extra pair of driving wheels made the 2-10-2 locomotives longer, heavier and provided more tractive power. It made space for a larger boiler which increased the power. Southern Pacific numbers the 2-10-2 type locomotives from 3600 to 3769. The initial "F" on the side of the cab stands for locomotives of this wheel arrangement.

During later years more powerful and faster locomotives have been built. First there was the 4-10-2 or "Southern Pacific" type locomotive which took over much of the work of the 2-10-2. Later the 4-8-8-2 or "A-C" type locomotive took over more of the work because it was more powerful and faster than either the 2-10-2 or 4-10-2.

Today the 2-10-2's are still being used in many places where the grades are not steep. They pull long freight trains across Nevada and other parts of the S.P. lines.

Facts about the big 2-10-2 type locomotive:

Length of engine and tender: 97 feet 10 inches.

Weight of engine and tender loaded: 660,800 pounds.

Horse power: 3100. Tractive power: 86,120 pounds.

Size of cylinder: diameter 29½ inches; stroke 32 inches.

Boiler pressure: 200. Diameter of drivers: 63 inches.



This Is a 4-6-2 or "Pacific" Type Locomotive

4-6-2 ○○ ○○○ ○

The 4-6-2 locomotives are called the "Pacific" type. They developed from the 4-4-2 or "Atlantic" type.

The 4-6-2 locomotives were designed years ago. At first they were considered "big." They were used to pull the important passenger trains. At that time the 4-4-2 was one of the most important type of passenger engines. The 4-6-2 was bigger than the 4-4-2. They were more powerful so they became very important, too.

As years passed, passenger locomotives grew bigger and more powerful. Soon the Pacifics no longer pulled the big passenger trains. Larger locomotives took their place in this work. But the Pacifics remained important. They pulled the small, fast passenger trains in level country. They pulled the trains that took people back and forth to work. Today they are still faithfully doing this same job.

Southern Pacific continued to obtain Pacific type locomotives. The later ones were bigger, and more powerful than the first ones. They kept the same wheel arrangement.

The initial "P" stands for locomotives of this kind. They are numbered from 2400 to 2491 and 3100 to 3129. Of all the different types of locomotives owned by Southern Pacific, probably more people know or can tell the Pacific than any other type.

Facts about a big Pacific type locomotive:

Length of engine and tender: 90 feet 11¼ inches.

Weight of engine and tender loaded: 549,600 pounds.

Horse power: 2500. Tractive power: 53,340 pounds.

Size of cylinders: diameter 25 inches; stroke 30 inches.

Boiler pressure: 200 pounds per square inch. Diameter of drivers: 73 inches.



This Is a "Ten-Wheel" Type Engine

4-6-0 ○○ ○○○

The 4-6-0 locomotive is called the "Ten-Wheel" type. It is easy to see how it got its name. Just count the wheels!

Ten-Wheelers were formerly used for through passenger and fast freight service. At present many of them pull local trains around San Francisco. Others haul freight in local service, where trains are light.

Although they are small compared to modern locomotives, Ten-Wheelers are still very useful in local service. No more of these are being built by S.P., however.

"T" is the initial that stands for 4-6-0 locomotives. They are numbered from 2103 to 2384.

Facts about the largest size Ten-Wheel locomotives:

- Length of engine and tender: 77 feet $1\frac{3}{16}$ inches.
- Weight of engine and tender: 392,800 pounds.
- Horse power: 2000. Tractive power: 38,320 pounds.
- Size of cylinders: diameter 23 inches; stroke 28 inches.
- Boiler pressure: 210 lbs. Diameter of drivers: 69 in.



This Is a "Six-Wheel" Switcher

0-6-0 ○○○

The 0-6-0 locomotives are called "Six-Wheel" switchers. Since switch locomotives must make sharp turns onto side tracks and spurs, they have no leading or trailing truck wheels. All they have are driving wheels.

Switchers of this type are small. Their work does not require great power or high speed.

The initial "S" stands for 0-6-0 switchers which are numbered from 1079 to 1299. Southern Pacific has some 0-8-0 switchers that are called "SE" or "Eight-Wheel" switchers. They are numbered from 1400 to 1409. They are used in freight yards where the loads handled are heavy.

