

# **SAFETY-VALVES**

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Safety-Valves by Richard H. Buel

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**RICHARD H. BUEL**

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# SAFETY-VALVES.

BY

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## INTRODUCTION.

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The writer, in presenting these remarks to engineers, does not pretend to offer much that is original, but has aimed to gather what is valuable from the great mass of material to be found in scientific periodicals and in publications that are not generally accessible. An endeavor has been made to systematize the treatment of the subject, and to give such varied solutions of the problems that arise in proportioning the parts of safety-valves as to render them plain to those who have only an elementary education. The importance of having the general principles of safety-valves understood by those who are charged with the care of steam machinery cannot well be over-estimated. With a safety-valve that is in reality all which its name implies, a large proportion of the risks incident to the use of boilers will be avoided; while on the other hand, a safety-valve that is only such in name is one of the readiest assistants to a disastrous boiler explosion.

NEW YORK, August, 1875.





## SAFETY - VALVES.

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### I. THE REQUISITE QUALIFICATIONS OF A SAFETY-VALVE.

As a safety-valve is designed to prevent the accumulation of pressure in a steam boiler beyond a certain point, it is necessary that the parts should be so proportioned that the valve will rise when the given pressure is attained. Until the valve rises it is subjected to the pressure of the steam at rest, so that this part of the subject involves the statical condition of a safety-valve. As soon as the pressure of the steam in a boiler lifts the valve, new conditions are introduced, because the steam is in motion, escaping through the orifice between the valve and the seat. It will

thus be evident that from the time the valve is raised until it is again seated by the reduction of the steam pressure the dynamical conditions are to be regarded. A good safety-valve should be so constructed that not only will it lift when the required pressure is attained, but so that it will also prevent the further increase of pressure, and will close promptly as soon as that pressure is reduced.

## II. PROPORTIONING THE PARTS OF SAFETY-VALVES, IN ORDER THAT THEY MAY RISE WITH GIVEN PRESSURES.

This part of the subject, as already remarked, deals with the statical condition of safety-valves. In other words, it is a question of the equilibrium of two forces acting in contrary directions--one, a weight or the tension of a spring, tending to hold the valve down; and the other, the pressure of the steam, tending to raise it. When these opposing forces balance each other the valve is ready to lift, and any slight increment

of pressure will raise it. It is, then, the conditions of the balancing or equilibrium of the steam pressure and the spring or weight that are to be considered. In some forms of safety-valves, a spring or weight is placed directly above the valve, and resists the upward pressure of the steam; or a weight is suspended directly under the valve, passing into the boiler. In other forms, the spring or weight is attached to a lever, to which the valve is also connected, the weight or spring being ordinarily at a greater distance from the fulcrum than the valve is. In the first form of construction, in which the steam pressure is opposed directly by the force of a weight or spring, without the intervention of a lever, these two forces will evidently balance when they are equal to each other. It is only necessary, therefore, to multiply the pressure of the steam in pounds per square inch by the area of the valve in square inches to find what weight must be attached, or what tension put upon the spring, to prevent the