ABSTRACT

A transverse fan for use in the cleaning and separating mechanism of a combine harvester and wherein such transverse fan is provided with a choke vane mechanism positioned in the air inlet for such fan, and with a damper mechanism positioned in the air outlet of such fan, such mechanisms being adjustable, singularly or in combination to vary the amount of air being delivered by such fan.

4 Claims, 3 Drawing Figures
Fig. 3

- TOTAL AIR
- CLEANER AIR
- DAMPERS CLOSED
- CHOKE MOVEMENT IN DEGREES
- CHOKE RESET TO WIDE OPEN
- SEPARATOR AIR

AIR C.F.M. PER. IN. OF WIDTH

CHOOSE MOVEMENT IN DEGREES
This invention is concerned with providing a combine harvester transverse fan with control mechanisms for varying the quantity of air discharged from such fan without varying the fan speed.

In combine harvesters, the regulation of air in the cleaning and separating mechanism is very critical, and this amount of air varies with the crop, condition of the crop and even the time of day, and this volume of air must be uniformly supplied because otherwise a high percentage of the crop would be blown out of the rear end of the combine. In multi-ducted systems, such as those having one duct for the cleaner and one duct for the separator, it is of extreme importance that the ratio of air being supplied by each duct remain constant while the volume is changed.

A further object of this invention is to provide a perforated damper in the discharge duct of a transverse fan for varying the volume of discharged air, while producing a uniform air flow. A further object of this invention is to provide an adjustable perforated damper in the discharge duct of a transverse fan which can be used in combination with the choke vane in the air intake opening of such fan for regulating the volume of air being delivered by such fan.

A further object of this invention is to provide an adjustable perforated damper in the discharge duct of a transverse fan and which can be adjusted in such duct for reducing the volume of air discharged by said fan 50 percent and in combination with a choke vane in the air intake of such fan, such choke vane can be adjusted in increments for said fan providing less than 50 percent normal air.

Other features and advantages will appear in the following description in the appended claims, reference being had to the accompanying drawings forming a part of this specification, wherein:

FIG. 1 is a side elevation of a combine harvester embodying the invention with parts of the combine broken away or removed for clarity of illustration;

FIG. 2 is an enlarged portion of the cleaning and separating fan shown in FIG. 1; and

FIG. 3 is a graph showing test results of the embodiments shown in FIGS. 1 and 2.

This invention is an improvement over the invention shown and described in my co-pending application Ser. No. 311,340, filed Dec. 1, 1972. Referring now to the drawings, there is shown in FIG. 1 a side view of a combine designated 10. A cleaning and separating fan 11 extends transversely across the lower portion of the combine, which includes a frame 12 supported at the rear on dirigible wheels 13, and supported at the front on drive wheels 14. Combine 10 is provided with a header 15; transversely spaced apart sidewalls 16, 16A; an operator station 17; a grain bin 18; an engine 19 and a separating and cleaning mechanism 20. A conveyor 21 carries grain and straw from a threshing cylinder (not shown) and discharges same on straw rack 22. Grain cleaning pans 23 are positioned beneath rack 22 and deposit clean grain in auger 24 which conveys same to grain bin 18 by means (not shown).

Cleaning and separating fan includes an enclosing casing 26 having end sections 27 which are attached to sidewalls 16 and 16A. A bearing 28 is supported in each of the end sections 27 and define a transverse fan axis 29. Fan 11 is provided with separating duct 31 extending upward inwardly under conveyor 21 for passing a stream of air through material being delivered to straw rack 22 by conveyor 21. Cleaning duct 32 extends rearwardly and upwardly to direct a flow of air under cleaning pans 23.

Referring now to FIG. 2 wherein an enlarged view of the cleaning and separating system 20 is presented removed from the combine 10. This preferred embodiment of the invention includes the casing 26 having transverse sections that extend from side wall 16 to side wall 16A therewith to thus form the enclosed casing. One of these transverse sections is the upper surface 33 of separator duct 31 and another of the transverse sections is the lower surface 34 of cleaner duct 32.

Fun casing 26 also includes an air intake opening 35 positioned between the upper section 33 of duct 31 and lower section 34 of duct 32. A drum shaped rotary fan or blower wheel 36 is supported by bearings 28 for rotation within casing 26. The blower wheel 36 includes a central shaft 37 mounted for rotation about axis 29 and a plurality of radially extending discs 38 secured thereto. Blower wheel 36 extends the entire width of casing 26 and a disc 38 is positioned at each end. Mounted on end disc are series of arcuate blades 39. These blades are mounted in the manner shown in pending application Ser. No. 249,479 file Oct. 2, 1972, to which reference may be had if further details of the blower wheel 36 are desired.

The blower wheel 36 revolves in a counterclockwise direction as seen in FIG. 2, and in so doing draws air through opening 35 and causes it to be discharged between upper section 33 and lower section 34. A transversely extending choke vane 42 is mounted between sidewalls 16, 16A of combine 10 and includes the shaft 43 mounted in sidewall 16, 16A for pivotal movement about a transverse axis. Choke vane 42 is co-extensive with blower wheel 36 and is used to adjust the amount of air entering wheel 36.

