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[54] COUNTERWEIGHT BAG TENSIONING DEVICE

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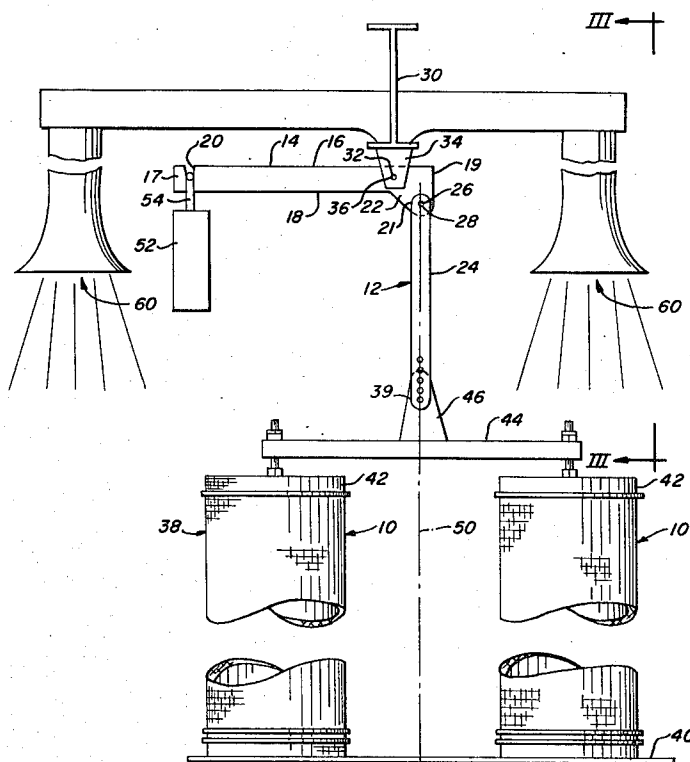
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[57] ABSTRACT

A bag tensioning device for use in a bag house and more particularly an improved counterweight and lever arm arrangement which maintains a dust collecting bag in equilibrium over a considerable range of total weight and with a relatively small vertical displacement of such a bag.

