Jan. 25, 1938. F. E. KRAUSS 2,106,609

CENTRIFUGAL EXTRACTOR

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Fig. 1.

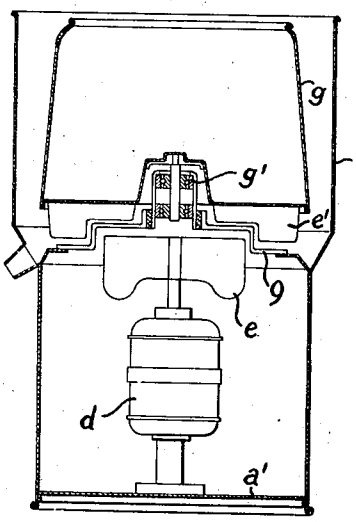

Fig. 2.

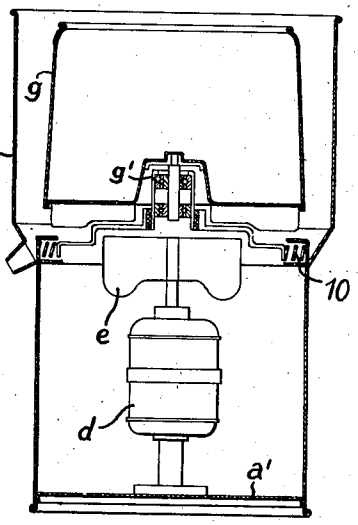

Fig. 3.

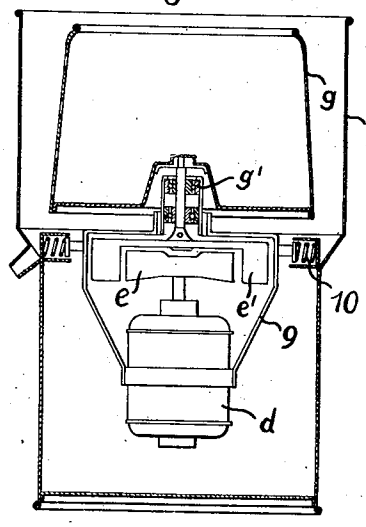

Fig. 4.

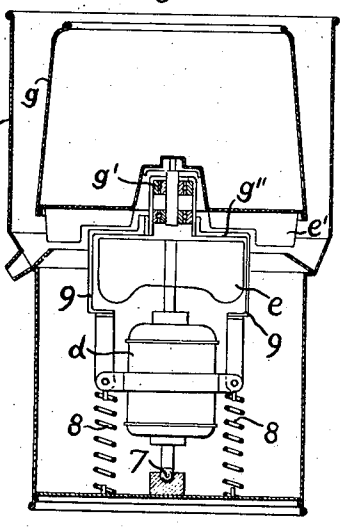

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Fig. 5.

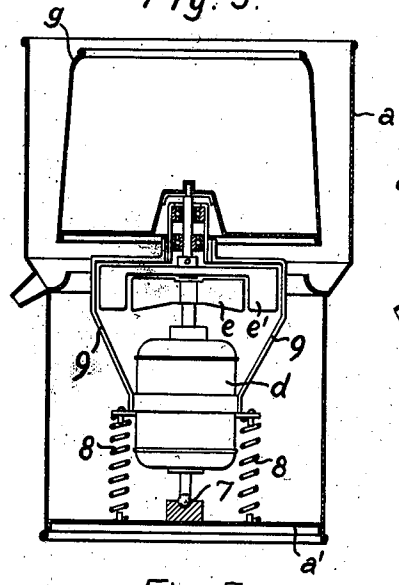

Fig. 6.

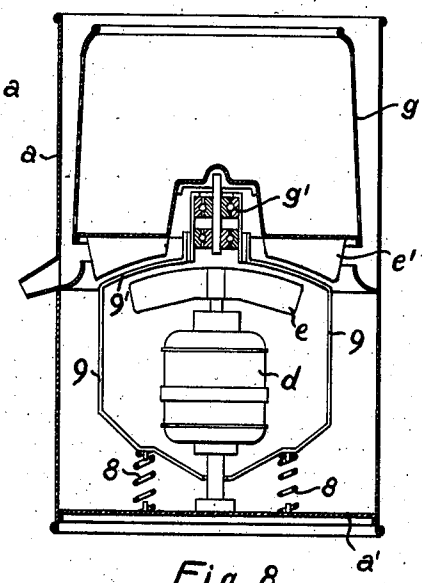

Fig. 7.