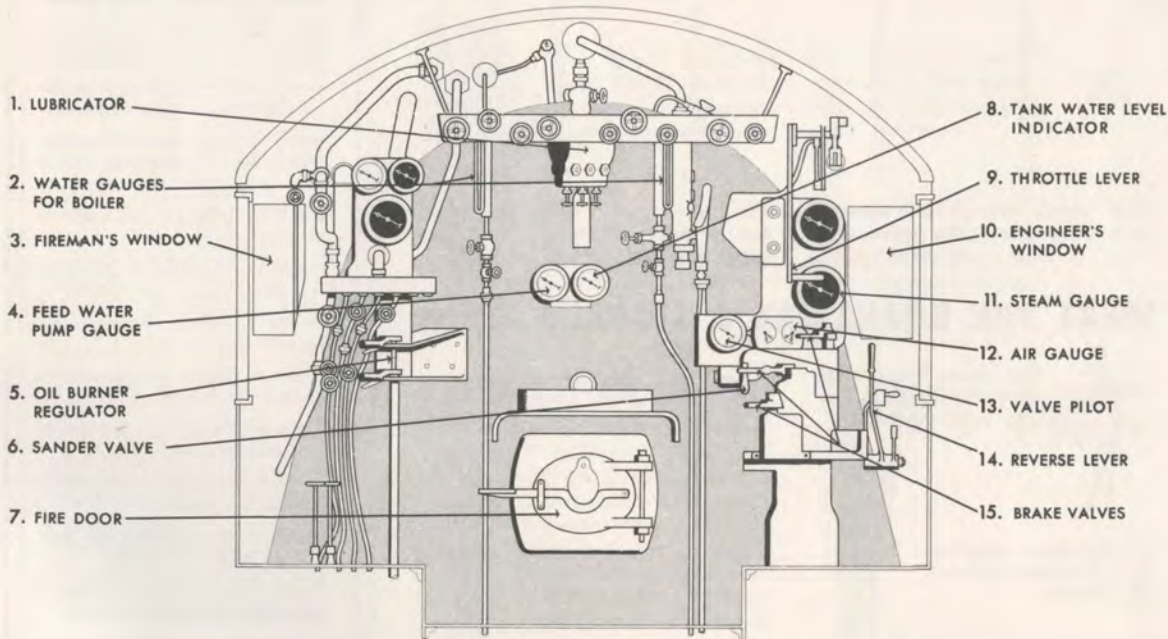
Facts about the 0-6-0 type Switch locomotive:

- Length of engine and tender: 61 feet 6 inches.
- Weight of engine and tender: 278,300 pounds.
- Horse power: 1450. Tractive power: 31,020 pounds.
- Size of cylinders: diameter 20 inches; stroke 26 inches.
- Boiler pressure: 200 lbs. Diameter of drivers: 57 inches.

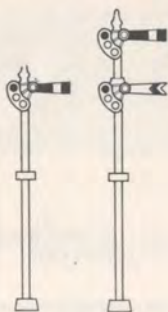
WHAT IS INSIDE THE CAB

All of us want to be locomotive engineers. All of us know how important his job is to watch out for everyone's safety and to run his train right on time. Few of us know what he has in the cab to help him run his locomotive. The picture

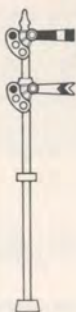
below is a drawing of the inside of a streamlined Golden State type locomotive cab. The drawing shows the gauges, the valves and all the other things the engineer must watch and use to run his locomotive properly.



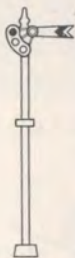
THE LANGUAGE OF THE BLOCK SIGNALS



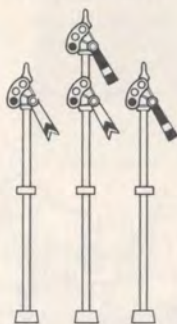
Block signals in this position mean "stop."



A block signal like this means "proceed with caution."



This means "proceed prepared to stop at next signal."



Block signals in this position mean "proceed" or "go."

WHAT THE BRAKEMAN'S SIGNALS MEAN



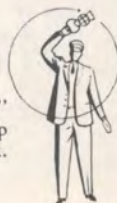
This means "stop." He swings his hand, flag or lamp across the track.

This brakeman is signalling "go." He raises and lowers arm vertically.



This signal means "reduce speed." He holds flag or lamp out at arm's length.

