

I. BENJAMINS.
FAN OR FAN BLOWER.
APPLICATION FILED NOV. 13, 1911.

1,055,308.

Patented Mar. 11, 1913.

2 SHEETS—SHEET 1.

FIG. 1.

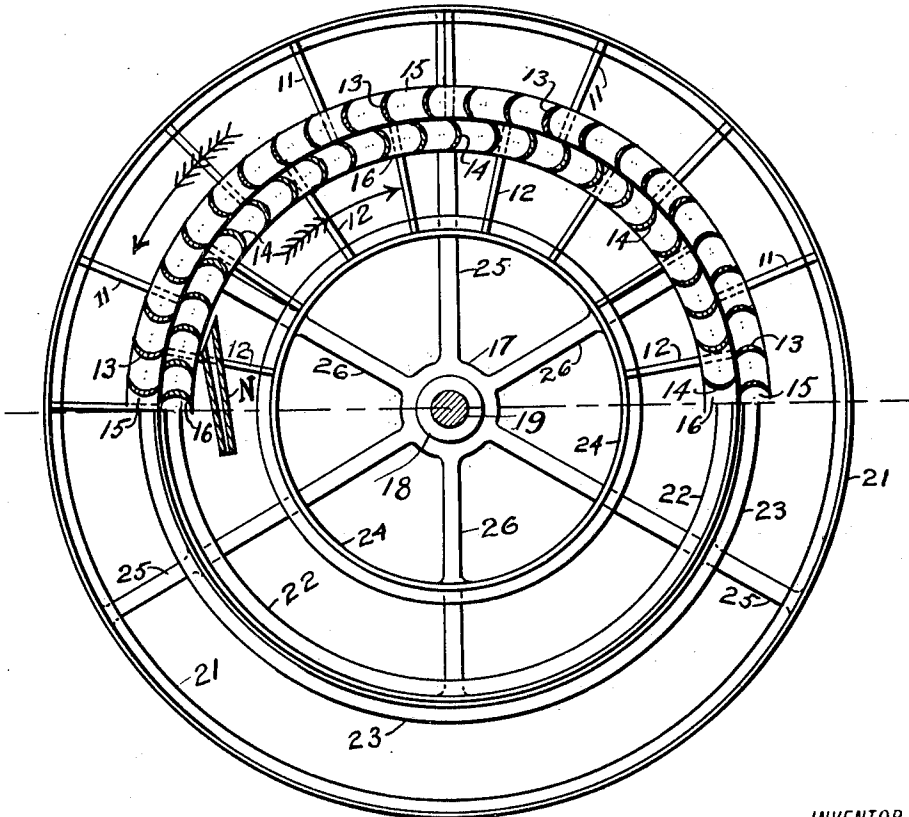
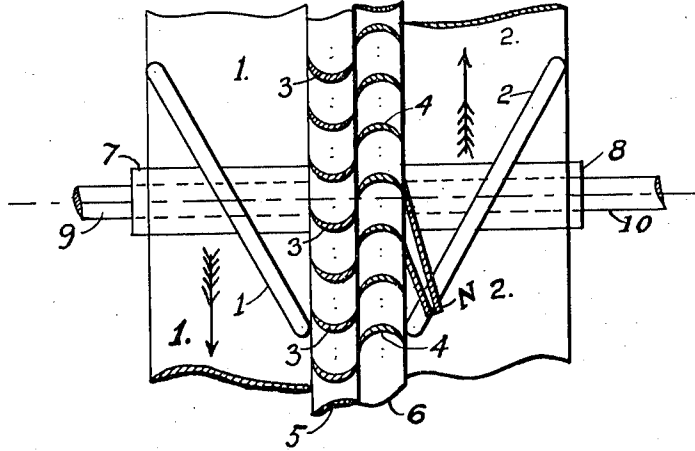


FIG. 2.

WITNESSES

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2 SHEETS—SHEET 2.

