

**CONSOLIDATED  
POP  
SAFETY VALVES**

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Consolidated Pop Safety Valves by Various

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**VARIOUS**

**CONSOLIDATED  
POP  
SAFETY VALVES**



# Consolidated

Pop Safety

# Valves



Consolidated Safety Valve Co.

General Offices: 85, 87 and 89 Liberty St., New York  
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Factory, Bridgeport, Conn.

*Handwritten:*  
L. J. F. S. 11.9  
T335A  
CSAA

## Introduction

**T**HE Consolidated Safety Valve Company has within the last two years inaugurated two exceedingly important movements in the safety valve practice of this country—movements which are causing universal modifications of design, and, for the first time in the history of engineering, are putting the methods of safety valve rating and specification upon a sound basis. This has, of course, required exhaustive testing and research, in conducting which this Company has spared no expense, deliberately adopting the policy of giving the results freely to the engineering public. This policy has obtained for the Company in this work the co-operation of railroads, of stationary and marine interests, and of eminent engineers, adding much to the broad application and value of the results obtained.

The movements referred to are: first, for the rating and specifying of safety valves according to their actual relieving capacities; and, second, for increasing their efficiency by modifications in design which make possible the obtaining of larger capacities, and a cleaner, more positive action.



## Safety Valve Capacity

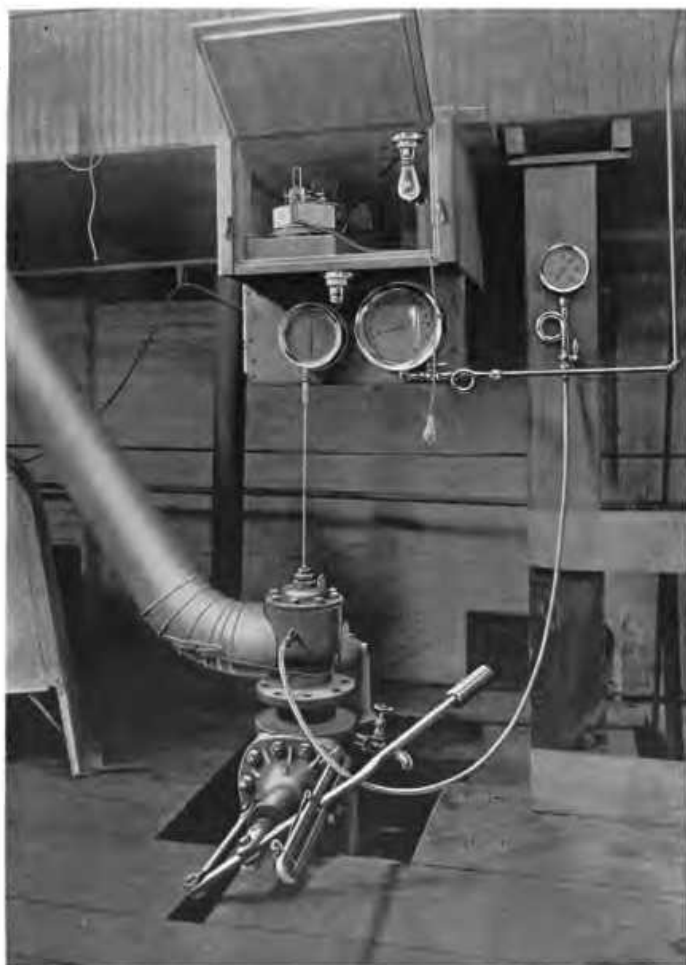
**A**N account of certain of the elaborate tests and extensive research work, conducted by this Company, showing the apparatus developed, the methods employed and results obtained, has been published in a pamphlet entitled "Safety Valve Capacity," which will be sent upon application to anyone interested in this subject. Because of this supplementary publication, the following account of the work will be brief.

The function of a safety valve is to prevent the pressure in the boiler, to which it is applied, from rising above a definite point; to do this automatically, and under the most severe conditions which can arise in service. For this the valve, or valves, must have a relieving capacity at least equal to the boiler evaporation, under these conditions. If it has not this capacity, the boiler pressure will continue to rise, although the valve is blowing, resulting in strain to the boiler and danger of explosion, consequent to over-pressure. Thus, with the exception of a requisite mechanical reliability, the most vital factor in a safety valve is its capacity.

Two factors in a safety valve geometrically determine the area of discharge and hence the relieving capacity. These are the diameter of the inlet opening at the seat, and the valve lift. The former is the nominal valve size; the latter is the amount the valve disc lifts vertically from the seat when in action. The rules for calculating the size of valves to be placed on boilers, which do not include a term for this valve lift, or an equivalent (such as a term for the effective area of discharge) assume, in their derivation, a lift for each size valve. Nearly all existing rules and formulæ are of this kind, which rate all valves of a given nominal size as of the same capacity.