11 Claims, 4 Drawing Figures



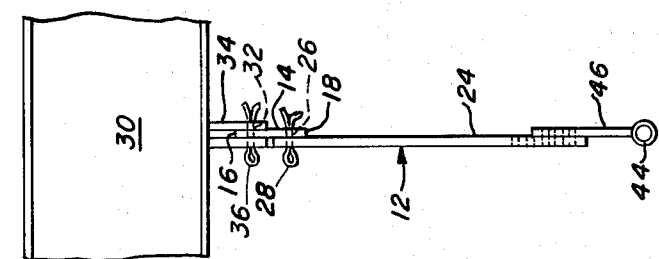


FIG. 3

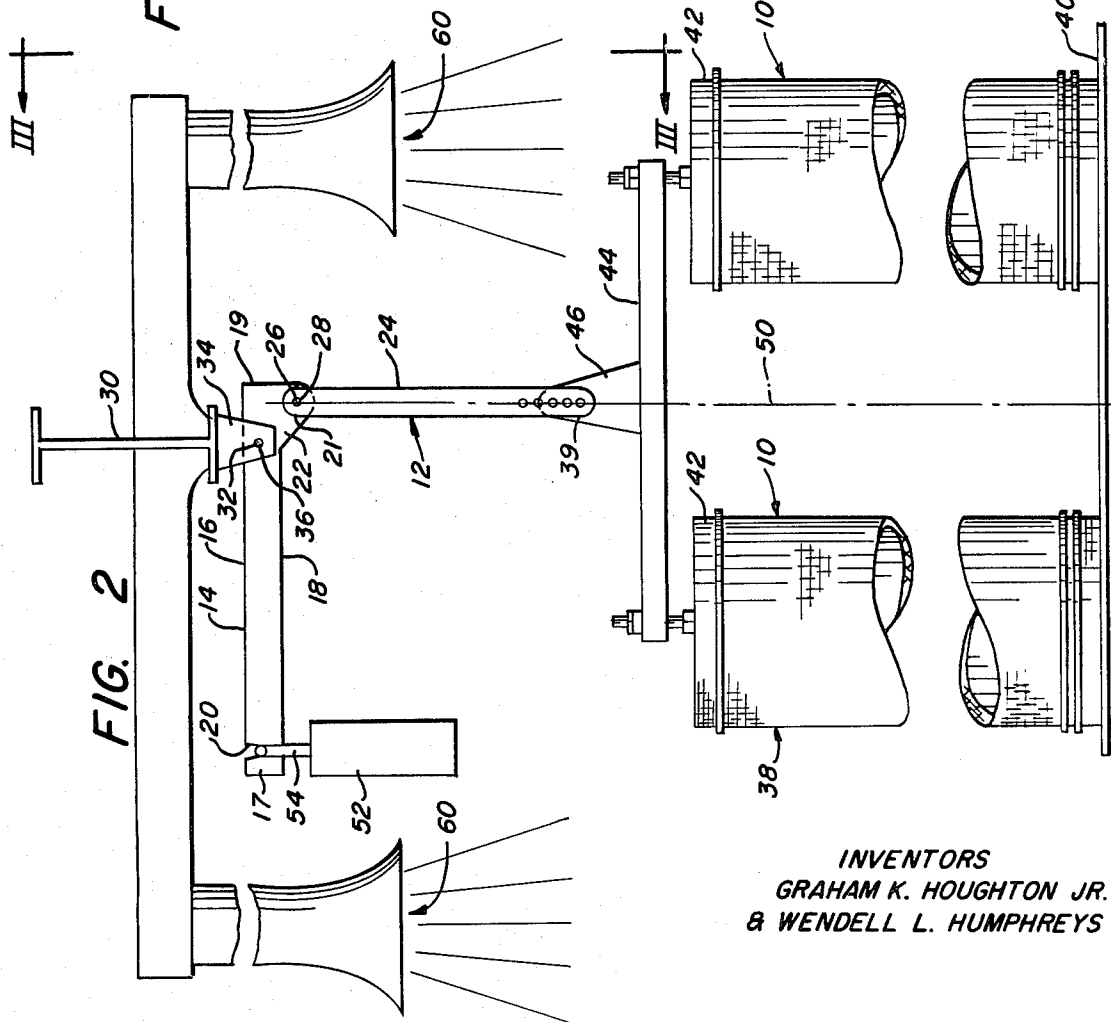


FIG. 2

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COUNTERWEIGHT BAG TENSIONING DEVICE

Bag house constructions of a type which remove foreign particulate matter from a fluid flowing therethrough, for example air, use a variety of means to maintain tension in the cleaning bags. One of such means to maintain tension in the bags is a lever arm having a weight attached to one end thereof and having the other end thereof secured to the bags to be tensioned. Such a lever arm is pivotally connected to a support beam or the like intermediate the ends thereof. With such prior lever arm arrangements, the weight added at the one end thereof was sufficient to maintain the arrangement in initial equilibrium and as dust collected in the bag the relative vertical and horizontal positions of the weight and bag pivot points would change to maintain the bag in equilibrium. The prior lever arm and weight arrangements have proved adequate for providing tensioning in the bags, however, the orientation of bag and arm pivot points in a substantially identical plane results in a rather large vertical displacement of the bag and hence the bag fabric tends to fold over itself at the bottom cuff thereof. Such folding over of the bag fabric results in a shortened useful life of the bag prior to replacement thereof.

By use of the present invention which includes a bent lever arm principle wherein the pivot point of the bag attachment is located below the pivot point of the lever arm attachment to the supporting member, a dust collecting bag is maintained in equilibrium over a considerable range of total weight and with a relatively small vertical displacement of the supported bag. Accordingly, the occurrences of the bag fabric folding over at the bottom cuff thereof are greatly reduced within a given range of bag weight and as such the lever arm supporting device of this invention results in an increase in the useful life of bags with respect to the life expectancy of such bags when using prior devices.

