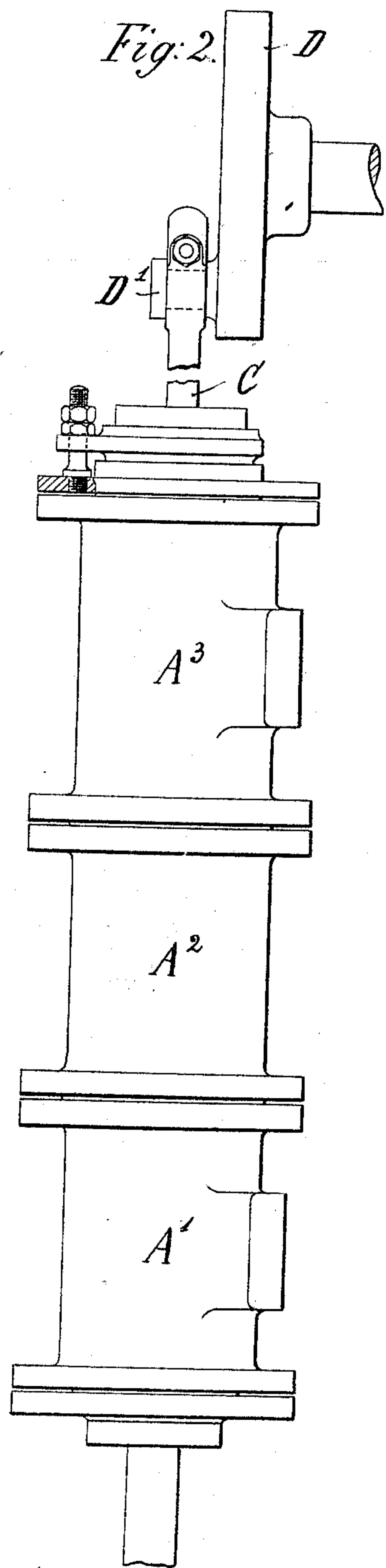


(No Model.)