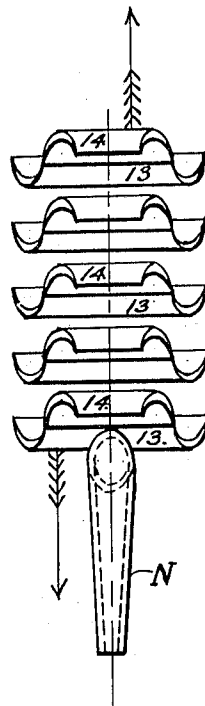
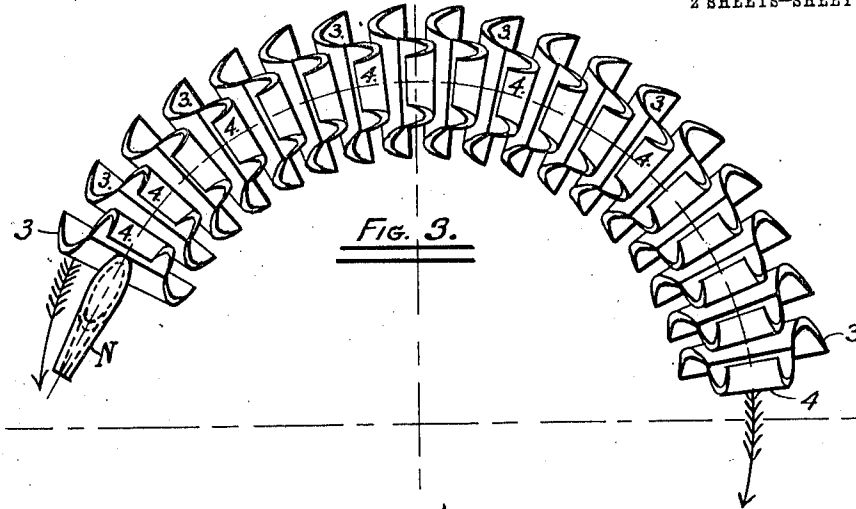


Fig. 4.

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UNITED STATES PATENT OFFICE.

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FAN OR FAN-BLOWER.

1,055,308.

Specification of Letters Patent.

Patented Mar. 11, 1913.

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To all whom it may concern:

Be it known that I, ISRAEL BENJAMINS, a citizen of the United States, residing in the city of New York, in the county of Kings and State of New York, have invented a new and useful Fan or Fan-Blower, of which the following is a specification.

My invention relates to improvements in fans or fan blowers used for moving air into or out of confined spaces, as for exhausting the air from dwellings, factories, etc., or to create a draft for the combustion of fuel on the grates of boilers; in the latter case, it may be employed either in the plenum or vacuum system, *i. e.* the air may either be blown under the grates under pressure, or it may be exhausted from the stack or uptake by means of a jet or directly by means of the suction created by the fan. It may also be employed in the arts, as in blast furnaces, and it may be driven either by belts from a shaft, by gearing, by electric motors, or by a steam turbine, as shown in the drawings. The fan may also be either of the propeller type, moving the air in a direction parallel or nearly parallel to the shaft or it may be of the centrifugal type.

The objects of my invention are; 1, to increase the efficiency of the fan or blower by a simple and inexpensive construction; 2, to enable the fan to deliver the air against a higher pressure, or to create a greater vacuum in exhausting the air, than is at present feasible with the known forms of fans or fan blowers; 3, where a steam turbine is employed for driving the fan, to improve the efficiency of the steam turbine itself, besides the efficiency of the fan. I attain these objects by the mechanism illustrated in the accompanying drawings or by similar means within the scope of my invention.

In the drawings the same letters designate the same parts throughout the several views.

Figure 1 is part of an edge view of the propeller form of fan or fan blower; Fig. 2 is an end view of the centrifugal type of my fan or fan blower which is shown in both figures as driven by a steam turbine consisting of two sets of buckets without guides. Fig. 3 is part of an end view of the turbine buckets corresponding to Fig. 1; Fig. 4 is part of an edge view of the steam turbine shown in Fig. 2; Figs. 1 and 3 determine a

parallel flow steam turbine; Figs. 2 and 4 determine an outward flow steam turbine.