Wheel 36 is driven by engine 19 at substantially constant speed through conventional drive means not shown. Choke vane 42 is provided with external control members (not shown) for adjusting the position of vane 42 relative to wheel 36. In FIG. 3 the two extreme positions of vane 42 are shown. Full line position is with vane 42 in wide open position and the dotted line position is with vane 42 partially closing air intake opening 35. It is to be noted that a passage 44 for air to enter wheel 36 is provided between vane 42 and main cut-off 46 formed by the lower edge of section 33, in any position of vane 42. The lower section 47 forms at its lower end, a flow divider 48 for dividing the output air between ducts 31 and 32. Cleaner duct 32 is provided with an upper section 49 whose lower edge is joined with divider 48. Section 49 is also provided with a transverse opening 51 through which duct or the like can be inspired and discharged through duct 32.

It is to be noted that passage 44 positioned between the main cut-off 46 and choke vane 42 continuously admits a stream of high velocity air to wheel 36, maintaining pressure balance within fan 11. This is necessary to keep the fan operating efficiently. Choke vane 42 is provided with a central position of vortex 34 for all choke vane positions from open to close. Significant percentage of air entering opening 35 travels in a relatively narrow band which forms passage 44 in close proximity to main cut-off 46. This phenomena reduces the difficulty in choking a transverse fan and facilitates the use of a relatively small, simple pivoted choke vane 42.
Separator duct 31 and cleaner duct 32 are provided with duct dampers 56 and 57, respectively, which are spaced from the fan a sufficient distance so as not to adversely affect the position of the fan vertex 54. Duct damper 56 is pivotally connected to upper section 33 for movement about a transverse axis 58 as shown in FIG. 2. Damper 56 is shown at generally a right angle to the longitudinal axis of separator duct 31. In this position damper 56, being made of perforated material, is blocking approximately 50 percent of the air that would normally pass through duct 31. Damper 56 can be pivoted by external means (not shown) to lie alongside the section 33, thus eliminating any choking of air in duct 31. Damper 56 extends transversely across the entire width of duct 31.

Duct damper 57 is similar to duct damper 56, and is mounted for pivotal movement about axis 59. As seen in FIG. 2, damper 57 is shown generally at a right angle to the longitudinal axis of cleaner duct 32. In this position, damper 57, being made of perforated material, is blocking approximately 50 percent of the air that would normally pass through duct 32. Damper 57 can be pivoted by external means (not shown) to lie alongside of section 49, thus eliminating any choking of air in duct 32. Damper 57 extends transversely across the entire width of duct 32.

It is apparent that duct dampers 56 and 57 in combination with choke vane 42, can be pivoted to its open position from which it can be gradually closed until the desired amount of air is obtained.

FIG. 3 graphically sets out this relationship. The left-hand side of the graphs represents operation of the separating and cleaning mechanism 20 with dampers 56 and 57 positioned in open position while choke vane 42 is moved from 0° to 25°, which results in a 50 percent reduction in air. If a further reduction is desired, dampers 56 and 57 are moved to closed position while choke vane 42 is moved to open position. This results in the air being reduced 50 percent, and a further reduction is desired, such be obtained by moving choke vane 42 from 0° to 40° as is shown in the right-hand side of the graphs.

It is apparent from these graphs that very accurate adjustment and distribution of the air flow is obtainable by an adjustment of dampers 56 and 57 and choke vane 42.

The embodiments of the invention in which an exclusive property of privileges claimed is defined as follows:

1. A combine having a straw separation area including straw racks and a grain cleaning area wherein said straw separation area including grain cleaning pans; a transverse fan for producing wide and uniform air streams for use in said separating and cleaning areas; means for driving said fan at a substantially constant speed; a casing enclosing said fan and including an air intake opening, a main cut off for air moved by said fan, a first air outlet duct directing air to said straw separation area and a second air outlet duct directing air to said grain cleaning area; a transversely extending choke means pivotally mounted on said combine in said air intake opening adjacent to said cutoff and comprising with said fan on an axis parallel to the axis of said fan, said choke means being adjustable between a choke position blocking part of said opening and an open position freeing said opening; a first baffle having perforations therethrough pivotally mounted on said combine in cooperative relation with所述 first duct for selective pivotal adjustment between an open position wherein said first duct is not obstructed thereby and a closed position wherein first baffle is in blocking relation to said first duct; and a second baffle having perforations therethrough disposed in said second duct and pivotally mounted on said combine for selective movement between an open position in which it does not obstruct said second duct to a closed position wherein it is in blocking relation to said second duct, said perforations in said baffles permitting partial flow through the associated ducts when said baffles are in their closed position, said first and second baffles being spaced from said fan a sufficient distance so as not to adversely affect the position of the fan vertex.

2. The structure of claim 1 wherein said baffles are of such a size as to reduce the air flow in said ducts approximately 50 percent when said baffles are in their said closed positions.

3. The structure of claim 1 wherein said first baffle is at the outlet of said first duct.

4. The structure of claim 1 wherein said choke means and baffles are selectively adjustable to provide a wide range of air flow rates to said straw separation and grain cleaning areas of said combine.

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