G. E. O. LANGE.
VACUUM PUMP.

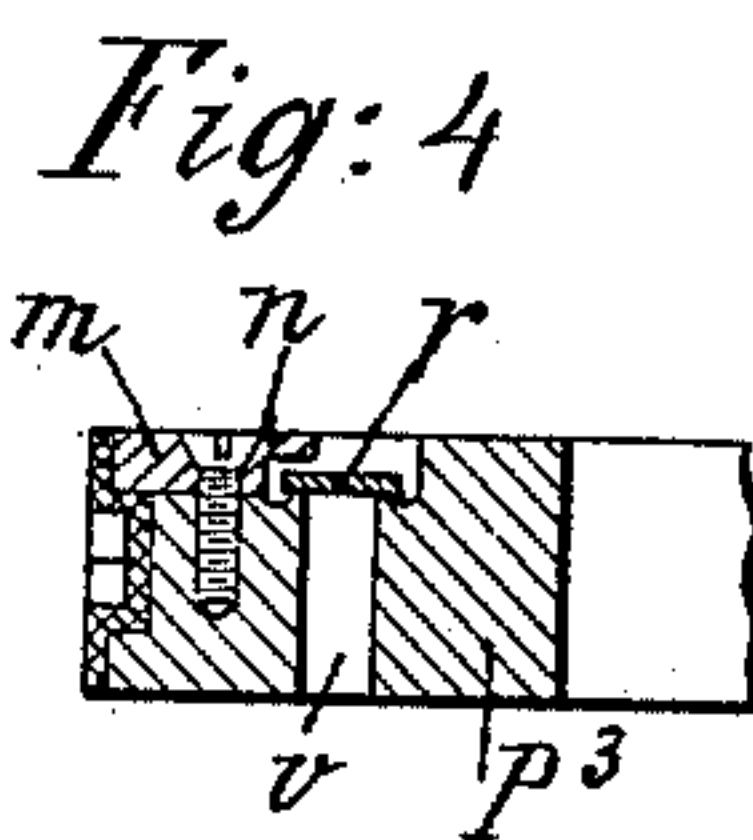
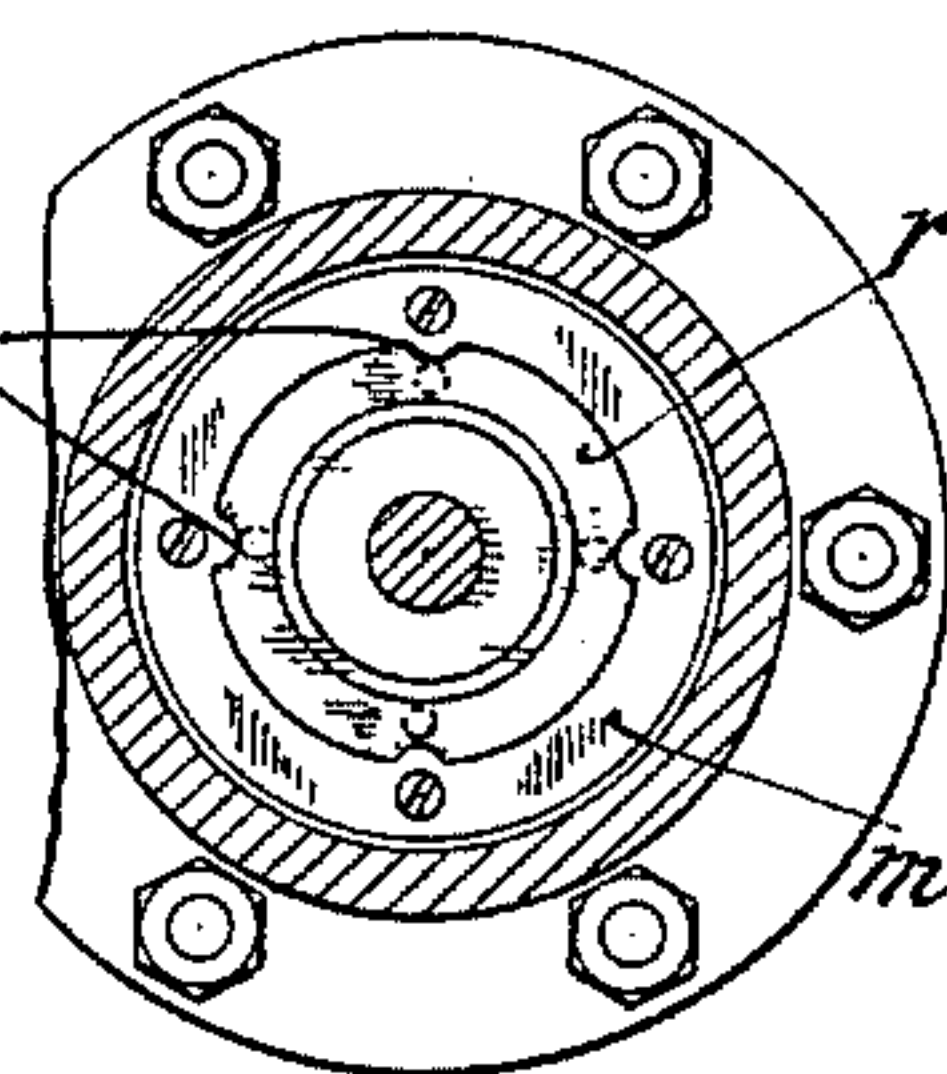
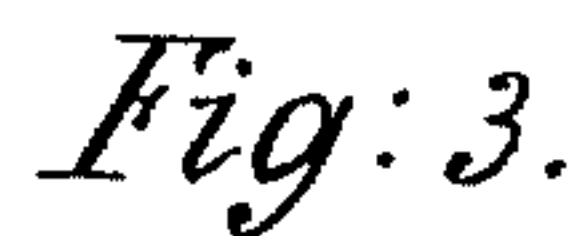
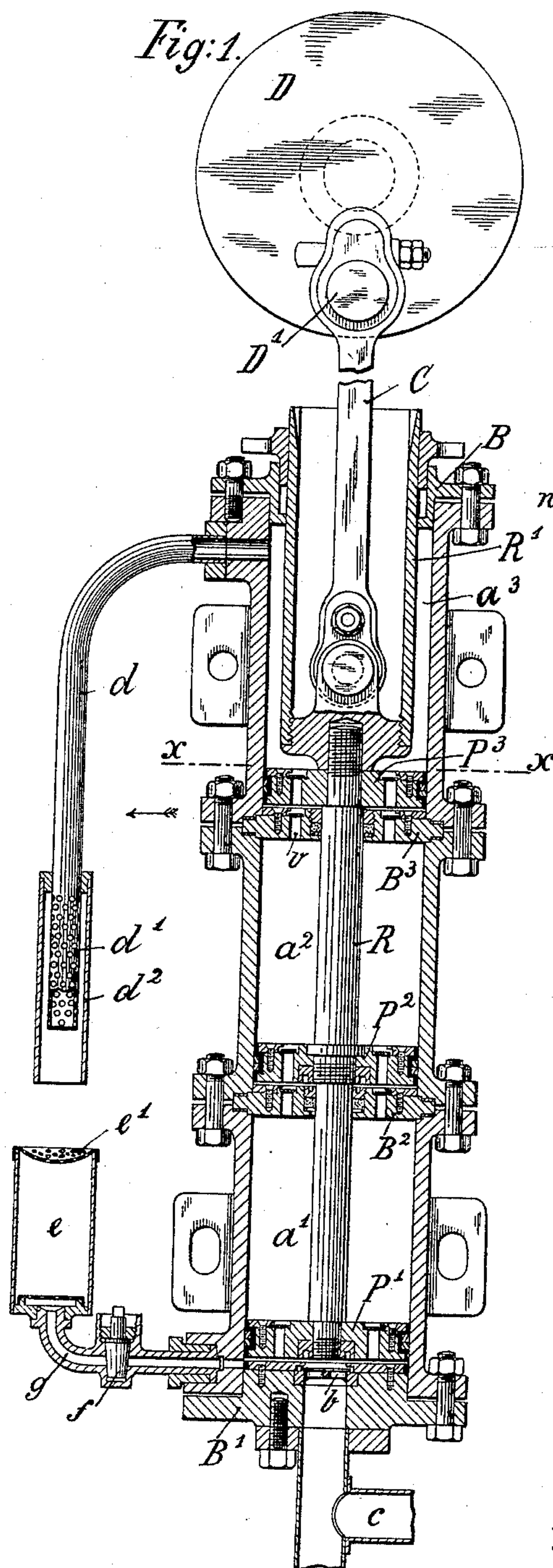
No. 509,541.

