

Jan. 8, 1946.

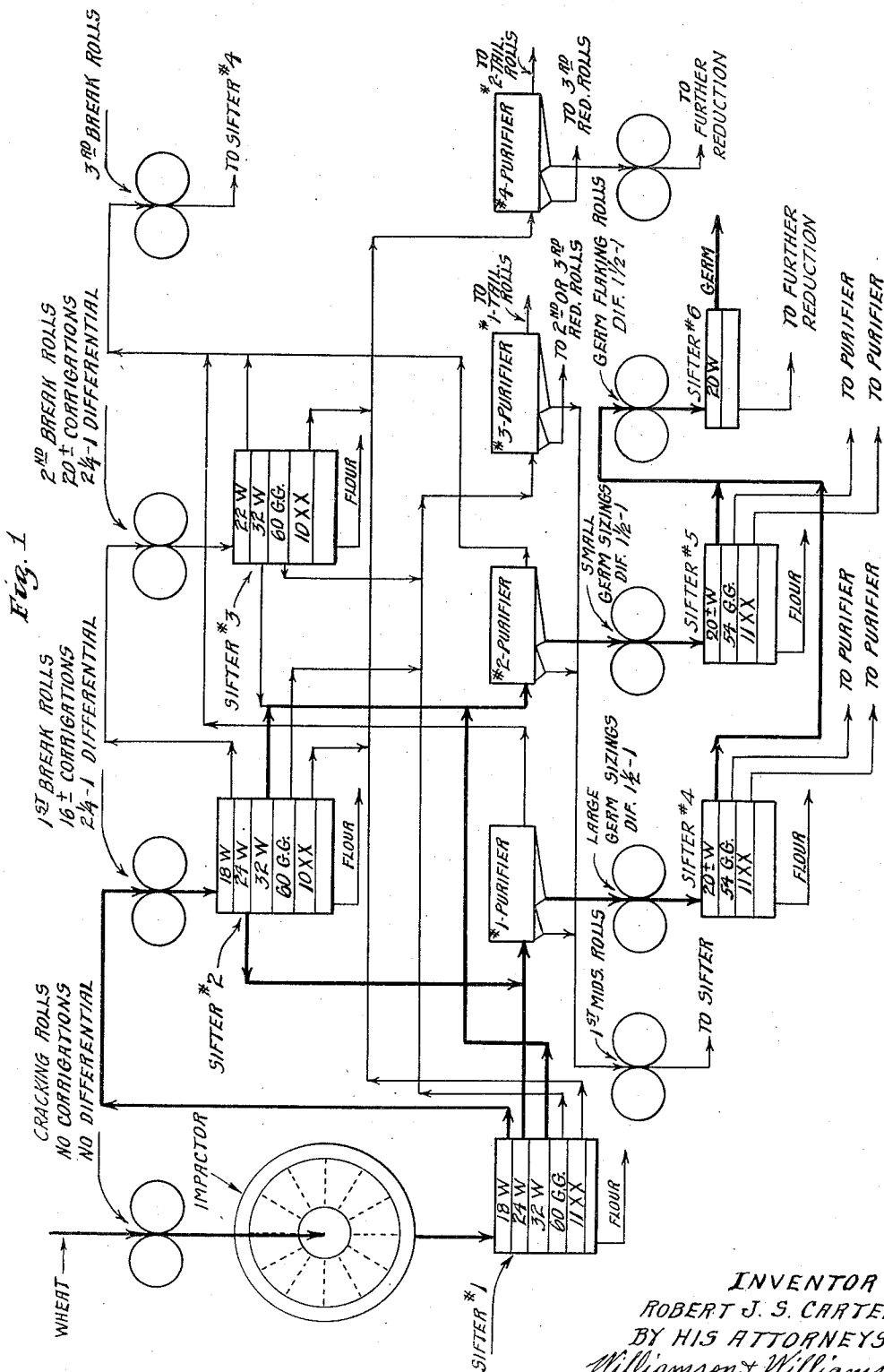
R. J. S. CARTER

2,392,365

MILLING PROCESS

Filed May 11, 1942

3 Sheets--Sheet 1



Jan. 8, 1946.

