

G. WAZAU.
 DYNAMOMETER FOR MEASURING FORCES.
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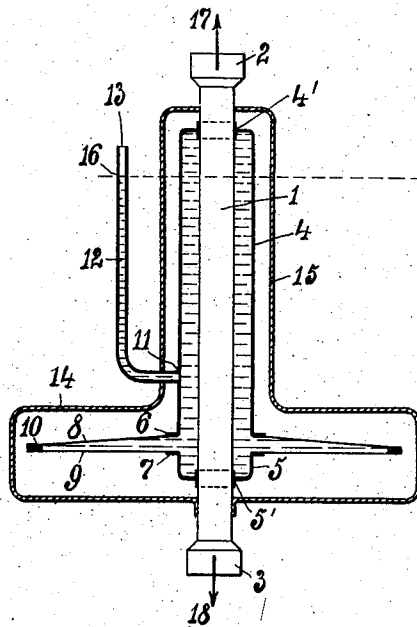


Fig. 1.

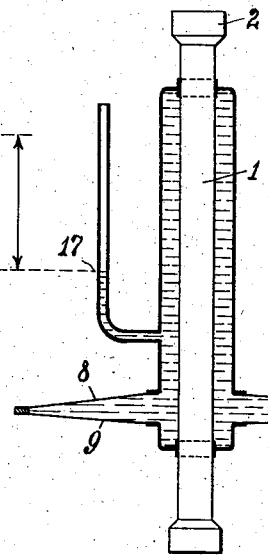


Fig. 2.

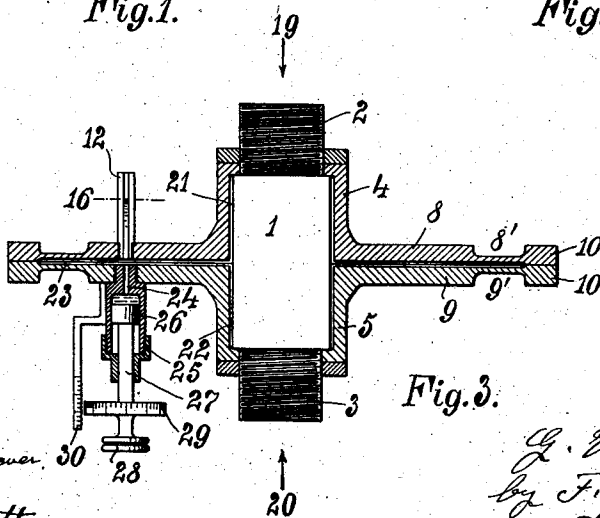


Fig. 3.

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UNITED STATES PATENT OFFICE.

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DYNAMOMETER FOR MEASURING FORCES.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, GEORG WAZAU, a subject of the German Emperor, residing at Geithain, in the Kingdom of Saxony and Empire of Germany, have invented certain new and useful Improvements in Dynamometers for Measuring Forces, of which the following is a specification.

My invention is an improvement in devices for measuring forces and is described and illustrated in this application in connection with a bar of steel to which force is applied, the degree of force in its effect on the bar being expressed on a scale by means hereinafter set forth.

The invention is fully illustrated in the accompanying drawing, in which—

Figure 1 is a side elevation partly in section, before the force or power is applied. Fig. 2 is a view similar to Fig. 1 of a part only of the device, after power is applied and Fig. 3 is a side elevation partly in section of a modification of the device.

The bar 1 is made of any metal for instance steel and has on its two ends each a head 2, 3. The two heads 2, 3, serve to couple up the bar 1 as is well known with the parts of any machine, which will produce a tensile force on the bar 1.

The machine, of which the contrivance, shown in the drawing, forms a part, is not illustrated in the drawing, because it can be of any preferred design and is well known in all its parts.

The bar 1 with the two heads 2, 3, and its coupling with the machine is also well known. The measuring contrivance only is new and is described as follows: Two pieces of pipe 4, 5, of an optional length are secured to the circumference of the bar 1, their outer ends being designated by 4' and 5'. Two circular plates 8, 9 are tightly secured to the two inner ends 6, 7 of these two pieces of pipe. The outer rims 10 of the two plates are securely connected with each other. A pipe 12 relatively small is fitted close to the one of the two pieces of the pipe at an optional place for instance at 11. The pipe 12 is vertically arranged and open at its upper end 13. In order to protect the arrangement described from sudden variations of temperature as much as possible, a casing 14, 15 is provided to inclose it. The hollow spaces 4, 5, 8, 9, 11, 12 are to be filled with any fluid, for instance, quicksilver or glycerin, so far that in the small vertical pipe 12,

the surface of the fluid stands at a point 16, which on the scale forms the zero for measuring.

