Nov. 9, 1937. H. Y. SATTERLEE 2,098,887

METHOD OF DISTRIBUTING MATERIAL

Filed June 19, 1937 4 Sheets-Sheet 1

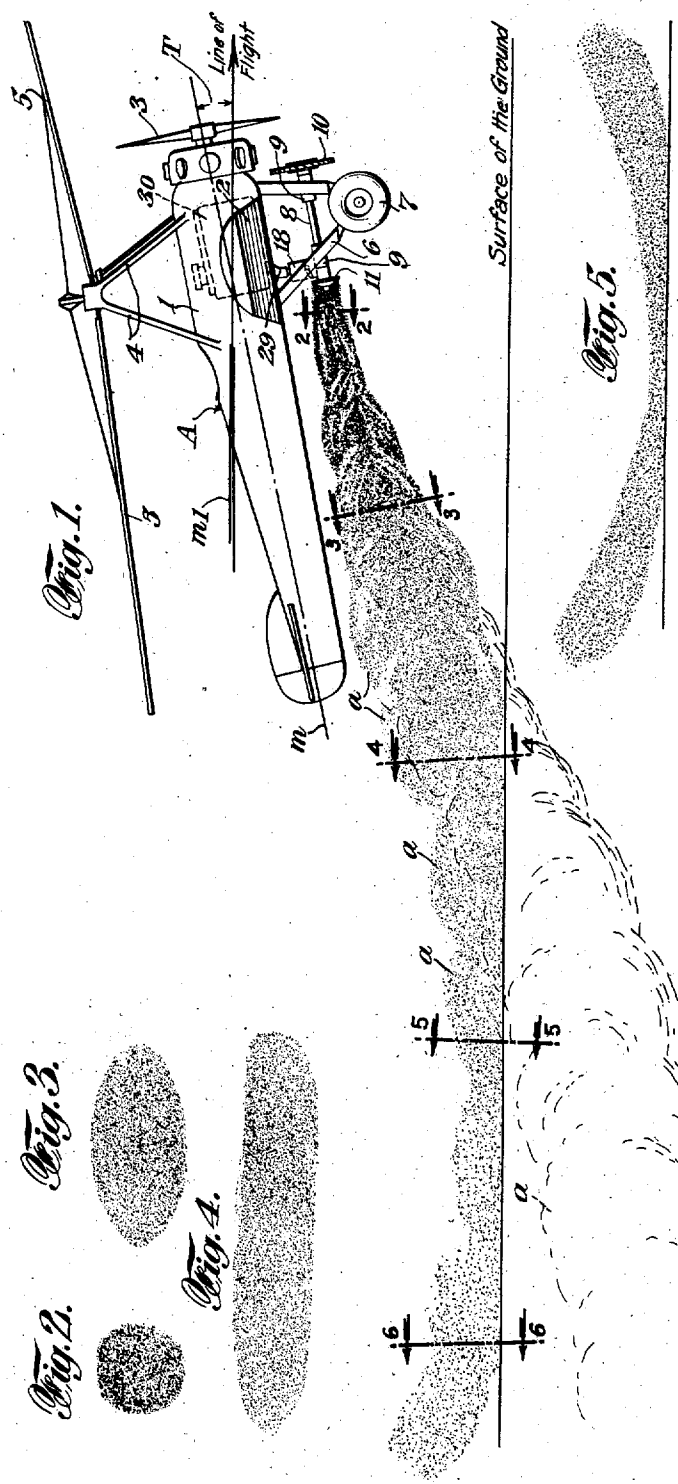


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

INVENTOR
Henry Y. Satterlee
BY
Ward, Crosby & Neal
ATTORNEYS

Nov. 9, 1937. H. Y. SATTERLEE 2,098,887

METHOD OF DISTRIBUTING MATERIAL

Filed June 19, 1937 4 Sheets-Sheet 2

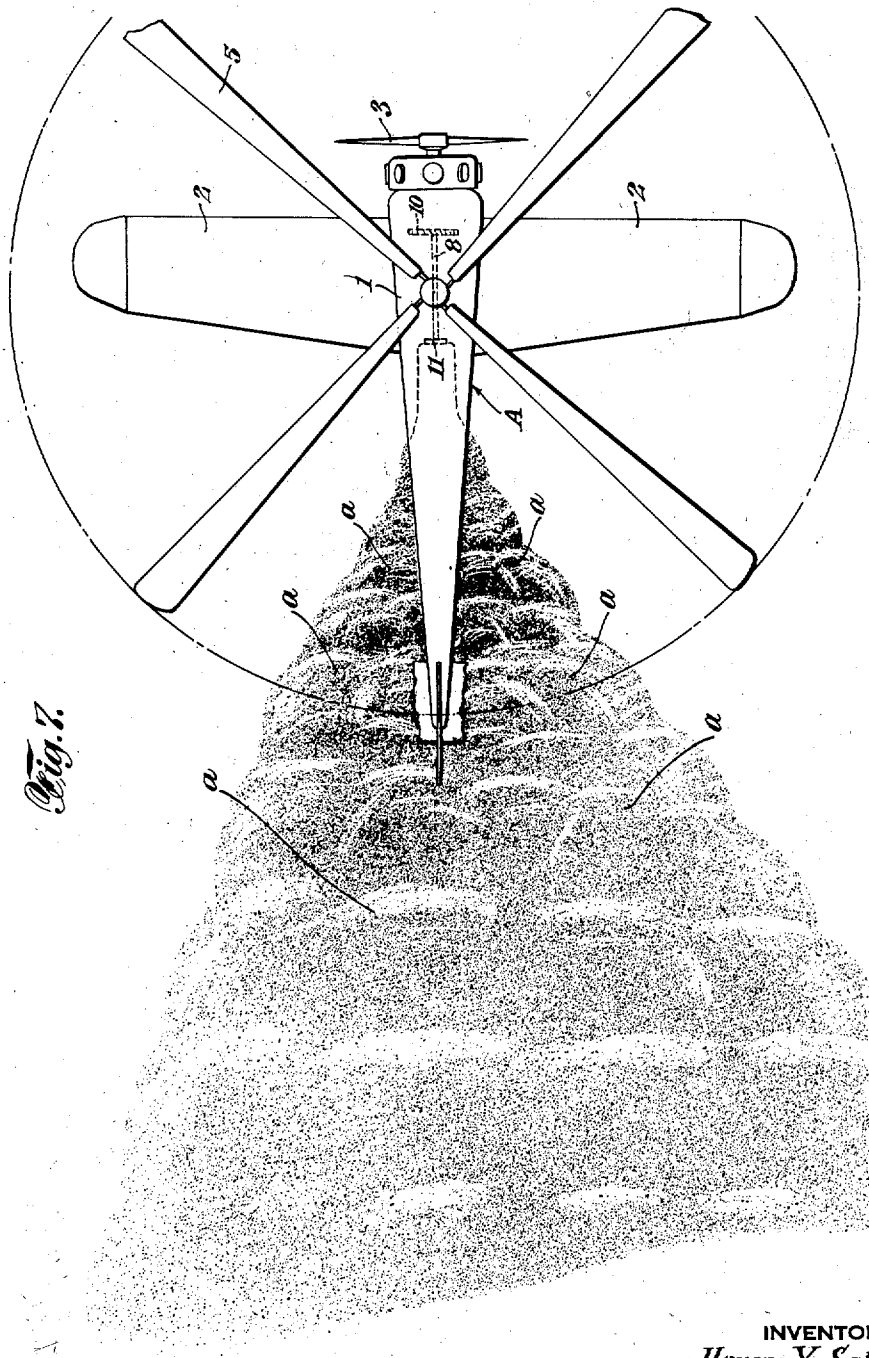


Fig. 7.