In Fig. 1—1 represents the blades of a right handed propeller fan or fan blower rotating on or with the shaft 9 in the direction of the arrow; (as shown); 2 represents a left ended propeller fan or fan blower rotating on or with the shaft 10 in a direction contrary to that of the fan 1; 3 represents the buckets of the steam turbine disk 5 rotating with the fan 1 and driving the same; 4, 4 are the buckets of the steam turbine disk 6 rotating with and driving the fan 2; 7 is the hub or boss of the right handed propeller fan; 8 is the hub or boss of the left handed propeller fan. N is the steam nozzle delivering a jet of steam to the buckets 4 of the turbine disk 6, which steam, on being deflected by the said turbine blades 5, impinges upon the turbine blades 3 and acts on them also. The fan and turbine casing is not shown. Any standard or special form of casing may be used.

The operation of this fan is as follows; A current of air being admitted to the fan 2 which rotates in a direction as shown by the arrow, the air is given a motion parallel to the shaft, and also a rotary motion in the direction of the arrow; the air, on leaving the fan 2 is encountered by the fan 1, which imparts to it an additional motion parallel to the shaft and in the same direction as that given to it by the fan 2, and in addition to that a rotary motion in a direction contrary to that given to it by the fan 2; the resultant motion of the air in the direction parallel to the shaft will be equal to the sum of the two motions imparted to it by the two fans, while the resultant rotary motion will be equal to the difference of the two motions imparted to the air by the two fans; and, if the two fans be of equal size and run at equal speeds in opposite directions, the air on emerging will have no rotary motion at all. The efficiency of the compound fan will evidently be higher on account of the elimination of this rotary motion from the air; the pressure of the discharged air will also be about double of that of a single acting fan for a given speed, which speed is limited by the centrifugal tension in the material of the fan. The efficiency of the double disk turbine will also be about twice the efficiency of a single disk turbine and without the

complication of guides, extra casings etc. for the turbine, and without the complication of separate chambers for the fans.

The shafts may either rotate with the fans, or they may be stationary and the hubs of the fans slide on them; also one shaft may be used instead of the two for both fans, and either one or both of the fans may be running loose on it. Any standard or special form of bearings may be used. The fan blades and turbine buckets may also be of any usual or special design.

In Fig. 2— 11 represents the vanes of the outer centrifugal fan, 12 are the vanes of the inner fan, each rotating in the direction of an arrow; 13 are the turbine blades or buckets of the disk 15 driving the outer fan, 14 are the blades or buckets of the turbine disk 16 driving the inner fan; 17 is the spider web, 18 the hub and 19 the shaft of either or both of the fans; N is the steam nozzle. The lower half of Fig. 2 shows only the skeleton or frame of the two fans; 21 is the outer rim of the outer fan; 22 is the outer rim of the inner fan; 23 is the inner rim of the outer fan; 24 is the inner rim of the inner fan; 25 are the arms of the outer fan spider, 26 are the arms of the inner fan spider. The operation is as follows; steam being admitted through the nozzle N to act on the blades 14, the inner fan will turn to the right, imparting to the air a centrifugal motion and tension and also a rotary motion to the right; the steam, on leaving the blades 14, will act on the blades 13 and drive the outer fan to the left. The air, on leaving the inner fan, will be acted on by the outer fan, which will impart to it an additional centrifugal motion and tension, and also a rotary motion to the left; the two rotary motions given to the air in opposite directions will neutralize each other as in the case of the apparatus shown in Fig. 1. The advantages will be the same for both types of fan or fan blower, as above described.

The frame of either the inner or outer fans may be of any suitable form; also the spider, shafts and bearings.

The steam turbine shown in Fig. 2 is of the outward flow type; but an inward flow turbine will work just as well, and even a parallel flow turbine, such as in Fig. 1 may be used.

