Nov. 9, 1971 F. J. BALLARD, JR 3,618,225

APPARATUS FOR AIR DRYING TOBACCO

Filed June 15, 1970 3 Sheets-Sheet 1

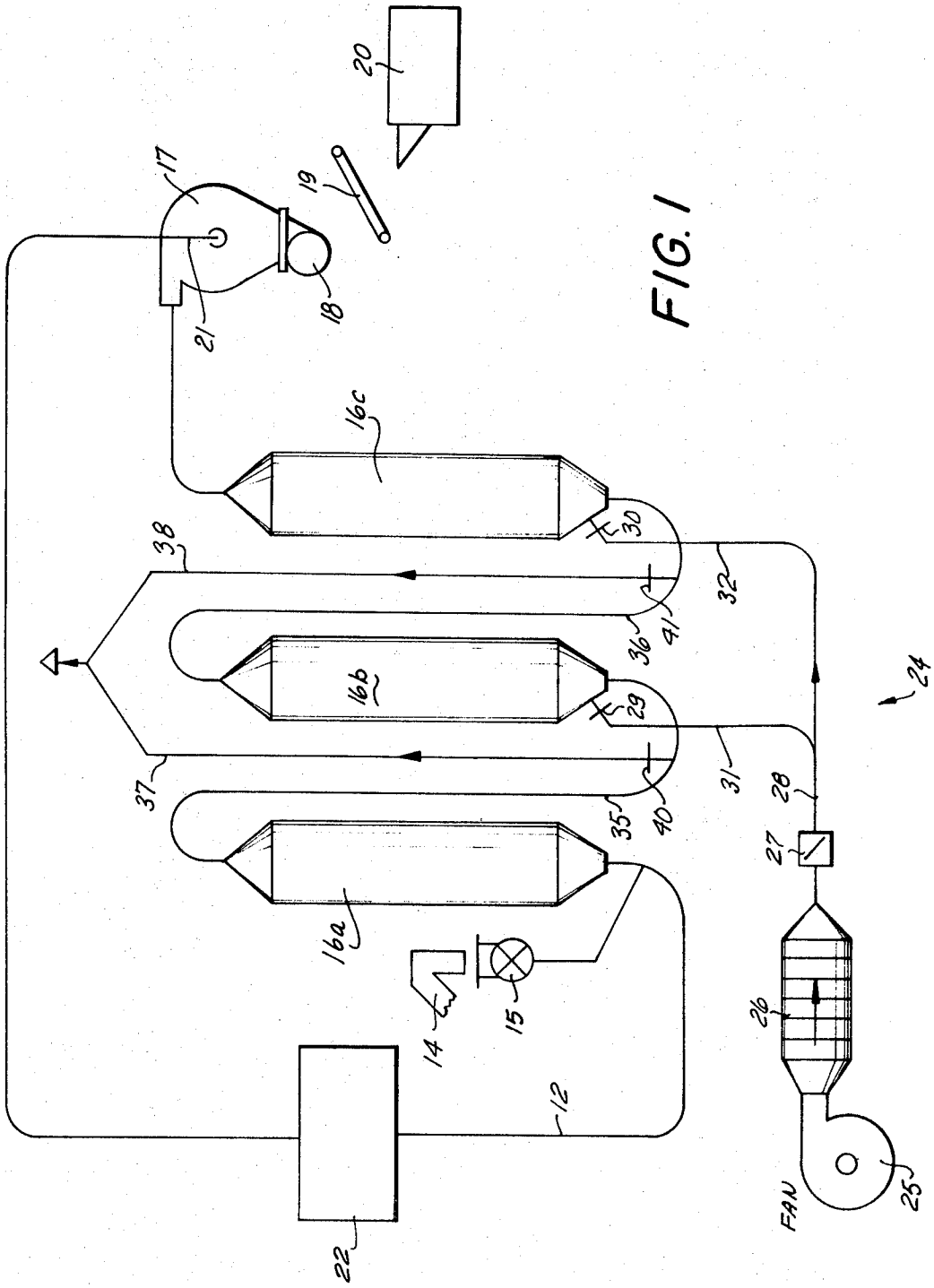

FIG. 1

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Filed June 15, 1970 3 Sheets-Sheet 2