INVENTOR
Henry Y. Satterlee
BY
Ward, Crosby & Neal
ATTORNEYS

Nov. 9, 1937. H. Y. SATTERLEE 2,098,887

METHOD OF DISTRIBUTING MATERIAL

Filed June 19, 1937 4 Sheets-Sheet 3

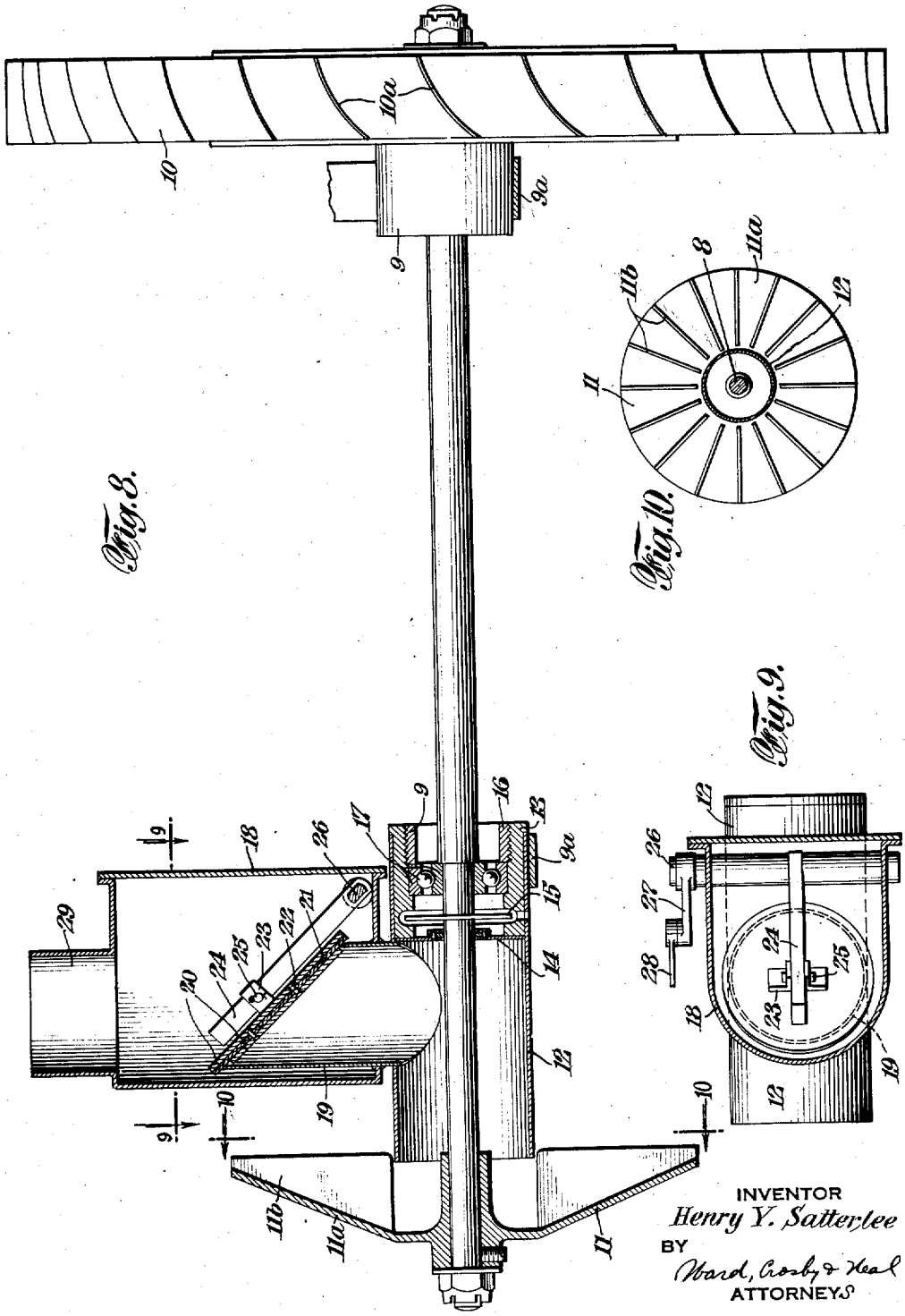


Fig. 8.

Fig. 10.

Fig. 9.

INVENTOR
Henry Y. Satterlee
BY
Ward, Crosby & Neal