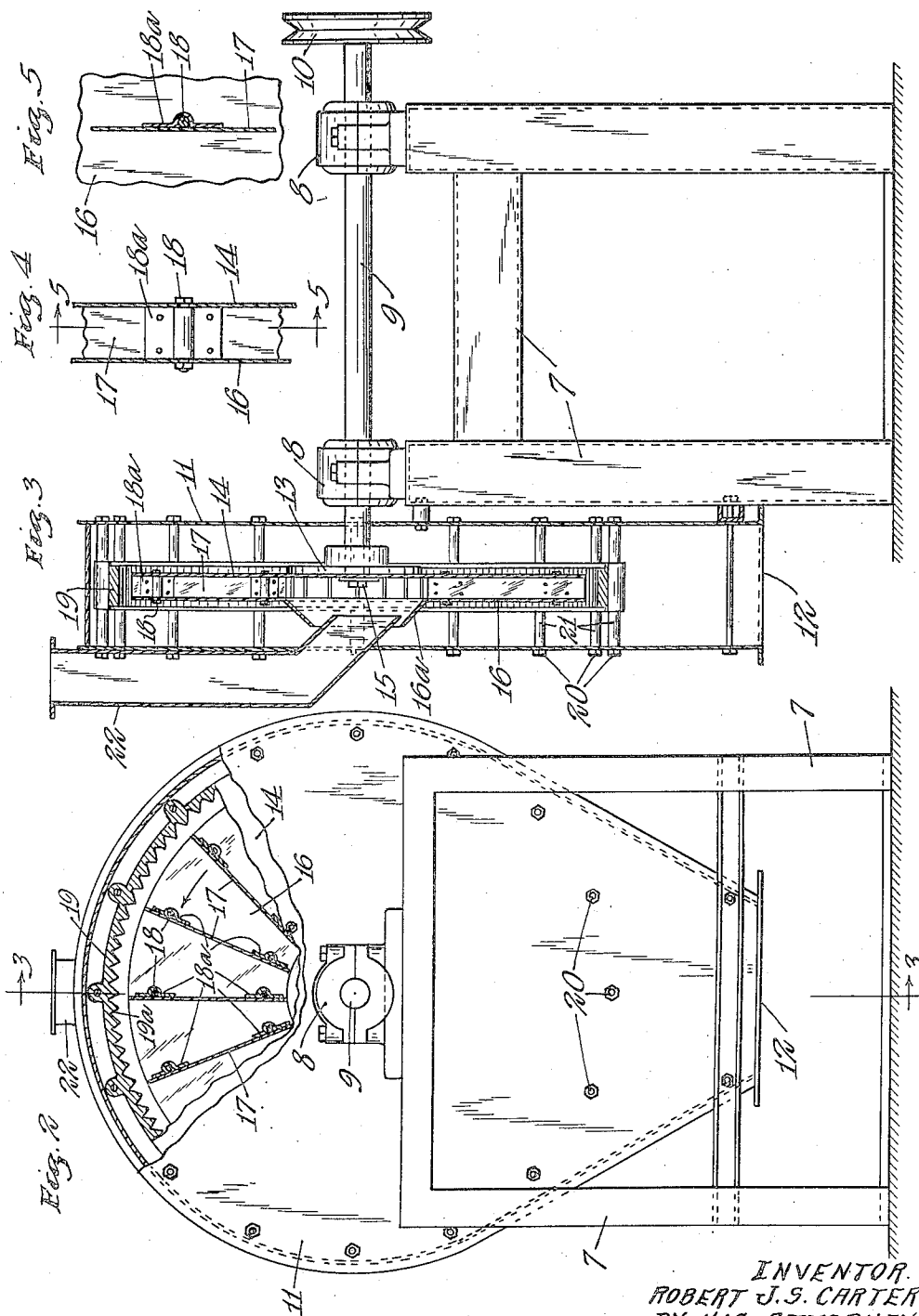
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3 Sheets-Sheet 2