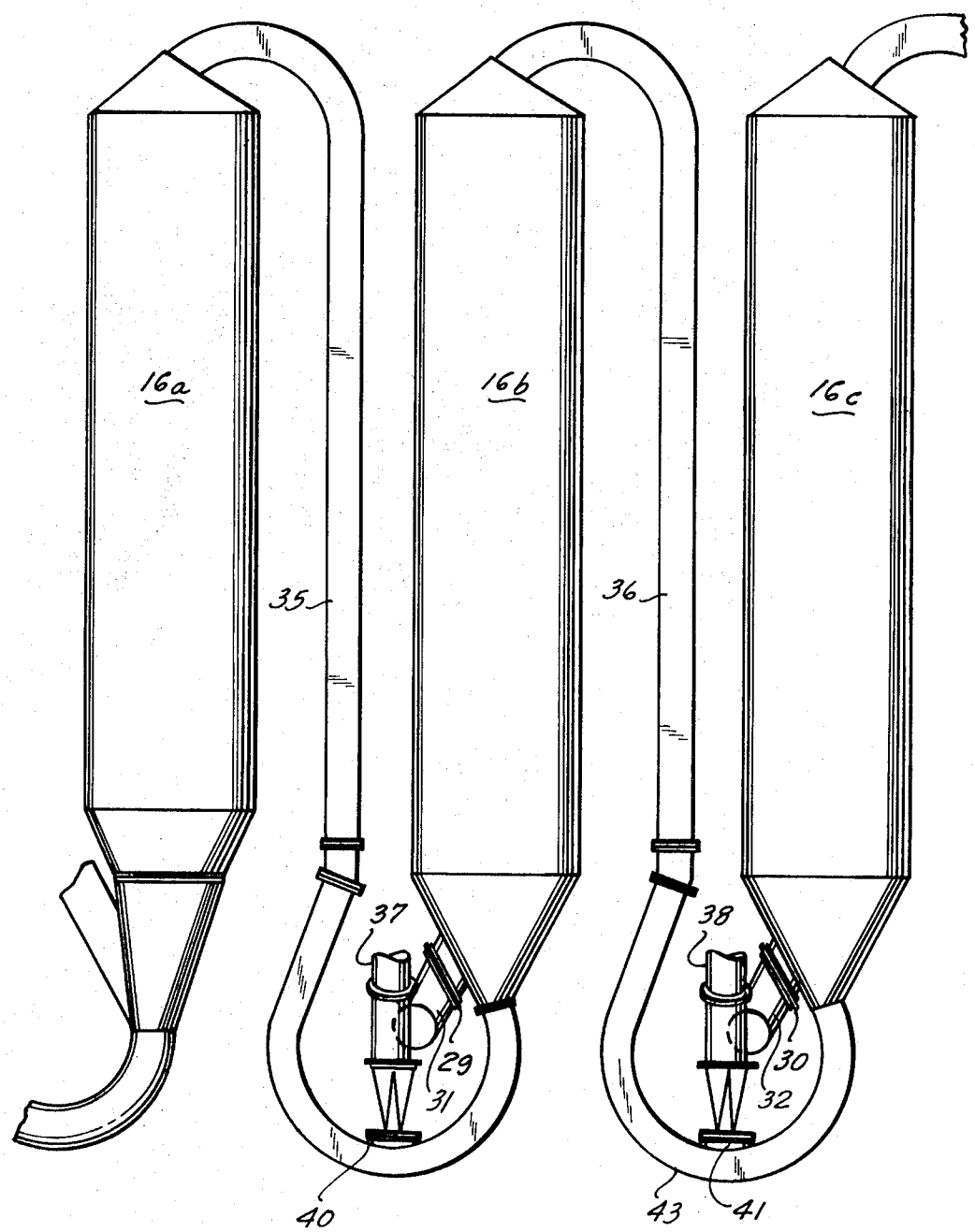

FIG.2

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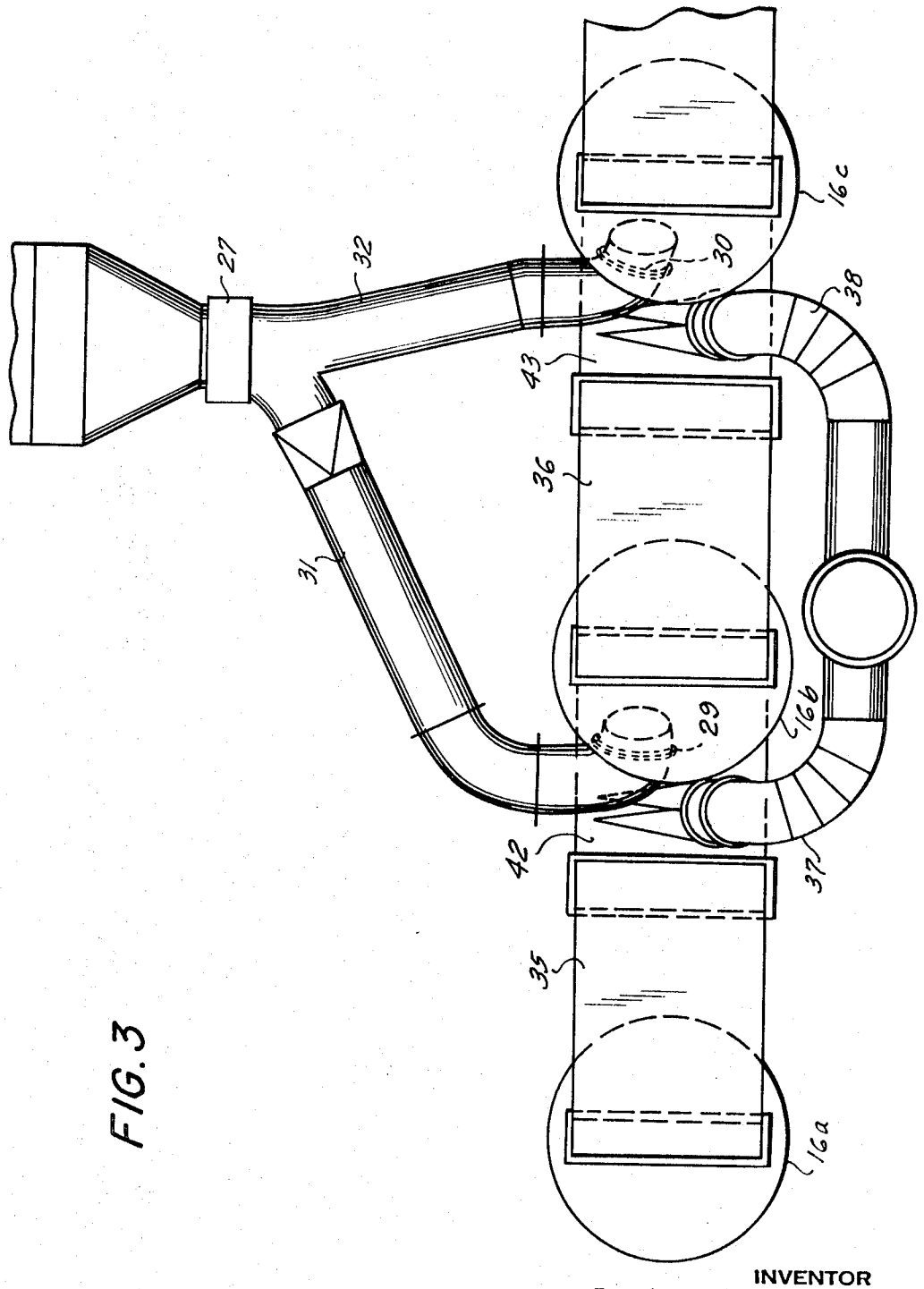

FIG. 3

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3,618,225

APPARATUS FOR AIR DRYING TOBACCO

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U.S. Cl. 34—57 A 10 Claims

ABSTRACT OF THE DISCLOSURE

A closed system is provided for drying tobacco by heated circulating air. The tobacco is initially introduced into the system in the path of the heated air. A plurality of heating chambers are in the system through which the air-conveyed tobacco is dried. When the tobacco has reached the desired degree of drying, it is removed from the system beyond the heating chambers. The system also provides for the recirculation and reconditioning of the air in order that it is at the desired temperature and moisture content at the point of introduction of the tobacco. The heated air supply at the location of the heating chambers is supplemented in order to increase the drying efficiency and the tobacco through-put of the system. The supplemental heated air supply includes a bleed for air between chambers which is thereafter replenished by the supplemental heated air system. In this manner, the temperature of the air is increased at this location in the system between chambers.

The present application is directed to an improved apparatus for air drying tobacco of the type disclosed in commonly assigned U.S. Pat. No. 3,357,436 granted on Dec. 12, 1967. The apparatus of this patent embodies a system for improving the filling power and quality of tobacco by drying it to a certain moisture content. Air is conditioned by lowering the moisture content and increasing its temperature. This is accomplished by bleeding off part of the recirculating air and replenishing it with an equal amount of fresh air at a lower moisture content. The quantity of air that is removed and introduced is automatically controlled. Similarly automatic means are employed for attaining the desired air temperature at the location at which the tobacco is introduced into the system. Practice has proven that the system of this patent performed satisfactorily with acceptable efficiency in obtaining tobacco of uniform moisture content.