ATTORNEYS

Nov. 9, 1937. H. Y. SATTERLEE 2,098,887

METHOD OF DISTRIBUTING MATERIAL

Filed June 19, 1937 4 Sheets-Sheet 4

Fig. 11.

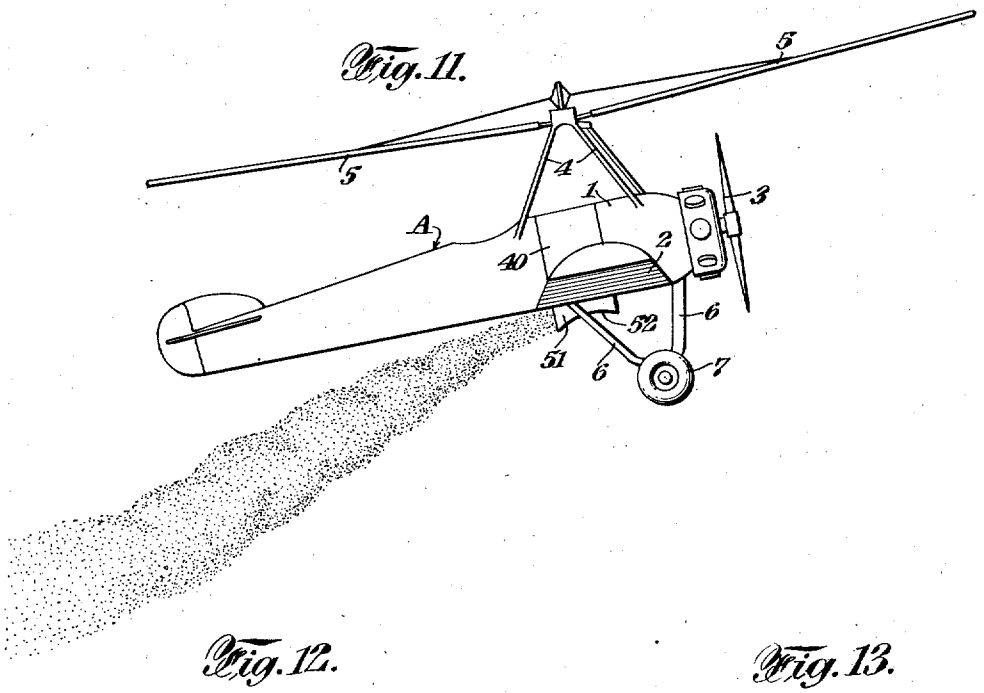


Fig. 12.

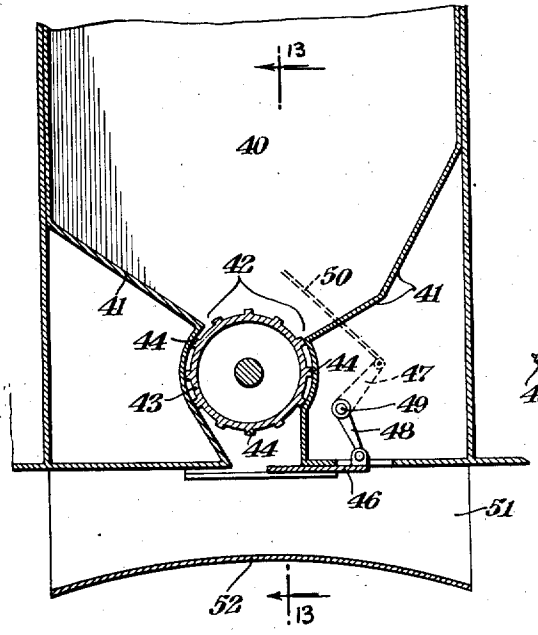
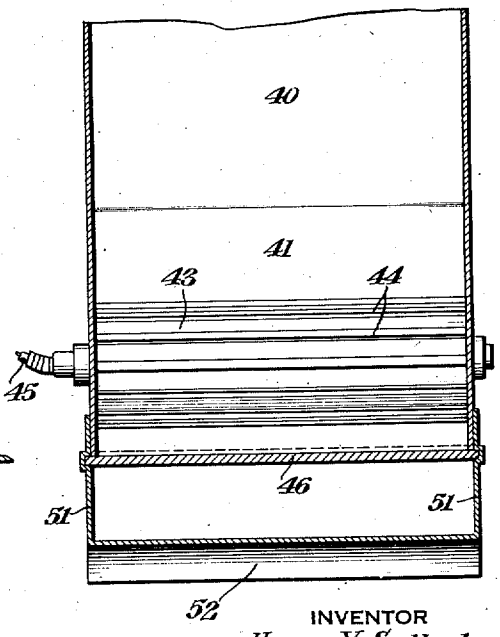


Fig. 13.