These and other objects and advantages of this invention will become more readily apparent from a reading of the following description and drawings in which:

FIG. 1 is a schematic plan view of a portion of a bag house incorporating the principles of this invention;

FIG. 2 is a partial side view of a plurality of dust collecting bags tensioned by means of a counterweight tensioning device of this invention;

FIG. 3 is an end view taken on lines 3—3 of FIG. 2 and

FIG. 4 is a displacement diagram illustrating the relative positions of the counterweight tensioning device of this invention throughout various conditions within the bag house.

Bag house construction of a type well known in the art include a plurality of dust collecting bags 10 suitably arranged therein to remove particulate matter from particle laden gas passed through such bag house. In order to obtain maximum filtering efficiency of a bag house construction, bags 10 thereof must be supported therein in such a manner that the maximum surface area of the filtering fabric of such bags 10 is exposed to the flow path of the particle laden gas. The bag supporting and tensioning assembly 12 of the present invention provides that the above specified support of bags 10 be accomplished by means of a lever arm and counterweight arrangement as hereinafter described in detail.

Bag tensioning assembly 12 includes an elongated arm member 14 having spaced longitudinally extending sides 16 and 18. A notch 20 extends transversely inwardly from side 16 adjacent one end 17 of member 14. Adjacent the other end 19 of member 14, a lug portion 22 depends transversely downwardly from side 18. An elongated bag carrying strap 24 has one end 21 thereof pivotally connected to lug portion 22 at strap pivot point 26 in any suitable manner, for example aligned transverse bores through strap 24 and lug portion 22 within which a known cotter pin assembly 28 is received. Strap pivot point 26 is located transversely downwardly from side 18.

Bag tensioning assembly 12 is located upwardly from bags 10 when such assembly is operatively positioned within a bag house. As viewed in FIG. 2 such operative positioning results in sides 16 and 18 being, respectively, the uppermost and lowermost surfaces of arm member 14. Assembly 12 is carried by a bag house structural member 30 which is pivotally secured to arm member 14 at tensioning assembly pivot point 32. Assembly pivot point 32 is axially intermediate arm end 17 and strap pivot point 26 and transversely intermediate sides 16 and 18. The above discussed pivotal connection can be achieved in any suitable manner for example a support lug 34 depends downwardly from the bottom flange of structural member 30 and aligned transverse bores extend through lug 34 and arm member 14 at assembly pivot point 32 within which a known cotter pin assembly 36 is received.

The tensioning assembly 12 is intended to be suitably connected to one or more bags 10 to maintain such bags 10 in tension throughout a wide range of dust accumulation thereon. As shown in FIGS. 1 and 2 each tensioning assembly supports two bags 10, two such bags 10 being supported by a single tensioning assembly 12 being generally indicated as bag assembly 38. Bag assembly 38 comprises two bags 10 having the lower ends thereof shown as being suitably fixed to a shelf 40 of a bag house and having collar members 42 fixedly secured at the respective upper ends thereof. An elongated structural member, shown as pipe 44, extends transversely between collar members 42 and has the respective ends thereof suitably secured to members 42. A lug member 46 is fixedly secured to member 44 on the vertical axis through the center of gravity 50 of assembly 38 and lug 44 extends upwardly from member 44 along the bag assembly vertical axis through the center of gravity 50.

With a tensioning assembly 12 pivotally secured to structural member 30 as described hereinbefore the end portion 39 of strap 34 opposite end 26 is secured to lug 46 in any suitable manner. A weight 52 having an upper handle portion 54 thereof is hung from arm member 14 by the insertion of handle portion 54 over end 17 and the seating thereof in notch 20.