The present invention proposes to further increase the drying and tobacco through-put efficiency of tobacco air drying systems as well as the system disclosed in the above patent.

Other objects and advantages will become apparent from the following detailed description which is to be taken in conjunction with the accompanying drawings in which:

FIG. 1 is a diagrammatic view of a tobacco air drying system incorporating the teachings of this invention and is particularly related to specific improvements of the system disclosed in the above patent;

FIG. 2 is an enlarged fragmentary elevational view showing the incorporation of the supplemental heated air unit incorporated in the air drying system between heated air chambers; and

FIG. 3 is a top elevational view thereof.

In the closed system shown in the drawings, air conditioned as to temperature and moisture content, as in the above patent, is delivered through a duct **12**. Tobacco is introduced into the system and into this air stream by an automatic feeder **14** through an airlock **15** and is conveyed by the air flow through one or more drying chambers **16**.

In each chamber **16**, the tobacco is conveyed upwardly, the velocity of the air being substantially lower than in the duct to the system. The chamber is so proportioned in relation to the velocity of air flow that the air flow in each of the chambers is insufficient to overcome the force of gravity on denser portions of the tobacco. In this manner, these denser portions will lose their initial upward velocity before reaching the top of the chamber and will sink back in the outer portion of the chamber and execute a circulatory motion in the chamber until their density has become less. These denser portions of tobacco may be the result of wetness of the tobacco or physical matting.

The tobacco-ladened air flows from the last chamber **16** into a separator **17** of known type in which the tobacco is separated from the air and is discharged through an airlock **18**. The tobacco may then be carried off by a conveyor belt **19** to a rotary cooling apparatus **20** of known type.

The air passes from the separator **17** through a duct **21** to the remainder of the closed system shown generally at **22** which may include the units and operate in accordance with the related part of the system disclosed in the above patent. Thus, as the patent mentions, the air may pass through means for separating any dust therefrom and also have a portion thereof discharged or bled from the system. The remaining air is recirculated and the removed air replenished by fresh air. The temperature of the air that is recirculated is suitably sensed in order to assure the optimum temperature of the air eventually introduced into duct **12**. Similarly, the water vapor content of the air at this juncture may be controlled and adjusted when necessary.

The above patent clearly points out that the amount of moisture removed from a particular tobacco, types of tobacco, blends of tobacco and particular forms thereof will vary whereby the operating parameters of the air drying system will vary accordingly in producing a uniform and constant moisture content of tobacco discharged from the system. Nevertheless, two important factors are taken into consideration in controlling the operation of the system, notably,

(a) the hold time of the tobacco within the system, and
(b) ratio of volume of air flow to weight of tobacco being discharged.

In addition, the quantity of heat required for drying the tobacco will depend upon the rate at which the tobacco is fed through the system and upon its initial moisture content. An increase in either the rate of feed or the moisture content will affect the air temperature of the air in duct **21** which normally has the effect of requiring the heat input to be increased.

With this in mind, it naturally follows that when it is desirable to increase the operational efficiency of the system and particularly increase the tobacco through-put of the system, an increase in the heat input would be required. According to the present invention, this is accomplished by a supplemental heating unit designated generally by numeral **24**.

The supplemental heating unit **24** functions to introduce supplemental heated air between the drying chambers **16** at a rate and in proportion to the amount removed at these locations.

Thus, the auxiliary heat supply unit **24** includes a fan **25**, the output of which is passed through a heater **26** which may include steam coils designed to heat the air to which they are exposed. The heated air passes through an air check valve **27** to prevent any undesirable reverse flow of tobacco into heater **26** and consequent malfunction of the auxiliary heating unit **24**. Air dampers or valves **29**

and **30** control the amount of heated air passing through branch lines **31** and **32** both of which are in communication with duct **28**. The combination of air dampers or valves **29** and **30** cooperate in regulating the quantity of auxiliary heated air introduced into heating chambers **16***b* and **16***c*, respectively, in order to assure tobacco conveying velocity and optimum drying of the tobacco conveyed in such chambers.