INVENTOR
Henry Y. Satterlee
BY
Hard, Crosby & Heal
ATTORNEYS

Patented Nov. 9, 1937

2,098,887

UNITED STATES PATENT OFFICE

2,098,887

METHOD OF DISTRIBUTING MATERIAL

Henry Y. Satterlee, Morristown, N. J., assignor to Swan-Finch Oil Corporation, New York, N. Y., a corporation of New York

Application June 19, 1937, Serial No. 149,047

6 Claims. (Cl. 244—136)

My invention relates to a method of distributing material from an autogiro during flight thereof.

My invention has particular reference to the art of distributing material from an autogiro in such manner that the application of the material shall be efficient and desirable for the intended purpose.

It has been found that the distributing of materials such as in spraying with the use of ordinary airplanes is not so efficient or satisfactory but I have discovered that the air blast produced by an autogiro, due particularly to the slip stream of the propeller and the down blast produced by the rotor, are especially efficient and useful for this purpose.

Various other objects, advantages and characteristics of my invention will become apparent from the following detailed description.

My invention resides in the method, autogiro distributing arrangement and features of the character hereinafter described and claimed.

This application is a continuation in part of my prior application Serial No. 1,345, filed January 11, 1935.

For an understanding of my invention and for an illustration of some of the various forms thereof, reference is to be had to the accompanying drawings, in which:

Figure 1 is a side elevational view showing an autogiro in the act of distributing material;

Figs. 2–6 inclusive are vertical sectional views taken approximately on the respective lines 2—2, 3—3, 4—4, 5—5 and 6—6 of Fig. 1;

Fig. 7 is a plan view illustrating the distributing operation shown in Fig. 1;

Fig. 8 is a vertical sectional view, partly in elevation, of an arrangement for distributing material from an aircraft during flight thereof;

Fig. 9 is a horizontal sectional view, partly in plan, and is taken on the line 9—9 of Fig. 8;

Fig. 10 is a vertical sectional view, partly in elevation, and is taken on the line 10—10 of Fig. 8;

Fig. 11 is an elevational view showing an autogiro in the act of distributing powder material;

Fig. 12 is a vertical sectional view, partly in elevation, showing the bin and distributing arrangement of Fig. 11; and

Fig. 13 is a transverse, vertical sectional view, partly in elevation, and is taken on the line 13—13 of Fig. 12.

To some extent, during recent years, ordinary airplanes have been used for such purposes as the distribution onto growing crops of material poisonous to insects. A measure of success has attended this practice but, at the same time, a number of objections arise with respect thereto. Thus, an airplane necessarily travels at high speed in order to remain aloft and, when such airplane is flown at very slight altitude close to the growing crops, the danger of a resulting crash is very real. Furthermore, the necessary high speed of airplane travel is not conducive to the most effective spreading of the material and, moreover, such high speed renders it difficult and impractical to manoeuvre the airplane and properly position it with respect to the growing crops particularly in response to directions given by an observer on the ground. Furthermore the cross-sectional shape of the slip stream of an ordinary airplane is not so well suited to spread materials from the air and also when the plane is flown at safe altitudes the slip stream does not act to force the materials into contact with surfaces to be sprayed, and there is also much loss from drifting in this way. These and various other disadvantages are incident to the use of airplanes for the purpose noted above.

In accordance with the invention of this application, an autogiro is utilized for distributing material such, for example, as particles of liquid or solid material so that such particles may descend to or near the level of the ground, onto growing crops or be otherwise utilizable as hereinafter described.

For further explanation of the invention, reference is to be had to Fig. 1 wherein A represents an autogiro. As is well understood, a machine of this character comprises a fuselage 1 from which projects the wing structure 2 if utilized, the usual tractor propeller 3 being disposed at the front of the fuselage and a frame 4 extending above said fuselage for the support of the usual rotor 5. The chassis frame structure 6 is disposed below the fuselage 1 and carries the usual wheels 7 whereby the machine is supported when resting upon the ground.

As one example of a preferred arrangement for passing liquid material into the slip stream of the autogiro, reference is to be had to Figs. 1, 8, 9 and 10 wherein a shaft 8 is shown as suitably positioned and mounted in suitable bearings 9 fixed, for example, to straps 9a, respectively, which are secured to the frame structure 6. Carried by the forward end of the shaft 8 is a suitable propeller 10 which, preferably although not necessarily, is a device known to the art as a De Bothezat fan, this fan comprising a plurality of suitably pitched blades 10a. Car-

ried by the shaft 8 at the end thereof opposite the propeller 10 is a structure 11 which comprises a flared skirt or conical section 11a from the interior surface of which project a plurality of vanes or webs 11b extending approximately radially with respect to the shaft 8. Disposed, preferably in concentric relation, around the shaft 8 is a feed tube 12 which, at its discharge end, communicates with the space defined interiorly of the skirt section 11a at the inner ends of the vanes 11b. Associated with the other end of the feed tube 12 is a tubular member 13 which, interiorly of said feed tube 12, carries a closure plate 14 and a spinning ring arrangement 15 utilizable for preventing passage of liquid material along the shaft 8 in a direction from left to right, Fig. 8. A locking sleeve 16 threaded to the tubular member 13 serves to maintain an anti-friction bearing arrangement 17 within the tubular member 13, said bearing arrangement 17 being included in one of the aforesaid bearings 9.

