

maw handle converting it into a brake club should not be permitted. Such a stick, frequently made of inferior material, is liable to break when stress is exerted against it, resulting in personal injury. Brake clubs should be selected from the very best of material.

2. The importance and necessity of securing every car left standing on a heavy grade, at way stations and at isolated points, should be stressed.

3. In controlling the speed of several cars that are being kicked or switched over a hump in the yard, or on heavy grades, the operator should not depend on one hand brake to control a greater number of cars than may be fully retarded with that amount of braking power. If necessary the brakes should be applied on several cars.

The bracket platform on the ends of high cars is favored instead of the deck location as it is quicker to ascend to this location and it permits the operator to have a double hold at all times—once he is positioned on the bracket platform he is enabled to watch in both directions, which is a decided advantage over the deck type of brake.

Operation of Air Brakes

By MARK PURCELL

General Air Brake Inspector, Northern Pacific Railway, St. Paul, Minn.

The speaker said in part: Mr. George Westinghouse invented the "Plain Automatic" Air Brake in 1872. The automatic feature resulted from the obtaining of an indirect application of the brakes through the medium of a valve device called a triple valve, and an auxiliary storage reservoir, which were added to the brake cylinder on each car.

The plain automatic air brake was a great improvement in many respects over the straight air brake, but chiefly from an emergency or safety point of view. Much of the flexibility (ability of the operator to increase or decrease the cylinder pressure quickly and in small amounts) for ordinary service brake operation had to be sacrificed. This brake served the purpose fairly well while trains were short and speeds, weight and frequency of trains low, but as these factors changed, its limitations became more and more apparent, particularly with reference to emergency operation. The propagating operation was too slow with long trains, which resulted in severe interchange of slack due to brakes becoming heavily applied on the forward portion of the train before the application had time to take hold on the cars farther back toward the rear. This limitation was overcome to a great extent by the invention of the "Quick Action Triple Valve" in 1887 and the equipment with which it was used came to be known as "Quick Action Automatic Brake." The quick action triple valve was developed by adding to the plain triple valve parts which brought about a local venting of brake pipe pressure in emergency applications, and thus caused a rapid serial application throughout the length of the train so that the time for the full application of all brakes on a 50-car train was reduced to about one-sixth of what is inherent with plain triple valves, and shocks are therefore lessened to a great degree and the distance for stopping greatly reduced.

Two of the features that exert a governing influence on braking are: First, the adhesion between the car wheels and the rails; this varies to considerable extent due to rail and wheel conditions, but changes little when the vehicle is moving as compared to when it is standing. Second, the adhesion, or friction between the brake shoes and the wheels. This latter is greater when standing than when running and varies widely with a change from low to high speed and vice versa. The per-

centage of brake power used is based upon the empty weight of the car, unless an empty and load type of brake is used. For a long time it has been customary to use a somewhat higher percentage of brake power on passenger than on freight train equipment. Due to passenger train speed generally being greater than that of freight trains, making greater braking power necessary if stops are to be made in similar distances, the amount of brake power necessary to stop in the same distance increases as the square of the increase of speed; that is, if speed is doubled, it requires four times as much braking power.

To take care of the many conditions that affect the safety and economy of train operation, from a brake control point of view, such as the progressive increase in weight of cars, longer trains, high speeds, greater weight and power of locomotives and greater frequency of trains, has necessitated several corresponding changes in brake equipment for passenger and freight cars and for locomotives.

Getting On and Off Cars

By J. B. SULLIVAN

Road Master, C. R. I. & P. Railway, Burr Oak, Ill.

The speaker said in part: Quoting from the records of train service accidents, I find the following: Year 1930, 5,451 accidents in which 441 persons were killed and 5,010 injured; year 1931, 4,543 accidents in which 447 persons were killed and 4,096 injured; year 1932, 4,466 accidents in which 520 persons were killed and 3,946 were injured. These records further show that but four train service accidents and four casualties were caused by defective equipment, all of which goes to show that practically all those deaths and injuries were directly traceable to the old human element, better known as man failure. A great many of those injuries were caused by alighting from cars on unfavorable terrain, such as ice, switch stands, timbers and ties, rocks, lumps of coal, holes in the ground, etc. Alighting from, or trying to board cars moving at excessive speed, is also conducive to injury and should not be attempted.

The proper way to get off a moving car is, first, face the direction of movement; second, place the inside foot on lower tread of sill step; third, grasp convenient tread of side ladder (depending on height of person) with inside of hand. When sure of the ground on which you are about to alight, let go with hand hold, remove foot from sill step and with body slightly inclined backward and legs partly flexed, alight on outside foot, using the other foot to overcome momentum.

To get on a moving car, grasp a convenient grab-iron or tread of side ladder firmly and swing the inside foot onto the lower tread of step. Practice, natural agility, a sense of timing and judge of distance, all go toward simplifying the movements until they become almost second nature.

The standardizing of safety appliances, such as sill steps, grab-irons, side ladders and such, although considered adverse legislation at the time of its inception, proved to be a blessing in disguise and their uniformity has done more in my estimation to eliminate casualties than any other thing.

But it is to the unsung hero of the railroads that I would dedicate this theme. This is the man that is known in railroad parlance as the "end man" or "pin puller" on a switching crew. Invariably the youngest man on the crew in point of service, he has more mounts, dismounts and remounts than all of the jockeys in America put together, with all of Uncle Sam's cavalry men thrown in for good measure. On