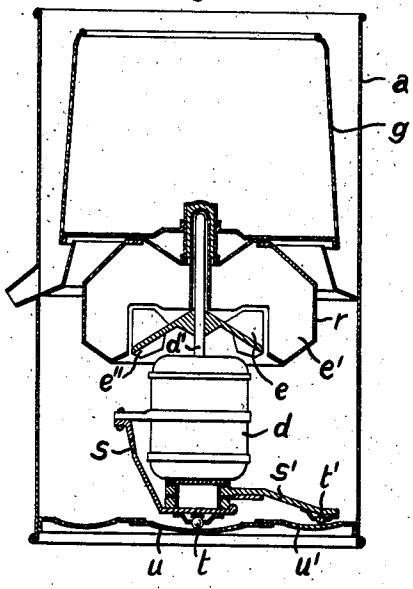

Fig. 8.

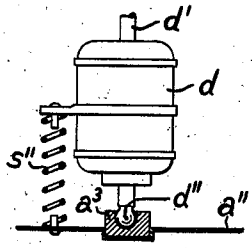

Fig. 9.

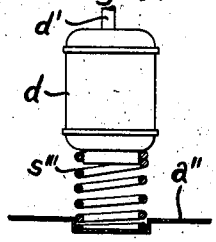

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Fig. 10.

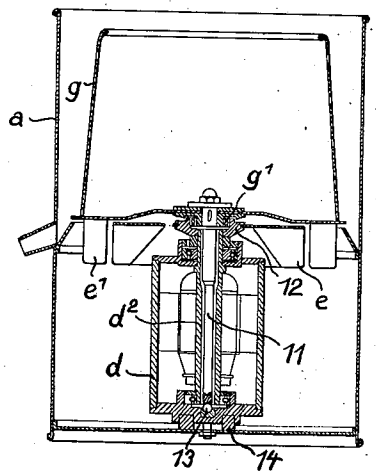


Fig. 11.

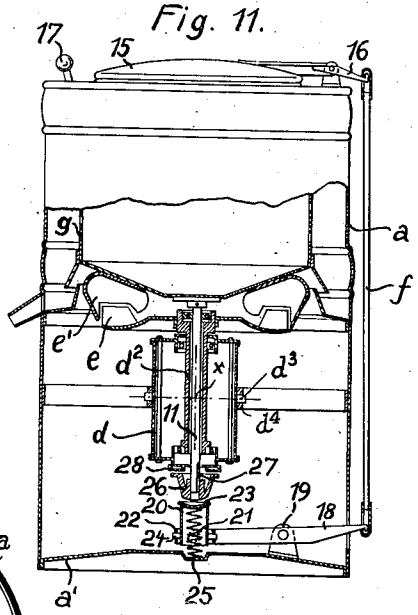
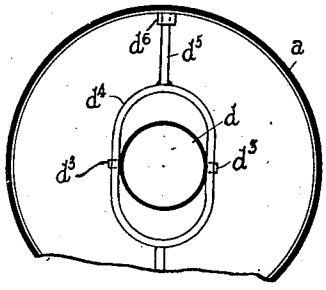


Fig. 11a



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Patented Jan. 25, 1938 2,106,609