To find what lifts valves actually have in practice, and thus test the truth or error of this assumption, that lifts are approximately the same for the same size valve, an apparatus has been devised by us upon which tests of different designs of valves have been conducted. With this apparatus, not only can a valve lift be read, at any moment, to thousandths of an inch, but an exact permanent record of the lift,

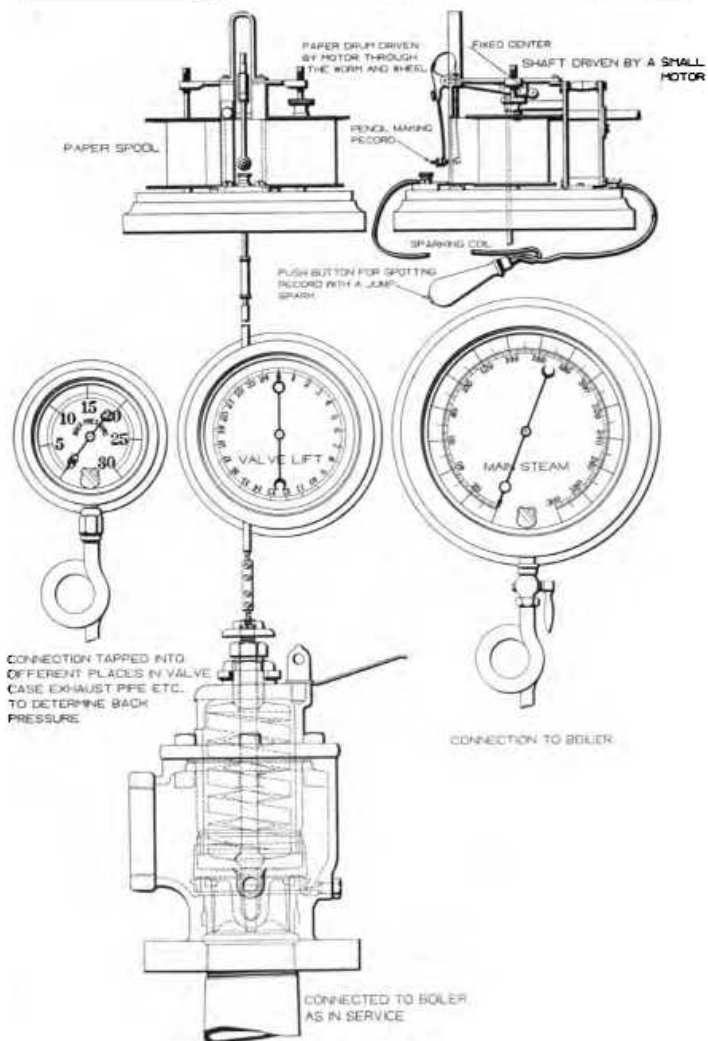
Consolidated Pop Safety Valves



SECTION OF TESTING LABORATORY AT THE PLANT OF THE CONSOLIDATED SAFETY VALVE COMPANY, BRIDGEPORT, CONN.



# Consolidated Pop Safety Valves



**SAFETY VALVE LIFT RECORDING APPARATUS**

## Consolidated Pop Safety Valves

during the blowing of the valve, is obtained. This record resembles a steam engine indicator card in appearance, and is of similar use and value in analyzing the action of the valve.

As appears in illustrations on pages 4 and 5, the valve under test is mounted upon the boiler in the regular manner, and a small rod is tapped into the top end of its spindle. This rod connects the lifting parts of the valve directly with a circular micrometer gauge and a recording gauge above. The steam pressures are noted and read from a large test gauge, graduated in pounds per square inch, and an electric spark device makes it possible to spot the chart at any point in its travel. In our tests, this was done as each pound pressure mark was reached, during the blowing of the valve. The actual lift equivalents of the pencil heights upon the chart are carefully calibrated in order that the record may be accurately measured to thousandths of an inch.

With this apparatus, investigations and tests were started upon seven different makes of 4-inch stationary type safety valves, and these

### Lifts, Discharge Areas, Etc., of different makes of Safety Valves

Size Inches	Popping Pressure Lbs. per square inch	Lifts		Effective area of discharge with opening lift Square inches	Per cent of largest area valve
		Opening Inches	Closing Inches		
<b>Iron Body Stationary Types</b>					
4	200	.064	.024	.568	46.6
4*	200	.031	.017	.390	31.4
4	200	.056	.032	.496	40.8
4	200	.094	.039	.834	68.5
4	200	.094	.055	.834	68.5
4	200	.082	.054	.727	59.7
4	200	.137	.088	1.22	100.
<b>Locomotive Muffler Types</b>					
3½	200	.072	.027	.559	51.4
3	180	.045	.027	.390	
3½*	200	.040	.023	.440	39.8
3½	200	.076	.041	.590	54.4
3½	200	.065	.034	.505	46.4
3½	200	.051	.030	.390	36.4
4	200	.058	.042	.515	
4	200	.086	.039	.764	
3½	200	.140	.102	1.09	100.

\* Flat Seat, other valves, 45 degree seat.

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Consolidated Pop Safety Valves

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LIFT APPARATUS AS ERECTED FOR LOCOMOTIVE TESTING AT BURNSIDE,  
ILLINOIS

tests were followed by similar ones upon nine makes of muffer locomotive valves, six of which were  $3\frac{1}{2}$  inch. All these valves were designed for and tested at 200 pounds steam pressure. The stationary valve tests were made upon a 94 horse-power Babcock & Wilcox Company water-tube boiler. The locomotive valve tests were made upon locomotive No. 900 of the Illinois Central Railroad, the valve being mounted directly upon the top of the main steam dome. Although a great amount of additional valve lift experimental work has been conducted, the above two series only, will be quoted here. The record of lifts, given in table on page 6 shows (with exception of a small preliminary simmer, which some of the valves have) an abrupt opening to full lift and an almost equally abrupt closing, when a certain lower lift is reached. Both the opening and closing lifts are significant of the valve action.