Upstanding from the feed tube 12 is a tubular structure 18 having a tube 19 re-entrant therein, the lower end of the tube 19 communicating with the feed tube 12 and the upper end of said tube 19 being inclined as shown in Fig. 8 so as to form a valve seat. Coactable with said upper inclined end of the tube 19 is a valve closure plate arrangement which, in the example shown, comprises a pair of plates 20 between which is sandwiched a disk 21 formed from leather or other similar material, the plates 20 and the disk 21 being secured together by rivets 22 or the like. The upper plate 20 has secured thereto a bracket 23 to which an arm 24 is secured by a pin 25, the arm 24 having its lower end secured to a shaft 26 oscillatory in bearings formed in said tubular structure 18. As shown in Fig. 9, one end of an arm 27 is secured to that end of the shaft 26 which projects exteriorly of the tubular structure 18, the other end of said arm 27 having fastened thereto an actuating member 28 which extends to some position adjacent the seat of the autogiro pilot so as to be accessible for ready operation. Communicating with the tubular structure 18 is a conduit 29 which leads to a tank or container 30 suitably supported interiorly of the autogiro fuselage 1, Fig. 1, the container 30 having therein a supply of the material which is to be spread during flight of the autogiro.

The material which is to be disposed within the container 30 may assume any one of a variety of forms. Thus, for example, when liquid material is utilized, such liquid material may be a petroleum distillate utilizable as an insecticide. A more viscous material which has been used with success is a liquid spray formed by mixing 100 pounds of lead arsenate with 25 gallons of water and six gallons of oil.

In operation, a supply of the selected material to be sprayed is fed into the container 30 and then, with the parts arranged as shown in Fig. 8, the autogiro is flown to the area which is to be sprayed and, when in proper position, the operator moves the actuating member 28 to thereby swing the arm 24 clockwise, Fig. 8, and open the passage through the tube 19 to a desired extent. Accordingly, under the influence of gravity, material descends from the container 30, passes downwardly through the conduit 29, the tubular structure 18, the tube 19 and then passes into the tube 12. In said tube 12, the material passes from right to left, Fig. 8, the material leaving the end of the tube 12 and spreading between the vanes 11b of the structure 11 which may properly be termed a spray "disk".

As appears from a consideration of Fig. 1, the spraying arrangement of Fig. 8 is supported in the slip stream of the autogiro and, accordingly, during flight of the autogiro, the propeller 10, by the action of the slip stream, is rotated at high speed to thereby impart corresponding rotative movement to the spray disk 11. It results, therefore, that the above described material, which spreads between the vanes 11b, is thrown or projected outwardly so as to be passed laterally into the slip stream of the autogiro and, as shown in Fig. 1, the slip stream drives or deflects material to be distributed generally in the direction taken by said slip stream, this action being accompanied by divergence of such material as hereinafter described. When using viscous spraying material of the character noted above, it has been observed that such material is in sheet form when thus projected into the slip stream of the autogiro. It shall be understood, however, that the invention is not to be limited in this respect.

During flight of the autogiro, as indicated in Figs. 1 and 2, there is a lower section of the slip stream immediately adjacent the spray disk 11 into which the material is passed so as to be suspended or entrained therein, this lower slip stream section being approximately circular in transverse, vertical section, Fig. 2. As the autogiro passes on, the down-draft produced by the blades of the rotor 5 causes the slip stream produced by the propeller 3 to be flattened whereby the aforesaid approximately circular configuration thereof is changed to a configuration which is approximately elliptical in transverse, vertical section, Fig. 3. Further, the propeller 3 and the rotor 5 serve jointly to cause the suspended material to diverge from that section of the autogiro line of flight which was established at approximately the time said material was fed into the slip stream, the diverging slip stream extending backwardly beyond the rear of the autogiro as shown in Fig. 7.

As illustrated in Figs. 4, 5 and 6, the described effects of the propeller 3 and the rotor 5 continue as the autogiro passes on whereby the major axis of the elliptical section is lengthened with consequent decrease in density of the suspended material. Further, it will be noted from Figs. 5 and 6, that the major axis of the elliptical section continues to lengthen after the autogiro passes on. That is, even though the rotor 5 is no longer directly above the stream in which the material is suspended, the major axis of the aforesaid elliptical section continues to lengthen until the effects of the propeller 3 and rotor 5 have been dissipated. Thus, by action of the propeller 3 and the rotor 5, the material which is passed into the slip stream from the spray disk 11 is divided and subdivided so as to form small particles which are distributed throughout the slip stream.