The magnitude of weight 52 is determined by summing the moments about tensioning assembly pivot point 32 and determining what weight is necessary for the sum of such moments to equal zero when the upper side 16 of lever arm 14 is horizontal with respect to the bag house within which tensioning assembly 12 is contained. To clarify the above discussion, reference is made to FIG. 4 wherein at the initial position T of arm member 14, the horizontal distance from notch 20 to

pivot point 32 is designated A, the horizontal distance from strap pivot point 26 to point 32 is designated B and the weight of weight 42 and assembly 38 are respectively designated C and D. A summation of the moments about pivot point 32 yields:

$$C \times A - D \times B = 0$$

and solving for the magnitude C of weight 52 gives the resultant equation:

$$C = (D \times B) / A$$

As particulate laden gas passes through the bag house, particulate matter therefrom is deposited upon the surfaces of bags 10 and accordingly the total weight of bag assembly 38 increases therefore resulting in a rotation of arm member 14 about pivot point 32 until equilibrium conditions are again established. Such a rotation of arm member 14 and subsequent equilibrium position is shown in FIG. 4 at position U wherein the sum of the moments about pivot point 32 now yields:

$$C \times A' - D' \times B' = 0$$

where A' = the horizontal distance between notch 20 and pivot point 32;

B' = the horizontal distance between pivot point 32 and pivot point 26'; and

$D' = D$ plus the additional weight of particulate matter accumulated on bag assembly 38.

As additional particulate matter accumulates on the bags 10 the arm member 14 will continue rotating in a manner as described above until the eventual collapse of the bags 10 supported by the assembly 12 or until further rotation thereof is prohibited by a stop means as for example, member 14 can rotate until side 16 thereof contacts the bottom flange of structural member 30. Preferably arm 14 will be stopped from rotation prior to the collapse of bags 10 to avoid excessive folding of the bag fabric which would result in shortened bag life.

In conjunction with the stop means mentioned hereabove, an apparatus can be provided which would cause a rather rapid vertical displacement of bag assembly 38 such that arm member 14 will strike the stop means with sufficient momentum that the reaction force from such striking will be transmitted to bag assembly 38 to at least partially dislodge accumulated particulate matter therefrom. Such an apparatus is schematically illustrated in FIG. 2 only, as a plurality of high pressure discharge nozzles 60 which are suitably connected to the bag house frame (not shown) and to a high pressure source (not shown) of air. When a high pressure blast of air is discharged from nozzles 60, a pressure is applied at the upper surface of bag assembly 38 causing the rapid vertical displacement thereof which results in arm member 14 striking the bottom flange of structural member 30 with sufficient force to dislodge accumulated particulate matter from bag assembly 38. It is to be noted that other means can be provided to cause the above mentioned rapid vertical displacement of bag assembly 38, for example: suitably positioned rapping means which are either mechanically or electrically operable; or the collapsing of the bags 10 through a reverse flow of air through the bag house.

By use of the tensioning assembly 12 of the present invention which spaces strap pivot point 26 vertically downwardly from the pivot point 32 of the tensioning assembly, the vertical displacement of strap pivot point 26 is less than the vertical displacement of prior tensioning assemblies, which located the strap pivot point on the same line with the assembly pivot point. For an example of the vertical displacement of the strap pivot point from the initial equilibrium position T thereof, reference again is made to position U of FIG. 4 wherein such vertical displacement is indicated by E and can be calculated by use of the formula:

$$E = F \cos(\phi - \theta) - H$$

where:

F = the distance between pivot points 26 and 32 measured along an axis X—X extending between such points;

ϕ = the angle between axis X—X and a vertical axis drawn through pivot point 32;

θ = the angle between the axes X—X and X'—X' when arm member 14 is at positions T and U, respectively; and

H = the vertical distance between pivot point 26 and 32 where arm member 14 is in position T.

Inasmuch as the novelty of the present invention resides in the bent lever arm construction discussed hereinabove and more particularly having the axis of rotation for bag assembly spaced vertically from the axis of rotation of the arm member, various modifications can be made to the preferred embodiment discussed herein without departing from the scope of the invention, for example: bag assembly 38 includes only one dust collecting bag or it can include a larger group of dust collecting bags than the two bag assembly 38 as described; bag assembly pivot point 26 can be in any location along a vertical drawn therethrough except in the same horizontal plane with pivot point 32 and still retain the advantages of less relative vertical displacement in relation to prior art tensioning assemblies; a plurality of bag assembly horizontal axes of rotation can be positioned along a vertical line and an operator can select which particular axis to use as conditions dictate; other structures can be used to connect bag assembly 38 to pivot point 26 than the strap 24 described, for example lug portions; and the like.