If a tensile force is applied to the bar 1 in the direction of the two arrows, 17, 18, the bar will expand slightly and consequently the hollow space between the two circular plates 8 and 9 will become larger. In Fig. 2 this enlargement of the intermediate space is intentionally illustrated in an exaggerated manner in order to make the process clear. In reality the expansion of the bar 1 is only a very small fraction of a millimeter. This small enlargement of the intermediate space between 8 and 9 is distinctly to be seen in the falling of the smooth surface of fluid, which stood before the trial in Fig. 1 at 16 and after the trial perhaps stands Fig. 2, at 17. The difference between these two smooth surfaces of fluid 16 and 17 forms the measure to find out the expansion of length of the bar 1 and one can calculate, from the expansion of length of the bar 1, the force, which has caused the expansion.

The contrivance illustrated in the drawing is only to be construed as one form of the invention. The arrangement can deviate in many respects from that which is shown. For instance the piece of pipe 5 can be as long or longer than the piece of pipe 4, or the piece of pipe 5 can be totally wanting, so that the circular disk 9 is immediately fixed to the bar 1.

In the above description it is supposed that a tensile force expands the bar. But the contrivance can also be employed when a force or pressure compresses the bar, that is to say shortens it. In this case the smooth surface of fluid in the vertical connecting pipe 12 would not fall, but rise.

A modified form of the invention is shown in Fig. 3. This form is very compact and intended to be packed up in a wooden case that it can be put in the machine's examining materials and used by its owner at an optional place. For this purpose, the scale 1 is so short and proportionately thick that it can be tested not only by a tensile force as shown in Fig. 1, but also by a force of pressure in the direction of the arrows 19, 20. The threads 2 and 3 serve to fix the apparatus to the operating machine. The part of the pipe 4 is integral with the circular disk 8 of one piece, as the part of the pipe 5 with the circular disk 9. But while in Fig. 1, the two circular disks

8 and 9 are made of very thin steel-plate similar to a membrane, in Fig. 3 the two disks 8 and 9 are so thick that they can resist a twisting force. Against this at 8' and 9' ring-shaped recesses are worked out on the circumference. The rims 10 of the two disks are connected and secured to each other. Experience has taught that the lessening at the rims of the plate at 8' and 9' is fully sufficient in order to allow the very small alterations of the length of the bar 1. These elongations amount about to the thousandth up to the tenth part of a millimeter. By this improvement the apparatus becomes more capable of offering resistance against accidental damage than in the case with the thin plates 8 and 9 in Fig. 1. The action for hydraulic enlargement is also a better one.

The interior 21, 22, 23 is filled out with a fluid, for instance quicksilver. The smooth surface of quicksilver stands in the little glass-tube 12 for instance up to the point 16. A bore 24 is arranged in the plate 9, which connects the interior 23 with the interior of a small cylinder 25. A small piston 26 reciprocates in the cylinder 25. The piston-rod 27 is furnished with a thread and if turned by its head 28, the piston 26 is shifted into the cylinder 25. A disk-scale 29 is fixed to the piston rod 27 and close by it an immovable straight-lined scale 30 is arranged.

In operating the apparatus, one turns the handle 28 so far in the one or other direction, that the column of mercury reaches, exactly up to the point 16. If the bar 1 is now strained by degrees, one turns the handle 28 again till the smooth surface of quicksilver over and over again returns to the point 16. One can then most exactly fix from the two scales 29 and 30, how much the length of the bar 1 has changed and can calculate from the degree of this elongation the force to be measured.

Having thus fully described my invention, what I claim is—

1. A dynamometer for measuring forces comprising a bar, couplings on the ends of said bar to connect the bar with other mechanism, a pipe 4 spaced around said bar with its ends tightly joined thereto, lateral disk-like extensions of the lower part of said pipe 4 and a gage pipe, extending upwardly and connected to said pipe 4, said pipes and extensions being provided with a liquid for the purposes specified.

2. A dynamometer for measuring forces, comprising a bar, means on the ends of said bar to connect the bar with other mechanism, a pipe 4 formed of two vertically spaced members having their outer ends secured to said bar, a horizontal hollow disk connecting the inner ends of the members of said pipe and opening thereinto, and a gage pipe connected laterally to said pipe 4 and bent upwardly, said pipes and extensions being provided with liquid for purposes specified.

3. A dynamometer for measuring forces, comprising a bar, means on the ends of said bar to connect the bar with other mechanism, a pipe 4 formed of two vertically spaced members having their outer ends secured to said bar, a horizontal, hollow disk connecting the inner ends of the members of said pipe and opening thereinto, the outer edges of said hollow disk being sealed, an upwardly bent gage pipe having a lateral connection with pipe 4, said pipes and extensions being adapted to hold a liquid under pressure, and a casing to protect the device from sudden changes of temperature.

In testimony whereof I affix my signature in the presence of two witnesses.

GEORG WAZAU.

Witnesses:

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SIDNEY RICH.