In Fig. 1, the autogiro A is illustrated as flying relatively close to the ground level, as six feet, more or less. Under such circumstances, the stream in which the particles of material are suspended is forced downwardly into engagement with the surface of the ground somewhat as indicated in said Fig. 1 although it often happens that the autogiro will have passed onward a distance of several feet before engagement is thus effected with the surface of the ground. This feature of the invention is of distinct importance.

It is the autogiro rotor 5 which forces the stream in which the particles are suspended downwardly into engagement with the surface of the ground and there is a "bounce" or resultant upward movement of many of the particles whereby the latter, for example, come into contact either with the lower surfaces of plants or other vegetation growing in the area under treatment or with insects feeding on such lower surfaces. By reason of the characteristic of the invention just described, it follows that insecticides, or equivalent, may be applied easily and conveniently to surfaces more or less facing the ground, such surfaces heretofore having been reached with difficulty, if at all.

Although a particularly useful application of the invention has reference to the treatment of low growing vegetation as described, it shall be understood that there are various other important applications of the invention. Thus, for example, by my invention, forest trees or other relatively tall trees may readily be subjected to spraying, dusting or other operations. With a treating operation of this character, it is desirable for the autogiro to fly at a suitable height, as twenty feet, more or less, above the tops of the trees. Under such circumstances, it will be understood that the stream bearing the suspended material does not engage the surface of the ground in the manner described above. Rather, such stream, after the autogiro passes on, continues moving downwardly, principally by reason of the previous thrusting action thereon by the autogiro rotor 5, an example of such downward movement being shown at the left of Fig. 1 below the horizontal line indicating the surface of the ground. As a result, the suspended material is positively driven downwardly into and through the trees whereby, for example, it engages the leaves on the trees or comes into contact with insects feeding on such leaves. Because thus driven into the trees, there is little drift of the cloud of spraying or dusting material such as often occurs to great extent with airplane dusting.

Experience has demonstrated that each blade of the rotor 5 delivers an observable impulse to the stream bearing the suspended particles of material. In Figs. 1 and 7, such impulses of the respective rotor blades are indicated at *a*, *a*, etc. These impulses are distinctly advantageous because creating swirls and eddies in the stream whereby the suspended material is effectively applied to leaf and other surfaces which face in directions other than upwardly.

In accordance with my invention, it is highly desirable that, during the spraying, dusting or other treating operations, the autogiro A shall fly with its nose elevated and its tail lowered so that the line of thrust is at a desired angle with respect to the line of flight. Thus, by reference to Fig. 1, the longitudinal axis *m* of the autogiro may be taken as representing approximately the line of thrust and *m1*, as stated, may be taken as representing the line of flight. The angle T between these lines is the angle of autogiro inclination and, in accordance with the invention, it is desirable that such an angle shall exist. In accordance with present knowledge, it is desirable for the angle of inclination to be between five and thirty degrees, more or less. It shall be understood, however, that the invention is not to be thus restricted.

Further in accordance with the invention, the speed of the autogiro, during the treating operation, should be slow as compared with the usual flying speed of such machines. Thus, in practice, it has been established that a flying speed between thirty-five and forty-five miles per hour, for example, gives satisfactory results. More particularly, in connection with the flying speed of the autogiro together with the angle of flight thereof, it has been determined that excellent results are obtained when the engine is operated at a speed only slightly faster than the stalling speed. It shall be understood, however, that the invention is not to be limited to the preferred flying speeds described immediately above.

Operation of the autogiro at an angle to a horizontal surface as just described is important particularly for the reason that the slip stream carrying the particles of material is thereby directed more sharply at the vegetation or other surfaces to be treated. Therefore, the downward thrust of the rotor blades more effectively impels the stream of material toward and into engagement with the vegetation to be treated. The described slow flying speed is important because rendering it possible for the autogiro to manoeuvre over areas which would otherwise be inaccessible and, further, because enabling the angle of flight to be at a maximum.

It will be understood that the propeller 10 operates at a more or less variable speed, this being dependent upon the speed of the autogiro. The invention relates to the use of such variable speed devices and it also has reference to a spraying or spreading device which operates at constant speed or substantially so. Thus, for example, the disclosed spray disk 11 may be rotated at substantially constant speed by a device for driving electrical generators at substantially constant speed during flight of an airplane, a device of this type being exemplified by the Deslauriers self-regulating constant speed air fan, the regulation of which depends on automatic change of the pitch of the fan blade. Or, for example, the spray disk may be rotated at variable speed in the manner described in my aforesaid application Serial No. 1,345, filed January 11, 1935.

Referring to Figs. 11, 12 and 13, the autogiro A is shown as having a bin or hopper 40 disposed in the fuselage thereof, this bin being adapted to contain a quantity of powdered or granular material such, for example, as pyrethrum dust, copper lime dust, sulphur powder, etc., etc. As illustrated in Fig. 12, the bin 40 is provided with downwardly and inwardly sloping walls 41, 41 so as to thereby form a narrow passage 42 extending throughout the length of said bin 40. Rotatably mounted in the passage 42 is a drum 43 having a plurality of spaced ribs 44 disposed on the drum periphery, these ribs 44 extending longitudinally of the drum. Connected to the supporting shaft for the drum 43 is a flexible shaft 45 or other suitable driving means, this shaft 45, or equivalent, being rotated in any suitable manner, as by an electrical motor, a wind-driven propeller, etc.

Slidably mounted in suitable manner on the lower surface of the bin bottom wall is a plate 46 utilizable for closing the aforesaid passage 42. Associated with the plate 46 are the lever arms 47, 48 which are pivotally related to each other at 49, the arm 48 being operated by a control member 50 which extends to a suitable location adjacent the seat of the autogiro operator.