It is understood that the present invention is not confined to the particular construction and arrangement of parts described and illustrated herein but embraces all such modifications thereof as come within the scope of the following claims.

What is claimed is:

1. In a bag supporting and tensioning assembly for supporting and providing tension for dust collecting filter bags in a bag house throughout a predetermined range of bag weight, the improvement comprising: rigid means adapted to be secured within a bag house, an elongated lever arm member having means defining a first horizontal axis of rotation intermediate the axial ends thereof and being pivotally supported at said first axis of rotation by said rigid means; said arm member pivotally supporting at least one such dust collecting filter bag at pivot means defining a second horizontal axis of rotation inwardly adjacent one end of said arm member, weight means secured to said arm member at

a point adjacent the other end of said arm member and longitudinally spaced from said means defining said first axis of rotation in counterbalancing relationship with said bag, said point of securement and said means defining said first axis of rotation being located on a substantially horizontal line, and said pivot means defining said second axis being located substantially below an extension of said horizontal line from said point of securement through and beyond said first axis.

2. A bag supporting and tensioning assembly as specified in claim 1 wherein said rotation limiting means comprises a bottom flange portion of said rigid means.

3. A bag supporting and tensioning assembly as specified in claim 1 wherein said first horizontal axis of rotation is integral with said arm member.

4. A bag supporting and tensioning assembly as specified in claim 1 wherein said first horizontal axis of rotation is vertically intermediate the longitudinally extending sides of said arm member.

5. A bag supporting and tensioning assembly as specified in claim 1 wherein means pivotally supporting at least one of said dust collecting bags comprises a strap member pivotally connected at one end thereof to said arm member and connected at the other end thereof to said dust collecting bags.

6. A bag supporting and tensioning assembly as specified in claim 5 wherein said means pivotally supports a plurality of dust collecting bags.

7. A bag supporting and tensioning assembly as specified in claim 1 additionally including rotation limiting means which limit the rotation of said arm member about said first horizontal axis of rotation.

8. A bag supporting and tensioning assembly as specified in claim 7 additionally including rotation instigating means which result in said arm member contacting said rotation limiting means with force sufficient to dislodge at least a portion of accumulated particulate matter from said dust collecting bags.

9. A bag supporting and tensioning assembly as specified in claim 8 wherein said rotation instigating means comprises at least one high pressure air discharge apparatus adapted to be secured to the bag house upwardly of said dust collecting bags.

10. In a bag supporting and tensioning assembly for supporting and providing tension for dust collecting filter bags in a bag house throughout a predetermined range of bag weight, the improvement comprising; a bag house, rigid means secured within said bag house, an elongated lever arm member having means defining a first horizontal axis of rotation intermediate the axial ends thereof and being pivotally supported at said first axis of rotation by said rigid means, said arm member pivotally supporting at least one of such dust collecting bags at pivot means defining a second horizontal axis of rotation inwardly adjacent one end of said arm member, weight means secured to said arm member at a point adjacent the other end of said arm member and longitudinally spaced from said means defining said first axis of rotation in counterbalancing relationship with said bag, said point of securement and said means defining said first axis of rotation being located on a substantially horizontal line and said pivot means defining said second axis being located substantially below an extension of said horizontal line from said point through and beyond said first axis, rotation limiting means on said rigid means which limit the rotation of said arm member about said first horizontal axis of rotation, and rotation instigating means which result in said arm member contacting said rotation limiting means with force sufficient to dislodge at least a portion of accumulated particulate matter from said dust collecting bags.

11. A bag supporting and tensioning assembly as specified in claim 10 wherein said rotational instigating means comprises at least one high pressure air discharge apparatus secured to said bag house upwardly of said dust collecting bags.

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