The number of nozzles may be greater than one. The fans or fan blowers shown in Figs. 1 and 2 may also be driven by electric motors, by belts or gearing with the same advantages of the fan, but, of course, leaving out the special advantages of the turbine. The connections or fastenings of the turbines to the fans are not shown, and they may be of any suitable design.

The blades of the two turbine disks are shown in Figs. 1 and 2 as of nearly the same

size; but they may preferably be made of unequal size as in Figs. 3 and 4, which show the turbine buckets as increasing in area in a direction about at right angles to the direction of the flow of the steam, the blades on the disk which is more remote from the nozzle being larger than those on the disk which is nearer the steam nozzle; no guides are needed on this turbine. The number of turbine disks may also be larger than two, each alternate disk running in an opposite direction from that of the other alternate disks, and each disk driving a fan, the alternate fans being right handed and left handed, if they are of the propeller type; centrifugal fans driven by these turbine disks are shown to have a number of vanes somewhat larger than usual, each vane being somewhat shorter than usual; this is designed for the purpose of making room for the compound or multiple fans within the space assigned for the simple fan.

I do not restrict myself to any particular number of vanes, nor to the relative dimensions of turbines and fans, both of which could also be modified in shape and varied in detail without departing from the main scope of my invention. I do not, however, intend to include in the scope of my invention any devices used for dredging or in any of the arts analogous to dredging.

What I claim as my invention and desire to secure by Letters Patent is:

1. In a fan or fan blower two or more rotary units, each comprising a set of vanes and a set of steam turbine blades, said units being adapted to rotate in opposite directions in alternate order and to propel the air in substantially the same direction.

2. In a fan or fan blower two or more rotary units, each comprising a set of vanes and a set of steam turbine blades, said units being adapted to rotate in opposite directions in alternate order and to propel the air in substantially the same direction, combined with one or more nozzles adapted to direct a jet or jets of steam on to the said blades.

3. In a fan or fan blower two or more rotary units, each comprising a set of vanes and a set of steam turbine blades, said units being adapted to rotate in opposite directions in alternate order and to propel the air in substantially the same direction, combined with suitable means for supporting said units and suitable bearings.

4. In a fan or fan blower two or more rotary units carrying each a set of vanes, said rotary units being driven each by a set of steam turbine blades in opposite directions in alternate order and adapted to propel the air in the same direction, combined with a suitable steam nozzle or nozzles adapted to direct a jet or jets of steam on to the nearest of the said sets of steam turbine blades, the

said blades of the first set being adapted to deflect the steam to the blades of the next set of turbine blades running in the opposite direction.

5 5. In a fan or fan blower two or more units carrying vanes, said units being driven each by a set of steam turbine blades in opposite directions in alternate order, and adapted to propel the air in the same direction
10 tion combined with a steam nozzle or nozzles directing a jet or jets of steam to the nearest of the said sets of steam turbine blades, the said sets of blades being successively larger from the direction of the said nozzle or nozzles outwardly, and each set of said turbine
15 blades nearer the said nozzle or nozzles being adapted to direct the steam acting upon it to the next outward set of turbine blades.

6. In a fan or fan blower two or more rotary units carrying vanes, the said rotary units being driven each by a set of steam turbine blades in opposite directions in alternate order, and adapted to propel the air in substantially the same direction, combined with a suitable steam nozzle or nozzles
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adapted to direct a jet or jets of steam on to the nearest of the said sets of steam turbine blades, the blades of the first of the said sets being adapted to deflect the steam on to the blades of the next set running in the opposite direction, the said sets of steam turbine blades being successively larger from the said nozzle or nozzles outwardly and the enlargement of the said blades being in a direction substantially at right angles to the direction of the flow of the steam on the said blades.
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7. In a fan or fan blower two or more rotary units, each having a set of vanes in substantially radial planes and a set of steam turbine blades, said units being adapted to rotate in opposite directions in alternate order, in substantially the same plane of rotation, and to propel the air in substantially the same direction.
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Witnesses:

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