Disposed below and secured to the bin 40 is a structure comprising side walls 51, 51 joined by a bottom wall 52 curved as shown in Fig. 12 so as

to form a Venturi tube arrangement. It will be understood that this Venturi tube arrangement is so disposed that the open sides thereof move transversely with respect to the line of flight.

In operation, as soon as the autogiro with the bin arrangement of Fig. 11 reaches an area to be dusted, the operator actuates the member **50** to thereby move the plate **46** to a desired open position. Then, with the drum **43** rotating at a desired speed, the particles of material pass downwardly through the lower open end of the passage **42** and enter the Venturi tube arrangement where, at the proper high velocity, such particles of material are swept along by and in the slip stream of the autogiro. Under substantially the same flying conditions, it will be understood that the stream in which such particles are suspended is acted upon by the rotor **5** and propeller **3** of Fig. 11 in substantially the same manner as hereinbefore described in connection with Figs. 1–7. Accordingly, with the dusting arrangement of Figs. 11, 12 and 13, similar advantageous results are obtained as with the spraying arrangement hereinbefore described.

The drum **43** and the ribs **44** serve as a means for controlling the amount or volume of the powdered material which passes through the passage **42**.

In view of all the foregoing, it clearly appears that an arrangement of the character described for spreading an insecticide onto plant growth or other surfaces by the use of an autogiro presents numerous advantages over the prior art method of using an ordinary airplane.

Obviously, an autogiro may be manœuvred at relatively slow speed or even caused to hover over an area to be treated. This is a highly desirable factor from the viewpoint of safety of the pilot and machine. Then, too, this characteristic just noted is highly advantageous because enabling the pilot to readily take directions from someone on the ground who is in charge of the operation. Another desirable factor in connection with the use of autogiros for the purpose stated resides in the fact that the base of operations may often be much closer to the area to be treated than would be the case if an airplane was utilized. This is necessarily true because an autogiro requires a landing field of but limited extent whereas a much larger landing field is required for an airplane. An autogiro also permits manœuvring about obstructions which may be in or around an area to be sprayed. For example, an autogiro could spray in the corner of a field completely hemmed in by trees and reach parts of the field with a precision which could not be attained by an airplane.

Although the invention has been described above in connection with the use of liquid and solid particles, it shall be understood that the invention is not to be so limited. Thus, it shall be understood that seeds or other solid or liquid particles, alone or in combination with a liquid may be disseminated or spread from an autogiro in a similar manner to that described above. Likewise, it is to be understood that a gas may be spread over an area in the manner hereinbefore described and that combinations of such materials, whether liquid, solid and/or gaseous may be chosen and utilized as desired.

An important application of the present invention relates to the control of mosquitoes. When this phase of the invention is practiced, it will be understood that a suitable mosquito control agent, such as a petroleum distillate, is spread or cast upon the water or other surface to be treated by an autogiro under the influence of its rotor operating in the general manner hereinbefore described.

The spray device and duster herein described are believed to be novel per se and although I have described their use with an autogiro, it is to be understood that it may be employed on an ordinary airplane as well. Therefore, said spray device and duster are not to be restricted for use on autogiros.

It shall be understood that the invention is not to be limited to a spraying disk arrangement of any particular character. For all types of materials to be spread, the mechanism by which the same is introduced into the slip stream may be of different character within wide latitude. Thus, under some circumstances, there may be utilized for this purpose, devices of the character known to the art for spreading material from ordinary airplanes. Furthermore, it shall be understood that the spreading mechanism need not necessarily be operated by the rush of air caused by flight of the autogiro. As well, such mechanism may be operated at any desired constant speed, for example, under storage battery control or, if desired, the mechanism may be directly connected to the autogiro engine.

In Figs. 8, 9 and 10, I have illustrated an arrangement which serves in an advantageous manner as a sprayer of liquid material. It shall be understood that this arrangement is not to be thus limited because said arrangement of Figs. 8, 9 and 10 is also capable of satisfactory use as a means for passing powdered or granular material into the aircraft stream.

In the appended claims, the reference to "traction" shall be understood as being generically descriptive of autogiros of the "pusher" type as well as of autogiros of the tractor type as disclosed.

While the invention has been described with respect to certain particular preferred examples which give satisfactory results, it will be understood by those skilled in the art after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention and it is intended therefore in the appended claims to cover all such changes and modifications.

What is claimed as new and desired to be secured by Letters Patent is:

1. In the art of distributing material from a supply thereof transported by a flying autogiro, the method which comprises passing material from such supply into the slip stream produced by the traction propeller of the autogiro, and utilizing the rotor of said autogiro to produce a pulsating down-draft on the slip stream and the material suspended therein, said rotor serving to flatten the slip stream and said propeller and rotor serving to modify the slip stream containing the suspended material so that such material diverges from the direction of the autogiro line of flight at the time said material was fed into the slip stream.

2. In the art of distributing material from a supply thereof transported by a flying autogiro, the method which comprises projecting material from such supply laterally into the slip stream produced by the traction propeller of the autogiro, and utilizing the rotor of said autogiro to produce a pulsating down-draft on the slip stream and the material suspended therein, said rotor serving to flatten the slip stream and said propeller and rotor serving to modify the slip stream

containing the suspended material so that such material diverges from the direction of the autogiro line of flight at the time said material was fed into the slip stream.