INVENTOR.
ROBERT J. S. CARTER
BY HIS ATTORNEYS.
Williamson & Williamson

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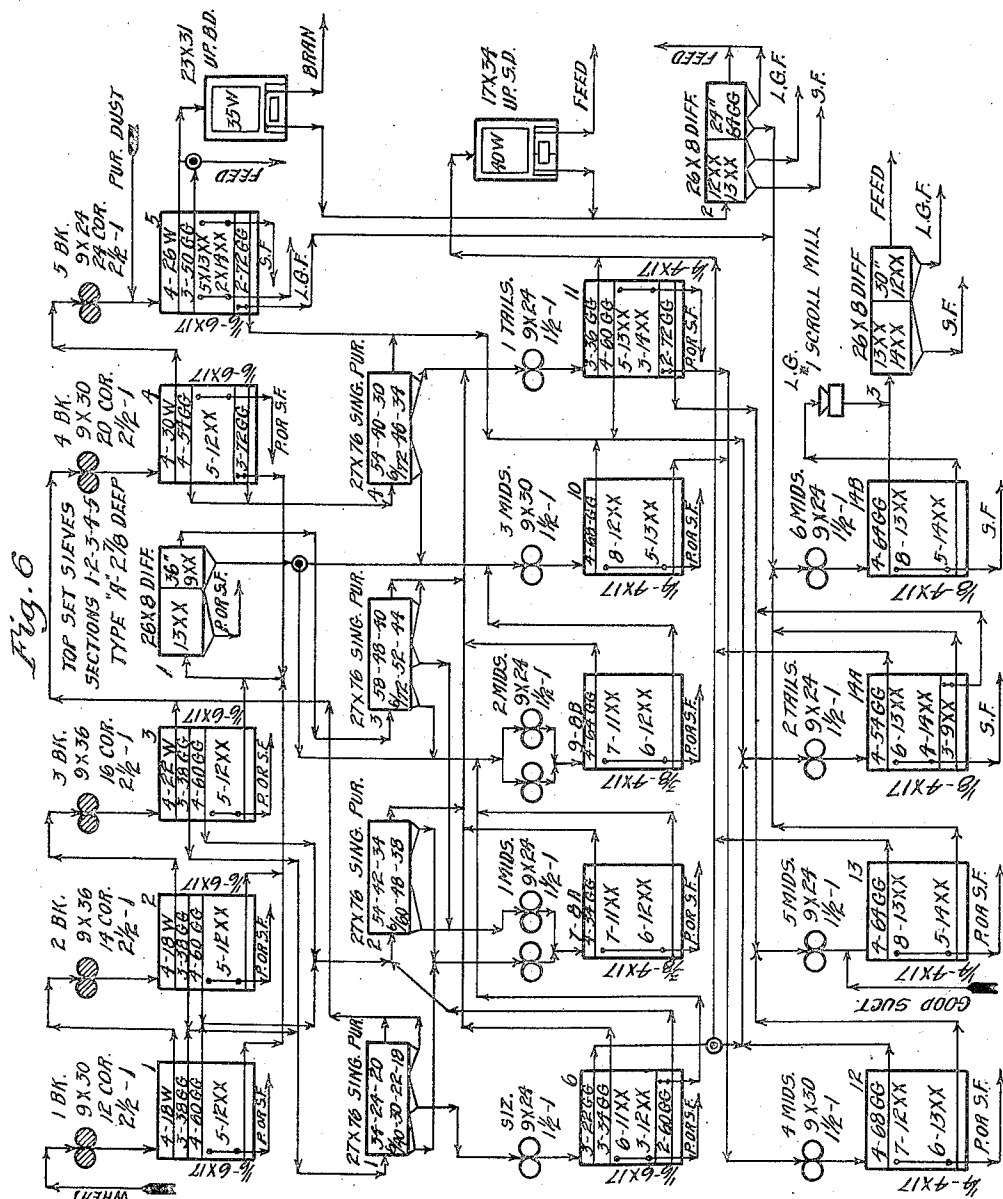
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,392,365

MILLING PROCESS

Robert J. S. Carter, Minneapolis, Minn., assignor
to Pillsbury Mills, Inc., a corporation of Dela-
ware

Application May 11, 1942, Serial No. 442,439

8 Claims. (Cl. 241-7)

This invention relates to processes for milling flour from such grain as wheat or rye.

In the milling of flour from wheat or rye it is the present practice to grind the grain at the head end of the mill by passing the same between oppositely rotating corrugated steel or iron rollers usually operating at a differential speed and then gradually to reduce the endosperm of the grain to flour by means of a series of grinding and sifting operations. The germ is located at one end of the wheat or rye berry and is naturally ground up with the endosperm to a greater or lesser degree as the berry is reduced to flour. Some of the germ is ground fine enough to pass through the bolting cloth and goes with the patent flour. Some of the germ flattens out and goes with the shorts while much of it is ground fine enough to go with the first and second clear flours. The germ contains oil which during the different grinding operations works into the endosperm and the sticky nature of low grade flours is due chiefly to the presence of this oil from the wheat germ. The wheat germ oil in the tail end stocks makes the same very difficult to separate. Also this wheat germ oil rapidly grows rancid and tends to cause rancidity in flour containing the same.