UNITED STATES PATENT OFFICE

2,106,609

CENTRIFUGAL EXTRACTOR

Friedrich Emil Krauss, Schwarzenberg, Germany

Application April 26, 1934, Serial No. 722,495
In Germany April 28, 1933

2 Claims. (Cl. 210—71)

According to the Patent No. 1,931,600, dated June 13th, 1933, a blower or fan is provided which is mounted co-axially with the drum between said drum or basket and the motor, so that the air current produced by the said fan drives the drum which is provided with vanes or blades. By these means the drum is made independent as regards its number of revolutions from the speed of the motor itself and is also adapted to freely yield to the stresses produced by reason of the non-uniform loading, by reason of the mobile mounting of the shaft of the drum or basket. The embodiment characterized in the principal patent however necessitates a considerable play or free space between the fan and the drum vanes, thus very greatly reducing the efficiency of the air current drive. The otherwise known central driving arrangements of centrifuges by means of a motor directly coupled with them, have very deleterious inherent effects and disadvantages. It is only possible to use specially designed motors having very special and expensive bearing arrangements, extremely great torque and correspondingly low number of revolutions, which notwithstanding satisfying the above requirements are if the drum or basket of the centrifuge is unevenly charged, subjected to abnormal loads, and are consequently easily burnt out. By reason of this the current consumption of current is wastefully large and they can not be connected to the standard house wiring.

The endeavour of the present invention is to improve to a very pronounced extent the efficiency of the air driving arrangement according to the example mentioned in the principal patent and the present invention attains this object by the fact, that the drum which is rotatable independently of the motor is with its air driving organs on the one hand, and the motor is with its vanes generating the air pressure on the other hand, in order to reduce the air gap (between the driven air vanes of the drum, and the air compression producing vanes of the motor) to a minimum, connected either rigidly or resiliently with the housing. This desirable result may be attained by various means. Thus it would for instance be quite possible to mount the motor and drum or basket each in separate bearings within the housing, either both rigidly or both or one of them resiliently. Moreover the motor may be tiltably or movably supported in or on the housing, and the drum may be carried by a separate frame, so that its pendulum like movements together with the fan and motor in respect to the housing may be absorbed by means of resilient or elastic intermediary devices or means. It consequently becomes possible to reduce the gap between the air pressure producing fan blades of the motor and the vanes of the drum to the utmost practical limit. But this is even more reduced in contradistinction to the constructional form shown in the principal patent by the fact that the drum is resiliently supported independently from the motor, but that notwithstanding this the supporting frame is at its part reaching between the blower or fan and the driving vanes of the drum in the shape of an arc the apex of which is the centre point of the oscillatory movements of the drum. It would also be possible to seat and mount the drum directly on the shaft or axis of the motor and also to receive its driving impulse through the housing, in order that the number of revolutions of the drum and the motor might be chosen ad libitum.

It becomes possible to use by means of such an arrangement a very small output standard motor, for instance a vacuum cleaner motor, which has only a small torque and current consumption.

The appended drawings illustrate the invention in the Figures 1 to 7 in seven different embodiments in vertical sections, by way of example. The Figs. 8 and 9 show two varied methods and means of supporting the motor. Figs. 10 and 11 show two further examples of construction of the object of the invention, in vertical section partly in elevation. Fig. 11*a* shows a detail arrangement to Fig. 11.

According to Fig. 1 the motor *d* is rigidly connected with the housing *a* as for instance the bottom *a'* of the housing; this motor drives the vanes *e* producing the current of compressed air. The drum or basket of the centrifuge is carried by the housing *a* by means of a frame 9 but above its bearing *g* in such a manner that it is prevented from executing any lateral oscillations in respect of the vanes *e* of the fan, so that the air gap between the vanes *e* and *e'* remains as small as possible, and can not in any way alter during working. By this means the efficiency of the driving arrangement is essentially improved. It is however also possible to mount one or both members of the machine, for instance the motor or drum, each individually yielding, so that a mutual play is possible. According to Fig. 2, the supporting frame 9 is supported on the frame *a* by means of buffer springs 10, so that the drum *g* is free when unevenly charged to execute very small lateral oscillations. But it is also possible, as shown in the embodiment according to Fig. 3, for the motor *d* to be carried by the frame 9 so

that the motor follows any movements made possible by the buffer spring mounting 10. The width of the air gap between the vanes *e* and *e'* would thereby in this case, just as in the case shown in Fig. 1 not be altered at all.

According to Fig. 4 the motor *d* is mounted or supported on the housing *a* by means of a spherical pinion 7 around which it is free to oscillate, and it is furthermore by means of springs 8. It carries a frame 9 provided with the bearings *g'* for the drum *g*. The frame 9 reaches through between the fan *e* and the vanes *e'* driving the drum *g*, but may have a comparatively narrow width or thickness so that the air gap between the vanes *e* of the housing and the driving vanes *e'* of the drum *g* can be kept very small but first and foremost constant. The oscillation of the drum which may occur due to the uneven charging of the drum of which the fan *e* and the motor *d* also partake, are absorbed by means of the springs 8.