Simultaneously with the introduction of auxiliary heated air into heating chambers **16***b* and **16***c*, a comparable amount of air is exhausted from ducts **35** and **36** containing tobacco ladened air the temperature of which has been reduced as a result of the drying action taking place in heating chambers **16***a* and **16***b*. In order to accomplish this air exhaust operation, air exhaust ducts **37** and **38** are coupled with ducts **35** and **36**, respectively. These ducts **37** and **38** may eventually be coupled to a common exhaust duct **39** for ultimate removal of the desired exhausted air from the system. The quantity of air removed from the system through ducts **37** and **38** is controlled by dampers or valves **40** and **41**, respectively. In this connection, it will be noted that these valves **40** and **41** and their associated ducts **37** and **38** are connected to the inner face of the bends **42** and **43** forming part of ducts **35** and **36**, respectively, to assure exhausting of only air from the system and not tobacco which is carried by means of centrifugal action through the bends adjacent the outer face thereof.

The inclusion of the auxiliary heating unit **24** has, in most instances, increased by 50% the output of air drying systems and particularly those contemplated by and embraced by the above patent. In one instance, for example, where such increased through-put was realized, the total air flow was 12,960 c.f.m. and the air temperature was approximately 365° F. in duct **12**. The exhaust from ducts **37** and **38** was at 3150 c.f.m. and 3750 c.f.m. with the indicated temperature of the air being 205° F. and 190° F., respectively. Auxiliary air was supplied through ducts **31** and **33** at 2750 c.f.m. in both instances with the air being in both ducts 335° F. The tobacco introduced into the system at **15** was at a moisture content of 21% and the median moisture content of tobacco after drying and cooling was between 12%–15%.

Obviously, lesser percentage increases in through-put may be similarly accomplished. As a practical matter, the auxiliary heating unit **24** permits anywhere from a 0% to 50% increase in capacity of the air drying system particularly of the type disclosed and contemplated by the above patent and those systems not employing the auxiliary heating unit in actual production today. Of course, increased drying efficiency is also realized and the extent of the limits thereof being dependent upon the percentage increase in through-put desired. Naturally, as the percent increase in through-put is lowered below 50%, closer tolerances of drying efficiency are proportionately obtained.

Thus, the aforenoted objects and advantages are most effectively attained. Although several somewhat preferred embodiments of this invention have been disclosed and described in detail herein, it should be understood that this invention is in no sense limited thereby and its scope is to be determined by that of the appended claims.

I claim:

1. An apparatus for drying tobacco in an air circulating substantially closed system having means for heating the air in the system, means for introducing tobacco at one end of the system and in the path of the heated air, a plurality of chambers in the system at a point beyond the tobacco introduction station and in each of which the tobacco is conveyed upwardly by the hot air flowing through each chamber and means for separating the tobacco from the conveying air after it has passed through the last of the chambers, the improvement of a supplemental heated air supply system associated with at least one of said chambers for increasing the drying efficiency of the apparatus and tobacco through-put thereof, the supplemental heated air supply system comprising means for bleeding an amount of air from the apparatus at a location between chambers, means for adding heated air adjacent the inlet air of the chamber following the air bleeding as a replacement of the amount of air bled from the apparatus and for increasing the air temperature of the air flowing through said one chamber.

2. The invention in accordance with claim **1** wherein the location between chambers includes a duct between such chambers which includes a bend having an inner curved face and an outer curved face against which the tobacco is thrown and directed by centrifugal forces as it passes through the bend, and the means for bleeding an amount of air includes a bleeder duct in communication with the bend and joined to the inner face of the bend whereby air-conveyed tobacco in the bend by-passes this bleeder duct.

3. The invention in accordance with claim **2** wherein a valve is in the bleeder duct for regulating the amount of air passing into the bleeder duct from the apparatus.

4. The invention in accordance with claim **3** wherein the means for adding heated air includes an air fan and a heater for receiving the air from the fan and heating it to a predetermined temperature.

5. The invention in accordance with claim **4** wherein the means for adding heated air includes an air damper means for regulating the amount of air passed into the air chamber.

6. The invention in accordance with claim **5** wherein the means for adding heated air includes a check valve for preventing tobacco from being transferred from the air chamber into the supplemental heated air supply system.

7. The invention in accordance with claim **1** wherein the means for bleeding an amount of air includes a bleeder duct at said location between chambers and a valve in the bleeder duct for regulating the amount of air passing into the bleeder duct from the apparatus.

8. The invention in accordance with claim **1** wherein the means for adding heated air includes an air fan and a heater for the air passed therethrough from the air fan.

9. The invention in accordance with claim **1** wherein the means for adding heated air includes an air damper for regulating the amount of air passing into the air chamber.

10. The invention in accordance with claim **1** wherein the means for adding heated air includes a check valve for preventing tobacco entering the supplemental heated air supply system from the air chamber.

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U.S. Cl. X.R.

131—35; 263—19 D