If the germ of such grains as wheat or rye can be removed at the head end of the mill before the germ is ground to any appreciable extent and before the oil from the germ is worked into the remainder of the grain berry many decided advantages will result. The milling process can be substantially shortened by elimination of a number of the breaks and many of the sifting and separating steps. The milling machinery may be simplified and considerable of the machinery now used may be eliminated. The sticky characteristics of low grade flours can be eliminated and accordingly the low grade flours can be easier separated. The wheat germ is prevented from getting into the patent flour and the first and second clear flours made. The liability of the flour produced to grow rancid by reason of the presence of the germ oil can be eliminated. The baking quality of the flour is improved by eliminating the germ. The oil can be largely eliminated from the germ once the germ is separated out and if it is desired to feed back in regulated amount germ either containing oil or not containing oil into any grade of flour, this can be readily done to produce a flour controlled as to the quantity of germ or germ oil therein.

It is the general object of this invention, therefore, to provide a new and improved process for

milling such a grain as wheat or rye whereby the germ can be separated at the head end of the mill from the remainder of the berry before the germ is substantially ground and thereby the various advantages referred to can be secured.

In the case of both wheat and rye the endosperm is relatively friable as compared to the germ. The germ is enclosed in a sac at one end of the berry and due to the presence of the germ oil the germ is relatively elastic as compared to the endosperm. By reason of the friable characteristic of the endosperm and the relatively elastic and non-friable characteristics of the germ I have discovered that if a berry, such as a wheat or rye berry, before it has been ground and either after the berry has been lightly cracked or before it has been lightly cracked is subjected to an impacting action the germ can be broken out from the endosperm and the bran in substantially whole form while the endosperm with the bran clinging thereto is being shattered. Having broken out the germ in substantially its whole form from the remainder of the berry I have found that it is possible to separate the germ from the remainder of the berry before the germ is substantially ground.

It is a further object of my invention, therefore, to provide a novel process for milling flour from such a grain as wheat or rye which process includes the step of subjecting the grain at the head end of the mill prior to substantial grinding to an impacting action.

It is another object of my invention to combine the impacting step before mentioned with a proper separating step whereby the germ of the grain in substantially whole and unground condition may be removed from the balance of the berry.

Another object is to provide a novel milling process whereby the grain before it has been ground is lightly cracked and thereafter the grain is subjected to an impacting action to shatter the endosperm while breaking away the germ in substantially whole form therefrom.

The objects and advantages of the invention will more fully appear from the following description made in connection with the accompanying drawings wherein—

Fig. 1 is a typical diagrammatic flow sheet for portions of a flour mill wherein the processes of my invention are employed, the milling operation as illustrated in the flow sheet being sufficiently shown to carry through a substantially complete separation of the germ from the remaining streams of the mill;

Fig. 2 is a view in rear elevation of an impactor that may be employed in connection with my processes, the view being taken looking to the left from the right side of Fig. 3 and certain of the parts being broken away and others being shown in section;

Fig. 3 is a view taken chiefly in vertical section substantially on the line 3—3 of Fig. 2 as indicated by the arrows;

Fig. 4 is an enlarged detail of certain of the parts shown in Fig. 3;

Fig. 5 is a vertical section taken on the line 5—5 of Fig. 4; and

Fig. 6 is a typical flow sheet of a small capacity flour mill operated in accordance with present conventional practice and wherein my processes are not employed, Fig. 6 being included for comparison with Fig. 1 and to permit better description of my departures from conventional milling practices.