This one means "back." He swings the flag or lamp in a circle across the track.



WHAT THE LIGHTS MEAN

Red—stop.

Yellow—proceed with caution.

Green—proceed or go.

WHAT OUR WHISTLES MEAN

Below, the sign "o" means a short sound. "—" means longer sound.

— o — (Nearing a public crossing like a road or highway).

— (Nearing stations, junctions, drawbridges, mail cranes located between stations, etc).

o o (This is the engineer's answer to most signals).

o o o (When train is standing, this signal means "back up").

— o o (To call attention to signals for a following section).

— o o o (Signal for flagman to protect rear of train).

o o o — (Signal for flagman to protect front of train).

— — — — (Signal for flagman to return from west).

— — — — (Signal for flagman to return from east).

Many short sounds (Warning to persons or livestock on track).

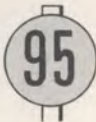
THE LANGUAGE OF THE RAILROAD MEN

- "Barn"—engine house.
"Brain plate"—a trainman's badge.
"Captain"—conductor.
"Crummy"—a caboose.
"Deadhead"—a person riding on a pass.
"Flimsy"—train order.
"Gate"—a switch.
"Gun"—torpedo for signaling.
"Highball"—a "clear track" signal.
"High iron"—main line track.
"Hog"—a locomotive.
"Hogger," "hoghead"—a locomotive engineer.
"Hole"—sidetrack for passing trains.
"Hotshot"—fast train.
"On the carpet"—office of the boss.
"Rattler"—freight train.
"Red Ball"—fast freight.
"Reefer"—refrigerator car.
"Reefer Block"—freight train of "reefer" cars.
"Shack"—a brakeman.
"The Old Man"—superintendent or boss.
"Trick"—shift, hours of duty.

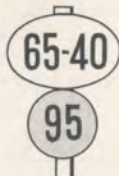
WHAT THE SIGNS MEAN



This is a "speed board" showing first, speed limit for passenger trains; second, speed for freight trains.



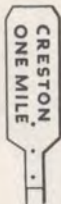
This is a "streamliner speed board." It is yellow. It tells how fast the streamliners may go.



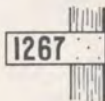
These two "speed boards" show (top) speed limit for regular trains (bottom) for streamliners.

This funny looking framework is usually called a "telltale" but its real name is "impaired overhead clearance indicator." "Telltals" are placed 150 feet in front of a tunnel or some place under which the train passes. It warns the train crew to duck so that they won't be hurt. The things hanging down are ropes. Safety for passengers, fellow workers and yourself is the most important thing in railroading.

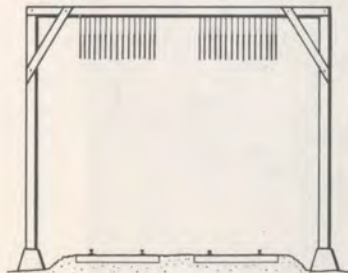
This is a "station 1 mile post" which tells the engineer that it is one mile to the next station.



This is a "mile post" which shows how many miles it is to the western end of the line.



This is a "whistling post" for crossings, roads, etc. It tells the engineer to whistle for the crossing.





CARLSBAD CAVERNS National Park,
A Golden State Route side trip



NEW ORLEANS, romantic terminal of
Southern Pacific Sunset Route

HOW TO SEE TWICE AS MUCH

As you can see from the map below, Southern Pacific offers you a choice of Four Scenic Routes across the country: OVERLAND ROUTE, shortest and fastest between San Francisco and Chicago, over the High Sierra and the Rockies and across Great Salt Lake on the spectacular Lucin Causeway; SUNSET ROUTE between San Francisco and New Orleans through Los Angeles, Southern Arizona, Texas and the Old South; GOLDEN STATE ROUTE, direct between Los Angeles and Chicago via Southern Arizona, El Paso and the Middle West; SHASTA ROUTE between San Francisco and the evergreen Pacific Northwest, connecting with northern transcontinental lines.

By going on *one* of these routes and returning on *another*, you see *twice* as much of the United States as you would by going and returning on the same route—in most cases for not 1¢ extra rail fare!

F. S. MCGINNIS, Vice-President, System Passenger Traffic



CROSSING GREAT SALT LAKE on the
historic Overland Route



MT. SHASTA, 14,161-foot sentinel of
the scenic Shasta Route.