Patented Nov. 28, 1893.



Witnesses:

Paulo Steven
David St. Mend.



Inventor:

Georg E. O. Lange,

By A. J. Dyerforth,
his attorney.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

GEORG EMIL OSCAR LANGE, OF BERLIN, GERMANY.

VACUUM-PUMP.

SPECIFICATION forming part of Letters Patent No. 509,541, dated November 28, 1893.

Application filed September 17, 1892. Serial No. 446,155. (No model.)

To all whom it may concern:

Be it known that I, GEORG EMIL OSCAR LANGE, a subject of the Emperor of Germany, residing at Berlin, in the Empire of Germany, have invented certain new and useful Improvements in Vacuum-Pumps; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it ap-
10 pertains to make and use the same.

This invention relates to vacuum pumps.

The object of the invention is to produce a vacuum pump which will operate with the expenditure of a small amount of power, and by
15 which the gradual rarefying of air may be accomplished.

The invention consists of the novel vacuum pump made to comprise the novel details of construction and arrangement of parts as
20 hereinafter described and claimed.

The invention is illustrated in the accompanying drawings, in which—

Figure 1— is a view in longitudinal section, of the pump, showing the interior of the pump
25 and also showing the means for giving motion to the pistons. Fig. 2— is a view in elevation, of the pump, taken from the right-hand side of Fig. 1, looking in the direction indicated by the arrow in Fig. 1. Fig. 3— is a
30 view in cross-section taken on the line $x-x$ of Fig. 1, showing the top of the piston, the piston-rod being shown in section. Fig. 4— is an enlarged detail sectional view of the left-hand half of a piston.

35 The pump-cylinder is made of three vertically-arranged adjacent sections, a' , a^2 , a^3 , connected, at their ends by flanges, receiving suitable screws. The upper section a^3 is closed at its top by the cover B constructed to serve
40 as a plunger stuffing-box, and the lower section a' is closed at its bottom by the valve-seat B'. Partitions B², B³, are arranged, respectively, between the sections a' and a^2 , and sections a^2 and a^3 . Each partition is provided
45 with a suitable annular valve. The construction of these valves, a full description of which will be given farther on, is shown in Figs. 1, 3 and 4 of the drawings. The piston-sections P', P², P³, have the common stem R passing
50 tightly through the partitions B², B³, and attached above to the hollow cylindrical plunger R', guided in the stuffing-box cover B.