Referring first to Fig. 6 a typical flow sheet of a modernized flour mill of 300 barrel daily capacity taken from edition No. 5 of "The Consolidated Grain Milling Catalogs" published by American Miller is illustrated, the milling operations being carried out in accordance with present conventional practice

In Fig. 6 various arrow equipped lines designate the various flow streams through the mill, the arrows indicating the direction of movement of these streams. At the top of Fig. 6 there are shown five pairs of oppositely rotating corrugated break rolls designated respectively "1 BK" "2 BK" "3 BK" "4 BK" and "5 BK" meaning first break, second break, third break, fourth break and fifth break. Below the designations 1 BK, 2 BK etc. will be found dimension figures such for example as "9 x 30," "9 x 36" etc. the first numeral indicating in the mill illustrated the diameter of the break rolls employed in connection with the particular breaks and the second numeral indicating the length of these rolls. Immediately below the dimension figures will be found designations "12 Cor.," "14 Cor.," etc. indicating the number of corrugations on the rolls of the respective breaks. Below the corrugation designations will be found such numerals as "2½—1," "2½—1," etc. which indicate the differential speeds between the two corrugated rolls of the several breaks. In other words, for example, in the first break one of the corrugated rolls travels through two and one-half revolutions while the other roll of the first break travels through one revolution.

Below the respective break rolls in Fig. 6 there are diagrammatically illustrated five sifters numbered 1, 2, 3, 4 and 5 respectively meaning the first, second, third, fourth and fifth sifters. Enclosed within each rectangle designating each sifter will be found numerals and letters which designate the number of and the size of the various screens, gauzes and bolting cloths employed in each sifter in the particular mill illustrated. For example, in the number 1 sifter "4—18W" means that four, eighteen mesh, wire screens are employed in this sifter at the top thereof; the designation "3—38 GG" means that three, thirty-eight mesh, Grits Gauze are employed immediately below the 4—18 wire screens. Similarly in the number 1 sifter the numerals "4—60 GG" means that four, sixty mesh, Grits Gauze are employed immediately below the 3—38 mesh Grits Gauze. Also in the number 1 sifter the designation "5—12 XX" means that five, twelve XX silk bolting cloths are employed in this sifter below the 4—60 mesh Grits Gauze. At the side of each of the sifters will be found numerals such

as "1/6—6 x 17" at the side of the number 1 sifter, which means that there is one of the number 1 sifters and this sifter is divided into six compartments seventeen sieves high. The designation "Top set sieves sections 1, 2, 3, 4, 5 Type 'A'—2½ 'deep'" means that in the first five sifters the top screens or sieves are what are known in the trade as Type A and are 2½ inches deep.

Below the first five sifters four purifiers are shown designated respectively at the left of each purifier by a number 1, 2, 3 or 4 meaning the first purifier, second purifier, third purifier and fourth purifier. Above each purifier appears a designation such as "27 x 76 Sing. Pur." meaning that the purifier is of a dimension 27 x 76 inches and is a single purifier as distinguished from a twin or multiple purifier. In each purifier will be found a group of numbers. For example in the first purifier the numbers "34—24—20—6/40—30—22—18" are found meaning that in this purifier six inches of 40 mesh, a 34 mesh, a 30 mesh, a 24 mesh, a 22 mesh, a 20 mesh and a 18 mesh, screens or gauzes are employed from left to right of the purifier in the sequence specified.

Below the several purifiers there are shown in Fig. 6 a group of reduction rolls with the dimension of these rolls given and the differential speeds of these rolls given, these reduction rolls being respectively designated "SIZ." meaning sizing rolls. "1 MIDS" meaning that the two sets of rolls adjacent this designation are the first middlings rolls, "2 MIDS" meaning that the two sets of rolls adjacent this designation are the second middlings rolls, "3 MIDS" indicating the third middlings rolls, "1 TAILS" indicating the first tailings rolls, "4 MIDS" indicating the fourth middlings rolls, "5 MIDS" indicating the fifth middlings rolls, "2 TAILS" indicating the second tailings rolls, "6 MIDS" indicating the sixth middlings rolls.

Below the several reduction rolls there are shown sifters appropriately numbered 6, 7—8a, 9—8b, 10, 11, 12, 13, 14a, and 14b which indicate the numbers of such sifters, these sifters also otherwise carrying designations as in the case of the first five sifters above referred to.

At the central part of the top of Fig. 6 there is shown a reel designated the No. 1 reel, while at the right lower part of the sheet are found two other reels designated the No. 2 reel and the No. 3 reel, each of these reels having appropriate designations thereon or adjacent thereto such as "26 x 8 DIFF." meaning that it is a differential reel 26 inches in diameter and eight feet long. The designation "36 inches 9 XX" means that there are 36 inches of 9 XX bolting cloth and the designation "13 XX" means that the rest of the length of the reel is clothed with 13 XX bolting cloth.