3. In the art of distributing material from a supply thereof disposed on an autogiro, the method which comprises causing the autogiro to fly along a path which is approximately parallel with the surface being treated and in inclined relation with respect to said path so that the autogiro nose is substantially higher than its tail, passing material obtained from said supply into the slip stream produced by the traction propeller of the autogiro, and utilizing the rotor of said autogiro to produce a pulsating down-draft on the slip stream and the material suspended therein, said rotor serving to flatten the slip stream and said propeller and rotor serving to modify the slip stream containing suspended material so that such material diverges from the direction of the autogiro line of flight at the time said material was fed into the slip stream.

4. In the art of distributing material from a supply thereof transported by a flying autogiro, the method which comprises passing material obtained from such supply into the propeller slip stream from a zone adjacent the bottom of the autogiro fuselage, and utilizing the rotor of said autogiro to produce a pulsating down-draft on the slip stream and the material suspended therein, said rotor serving to flatten the slip stream and largely preventing such material from rising above the tail of the autogiro, said propeller and said rotor serving to modify the slip stream containing the suspended material so that such material diverges from the direction of the autogiro line of flight at the time said material was fed into the slip stream.

5. In the art of discharging material from a rial diverges from the direction of the autogiro the method which comprises feeding material from such supply to the slip stream produced by the traction propeller of the autogiro whereby the slip stream deflects the material generally in the direction taken by said slip stream, and utilizing the rotor of said autogiro, to produce a pulsating down-draft on such material, said propeller and said rotor causing such material to diverge from the direction of the autogiro line of flight at the time said material was fed into the slip stream.

6. In the art of discharging material from a supply thereof transported by a flying autogiro, the method which comprises causing the autogiro to fly along a path which is approximately parallel with respect to the surface being treated and at a speed only slightly faster than the stalling speed of the autogiro so that the autogiro nose is substantially higher than its tail, feeding material from such supply to the slip stream produced by the traction propeller of the autogiro whereby the slip stream deflects the material generally in the direction taken by said slip stream, and utilizing the rotor of said autogiro to produce a pulsating down-draft on such material, said propeller and said rotor causing such material to diverge from the direction of the autogiro line of flight at the time said material was fed into the slip stream.

HENRY Y. SATTERLEE.

CERTIFICATE OF CORRECTION.

Patent No. 2,098,887. November 9, 1937.

HENRY Y. SATTERLEE.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, second column, line 5, claim 5, strike out the syllable and words "rial diverges from the direction of the autogiro" and insert instead the words and comma supply thereof transported by a flying autogiro,; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 25th day of January, A. D. 1938

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.

containing the suspended material so that such material diverges from the direction of the autogiro line of flight at the time said material was fed into the slip stream.

3. In the art of distributing material from a supply thereof disposed on an autogiro, the method which comprises causing the autogiro to fly along a path which is approximately parallel with the surface being treated and in inclined relation with respect to said path so that the autogiro nose is substantially higher than its tail, passing material obtained from said supply into the slip stream produced by the traction propeller of the autogiro, and utilizing the rotor of said autogiro to produce a pulsating down-draft on the slip stream and the material suspended therein, said rotor serving to flatten the slip stream and said propeller and rotor serving to modify the slip stream containing suspended material so that such material diverges from the direction of the autogiro line of flight at the time said material was fed into the slip stream.

4. In the art of distributing material from a supply thereof transported by a flying autogiro, the method which comprises passing material obtained from such supply into the propeller slip stream from a zone adjacent the bottom of the autogiro fuselage, and utilizing the rotor of said autogiro to produce a pulsating down-draft on the slip stream and the material suspended therein, said rotor serving to flatten the slip stream and largely preventing such material from rising above the tail of the autogiro, said propeller and said rotor serving to modify the slip stream containing the suspended material so that such material diverges from the direction of the autogiro line of flight at the time said material was fed into the slip stream.

5. In the art of discharging material from a rial diverges from the direction of the autogiro the method which comprises feeding material from such supply to the slip stream produced by the traction propeller of the autogiro whereby the slip stream deflects the material generally in the direction taken by said slip stream, and utilizing the rotor of said autogiro, to produce a pulsating down-draft on such material, said propeller and said rotor causing such material to diverge from the direction of the autogiro line of flight at the time said material was fed into the slip stream.

6. In the art of discharging material from a supply thereof transported by a flying autogiro, the method which comprises causing the autogiro to fly along a path which is approximately parallel with respect to the surface being treated and at a speed only slightly faster than the stalling speed of the autogiro so that the autogiro nose is substantially higher than its tail, feeding material from such supply to the slip stream produced by the traction propeller of the autogiro whereby the slip stream deflects the material generally in the direction taken by said slip stream, and utilizing the rotor of said autogiro to produce a pulsating down-draft on such material, said propeller and said rotor causing such material to diverge from the direction of the autogiro line of flight at the time said material was fed into the slip stream.

HENRY Y. SATTERLEE.

CERTIFICATE OF CORRECTION.

Patent No. 2,098,887. November 9, 1937.

HENRY Y. SATTERLEE.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, second column, line 5, claim 5, strike out the syllable and words "rial diverges from the direction of the autogiro" and insert instead the words and comma supply thereof transported by a flying autogiro,; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 25th day of January, A. D. 1938

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.