A connecting-rod C is attached at its lower end to the bottom of the inside of the plunger, and at its upper end to the crank-pin D' 55 of a pulley or wheel D turned by hand or machinery. At the bottom B' provided with a clack or gravity-valve, formed of a circular plate b , is placed the induction pipe c designed to be connected to the receptacle from which 60 air is to be exhausted.

In the operation of the pump, a reciprocating motion is imparted to the plungers from the connecting-rod C, and the first suction takes place between the bottom B' and the 65 piston P'. After passing through the valves of the piston P', the air sucked out passes from the cylinder a' , through the partition or valve-seat B² under the piston P². On the falling of the piston P², the air is delivered 70 into the cylinder space a^2 , and under the piston P³, and so on into cylinder space a^3 , and out through pipe d . In this manner, the three pistons P', P², P³, take the air from the vessel to be exhausted, through the three pump- 75 cylinders, gradually into the open air, while it is effected that the rarefaction of the air increases from above downward.

As an aid in getting all of the air out of the separate chambers a' , a^2 , a^3 , a circulation of 80 oil is employed which provides a constant covering to the three pistons or valve bodies with a layer of oil. The arrangement for this purpose consists essentially in an oil-holder e , the discharge-pipe g from which, provided 85 with a regulating cock f , opens through one side of the pump direct upon the bottom B' of the lower cylinder section a' . In working the pump, there will be continuously a certain quantity of oil taken along up to the 90 blow-out pipe d , while thereby the keeping close and air-tight of the pistons and valves and stem will be insured. The discharge-pipe d is turned downward and has a perforated end d' , and is surrounded by a larger 95 and longer pipe d^2 , which opens over the oil-holder. The oil-holder e is provided with a sieve-cover e' , and the bottom of the oil-holder has a similar sieve. By the cock f , the draft of oil from and return of the same to the 100 holder can be regulated. The air, which together with the small quantity of oil is taken along with every lift, finds exit by pipe d , and escapes into the widened mouth-pipe d^2 ,

through the holes in the part d' , and is thereby prevented from interfering with the flow of oil to the oil-holder e .

The new construction of valves shown in Figs. 3 and 4, which is the same as that on the valve-seats B^2 and B^3 , is distinguished by a flat annulus r set in an annular depression with room to lift and slight side play, in such manner that it forms the common valve for four or more valve openings v set in a circle in the piston. A removable concentric ring m with catching projections n , serves as a stop for limiting the movement of the ring. It will be seen that when a flat disk or ring r is employed, and so arranged as to leave it free to turn, which it will do as the valve is opened or closed, any wear which occurs will be equalized, thus insuring the perfect fit of the valve on its seat. The circular flat valve b on the seats B' , B^2 , B^3 , is made in the same manner.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a vacuum pump, a series of cylinder sections, a series of pistons provided with valves, connected to a common stem, partitions arranged between the cylinders, valves in the partitions, an oil holder communicating with the lower cylinder section, and an outlet pipe adjacent to the oil holder, and an induction pipe having a valve therein, substantially as described.

2. In a vacuum pump, a series of communicating cylinders provided with pistons hav-

ing passages therethrough and mounted on a common stem, and an oil holder communicating with the top and bottom cylinder whereby a continuous flow of oil through the cylinders is maintained, substantially as described.

3. In a vacuum pump a series of communicating cylinders provided with pistons having passages or channels therethrough and mounted on a common stem, an oil holder and an induction pipe communicating with the lower cylinder, and an outflow pipe communicating with the upper cylinder having its end vertically aligned above the oil holder, substantially as described.

4. In a vacuum pump a series of cylinder sections, a series of pistons provided with valves, connected to a common stem, partitions arranged between the cylinders, valves in the partitions, an oil holder and an induction pipe communicating with the lower cylinder and an outflow pipe communicating with the upper cylinder and having its end vertically aligned with the oil holder whereby the oil is caused to flow continuously through the cylinders and the air separated therefrom, substantially as described.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

GEORG EMIL OSCAR LANGE.

Witnesses:

EDWIN A. BRYDGES,
WILHELM VOGT.