The frame 9 might also be extended, as shown in Fig. 5 between the driving vanes *e'* and the drum *g* to the bearing *g'* of the said drum *g*.

By this means the gap between the vanes *e* and *e'* may be still further and appreciably reduced, and can thus be reduced to the very minimum, thus further increasing the efficiency of the unit. In this case also any oscillations occurring will be absorbed by the spring 8. If it is deemed preferable to eliminate the rigid connection between the motor and the mounting of the drum, then the motor *d* is, as shown in Fig. 6 independently supported on the housing *a* as well as the frame 9 is. The motor may in this case be held comparatively rigidly. The frame 9 is again supported by springs 8. The part 9' of the frame 9 reaching between the fan vanes *e* and the driving vanes *e'* is as well as the adjacent edges of the arcuated or curved in the shape of an arc the apex of which lies in the centre point of the oscillatory movement of the drum *g*, that is to say approximately from the centre of the bottom *a'* of the housing. By reason of adopting this arrangement the air gap between the vanes remains even if the drum oscillates, suitably small and uniform. In the embodiment shown in Figs. 4 and 6 that part of the frame 9 situated between the vanes might be enlarged and be designed to act as guide vanes 9'' so as to minimize the drop in the pressure of the air current its passage from the fan *e* to the driving vanes *e'*.

According to the constructional form shown in Fig. 7 the motor *d* is here also arranged in the lower part of the housing *a*, the said motor being supported on the bottom *a''* of the housing for instance by means of a ball *t* and a cup *u*. The motor is laterally supported by means of arms *s'*, the balls *t'* and the corresponding cups *u'*. The fan *e* is mounted on the motor shaft *d'*, said fan generating the air current driving the drum *g*. The drum shaft is prolonged beyond the fan *e* and carries the drum *g* which is loosely mounted on this extension *d''*. The drum itself is provided with the vanes *e'* mounted at its bottom extremity, said vanes may be enclosed in a suitable housing or cowl *r*. The fan *e* may also form special vanes *e''* which generate a downwardly directed air current in order to ventilate and cool the motor.

The drum *g* is driven by means of the air current generated by the vanes of the fan driven by the motor, the drum *g* being adapted to loosely rotate on the motor shaft *d'* without being compelled to run at the same speed as the latter. It is not necessary for the fan *e* to continuously asperate fresh air from the bottom, which is then after it has exerted its action on the vanes *e'* allowed to escape freely, as the air may be caused to circulate through the fan *e* and driving vanes *e'* in a continuous closed circuit, and thus the fan does not create any outwardly noticeable air currents, because the housing *r* catches the air current and guides it suitably in order to be used over again. The tendential lateral movements of the drum are directly transmitted to the motor, which freely follows such movements by reason of its movable and resilient guiding on the bottom *a''* of the housing. The pans or races *u*, *u'* create a tendency for the motor and drum always to re-assume its central position.

A lateral pendulum type of support for the motor together with the drum is in many cases sufficient to attain the results aimed at; said lateral pendulum support is of the similar type to that known in conjunction with centrifugal drums or baskets rigidly mounted on the motor shaft. When the drum is loosely mounted on the motor shaft other movements of oscillation occur, because the drum generates, sinuously opposite pendulum motions acting in other directions, which more or less nullify the first mentioned oscillations. In such cases the motor is supported by means of springs *s'* and it rests by means of a ball trunnion *d''* in a central cup or socket a^3 as shown in Fig. 8 or the said motor may be supported on a central spring *s''* on the bottom *a''* of the housing *a* as shown in Fig. 9.

It is not necessary that the drum *g* should be supported in bearings at the bottom, it may just as well be suspended from the top by means of a strap which is mounted on the housing or frame *a* and thus carries the drum from the top. Such suspended bearing mountings are known per se, but it is very essential in this case, that the drum be not driven directly by the motor *d*, but that the drum should be driven by compressed air; (or rather by an induced current of air generated by the fan mounted on the motor).

Figs. 10 and 11 show two further examples of construction of the object of the invention, in vertical section partly in elevation.

In order to obtain a very long lever arm for the drum shaft, the latter can be mounted in the hollow motor shaft and, passing through it, can be supported in a special foot bearing, in accordance with Fig. 10. The shaft 11 of the drum *g* is first mounted in a neck bearing g^1 in the hollow motor shaft d^2, which latter is widened to form a crown 12, and the said shaft 11 then passes through the hollow motor shaft d^2 to the lower side of the motor, where it is supported in a special foot bearing 13. A special bearing supporting the drum shaft 11 at the lower end in relation to the motor can of course be built, but this can be dispensed with. The support of the motor *d* and of the drum *g* in relation to the housing can be effected in accordance with the examples in the above-described part of the description, but it is also possible to use an elastic ring 14 to provide resilient mounting.

The crown 12 of the hollow motor shaft d^2 carries the rim *e* of the blower blade inside the blade rim e^1 of the drum *g*.

In place of the foot bearing a brake can be fitted, which brake in accordance with Fig. 11 can be applied centrally to the drum shaft, while

the drum, when working, runs without the brake having effect.

The drum *g* has its shaft **11** mounted in the motor *d*, and from the latter the drive is transmitted to the drum in any desired fashion, for example with the aid of a wind coupling *e*, *e'*. The brake rod *f* is mounted at the side of the housing *a* of the centrifuge, the said brake rod being coupled to the cover **15**, which releases the brake rod *f* on being opened but lifts up with the aid of the arm **16** on being closed. The opening of the cover **15** takes place of its own accord, that is to say, under the action of a spring by operating a push-button **17**. The brake rod *f* engages with the lever **18** supported at **19** on the base of the housing *a'*, while to the inner arm of the said lever a pressure piece **20** is linked at **21**. The said pressure piece takes the form of a sheath closed at the top end and is under the influence of the spring **25** which endeavours to press against the brake cup **26** of the drum shaft **11**. The pressure piece **20** is held to the lever arm **18** by means of a universal joint, the arrangement being as follows: the piece **24** itself is mounted in a ring **22** with the aid of the wedge **24** diametrically opposite to it, while the ring **22** grips the lever **18** at **21**. The pressure surface of the pressure piece **20** is, for example, curved in the form of a bearing bush **23**, the arc of the curve being made eccentric to the centre of oscillation *x* of the motor *d*. The latter is mounted by a universal joint to the housing *a* of the centrifuge. The motor *d* may oscillate by means of its pinion d^3 in a gimbal d^4, and this latter may oscillate by means of its pinions d^5 in bearings d^6 of the housing *a*. The lower surface of the brake cup **26** is also of corresponding shape. On the motor housing *d* is fitted a friction disc **28** against which the brake cup **26** is pressed when owing to the opening of the cover **15** the brake rod *f* is released, whereby the spring **25** presses the pressure piece **20** against the brake cup **26** and the latter against the brake disc **28** of the motor. The pressure piece **20** can follow the swinging motion of the motor *d* with the drum *g*, owing to the fact that it is supported by means of a universal joint.

The brake cup **26** can be made fast to the drum shaft **11**. In that case the drum *g* will also rise with the brake cup **26**. This is however not necessary, because the brake cup **26** can also be mounted on the drum shaft **11**, with a spring **27**, i. e. prismatically, so that only the brake cup **26** rises, moving along the shaft **11**.

I claim:

1. A centrifugal extractor comprising in combination, a housing, a motor therein, means for resiliently supporting the motor in said housing, a prolonged shaft on the motor, a fan mounted on said shaft, a basket in said housing, a bearing carried by the basket fitting on and freely rotatable on a shaft arranged in the same axis with the prolonged motor shaft and carried by said motor, fans carried by the basket, said basket fans being concentric to the motor fan to drive the basket differentially in relation to the motor.

2. A centrifugal extractor comprising, in combination, a housing, a motor therein, means for resiliently supporting the motor in said housing, a prolonged shaft to the motor, a fan mounted on said shaft, a basket in said housing, a bearing carried by the basket fitting on and freely rotatable on said prolonged motor shaft, fans carried by the basket, a cowl housing the basket fans, said basket fans being concentric to the motor fan to drive the basket differentially in relation to the motor.

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