Also located at the lower right part of Fig. 6 a No. 1 scroll mill is illustrated, while at the right hand portion of the sheet two dusters are shown the upper one of which is the bran duster and the lower of which is the shorts duster, each showing the appropriate screens employed therein and the dimensions of each are given. Adjacent the upper duster, a designation "UP. B. D." is found, meaning upper bran duster, while adjacent the lower duster is the designation "UP. S. D." meaning upper shorts duster.

Adjacent certain of the stream entrance arrows and certain of the stream exit arrows are letters or designations indicating what is carried by the particular streams. At the top left of Fig. 6 will be found a large arrow with the word "WHEAT"

written alongside of the same meaning that cleaned and conditioned wheat in berry form is introduced at this point. The letter "P" means patent flour. The letters "SF" mean straight flour which includes patent flour and first and second clear flour. The designation "BRAN" of course means bran; the designation "FEED" means feed; and the designation "LGF" means low grade flour. The designation "PUR. DUST" means dust removed by suction on the purifiers.

Considering the particular flour mill shown in Fig. 6 which, of course, is only one typical mill, the cleaned and conditioned wheat in berry form is fed to the first break rolls at the head end of the mill where it is acted on by these rolls. These rolls are set close together and they grind the wheat and tear the wheat berry apart while breaking it up due to the corrugations of the rolls and the differential speed at which they are run. Of course, considerable of the germ is ground and broken up with the remainder of the wheat berry in the first break. Some of it scalps from the first screens of the first sifter and passes to the second break where additional germ is ground up. Part passes from the second break rolls to the second sifter where it is ground, passes to the third sifter, etc. The course of the flow of the various streams passing through the various break rolls and passing through or scalped from the various screens, Grits Gauze, and bolting cloths of the various sifters, working through the various screens of the different purifiers, passing to the various reducing rolls, then again working through different shifters, passing through the different reels, working through the different dusters, scroll mill etc. can be readily traced by following through the different arrow equipped lines. No attempt is here made to describe in detail the entire conventional milling operation which, of course, differs considerably in different mills and different sizes of mills. Suffice it to say that the wheat germ at the head end of the mill is ground with the rest of the wheat berry. Some of the germ oil is pressed from the germ to work into the endosperm at the time of the first break, a considerable part of the germ is scalped from the first sifter to flow with the larger particles of the wheat berry to the second break while ground parts of the wheat germ scalp off screens of the first, second and third sifters to run to the several purifiers etc. and considerable of the finer particles of germ passes through the bolting cloth into the various flour streams. In other words, the germ runs through the entire milling process with the remainder of the wheat berry and is ground, reground, separated, reduced and treated along with the remainder of the wheat berry, most of the germ passing through with the coarser streams of the tail end of the mill to make these tail end streams quite sticky and difficult to separate by reason of a large amount of germ oil therein and causing more or less permeation of the different flour streams with parts of the germ oil as well as ground particles of the germ itself. No attempt is made in the usual milling process to break out the wheat germ from the remainder of the wheat berry at the head end of the mill before grinding. However, some of the germ will tend to scalp off with bran particles that are about the same size as the germ during the milling process and in some mills it is a practice to employ special machines to separate the germ from the branny particles but such separation is made after grinding and in streams toward the tail end of the mill.

The process is carried out in milling rye as to the treatment of germ in much the same manner as in respect to wheat but the process is shorter.

I now refer to Fig. 1 of the drawings wherein there is diagrammatically illustrated sufficient of a wheat milling process to describe my invention.

In accordance with my invention, at the head end of the mill and before the wheat berries have been ground, broken or torn apart in any way, the cleaned and conditioned wheat berries are preferably lightly cracked by passing the same between a pair of oppositely revolving smooth faced cracking rolls having no corrugations and preferably no differential speed. These cracking rolls are shown at the top left of Fig. 1 and they are designated on this view "Cracking rolls no corrugations no differential." These rolls are spaced apart a slightly greater distance than the corrugated rolls used as the first break rolls of a flour mill. In some instances it may be desirable to use slightly roughened cracking rolls instead of smooth faced rolls but care must be taken not to employ rolls that will grind the berries. While it may be desirable, under some conditions, to run one of the two cracking rolls at a slightly greater speed than the other of the two cracking rolls, I have found that very good results are obtained when the two cracking rolls are run at the same speed and in any case a differential speed is not used which will cause the berries to be ground or torn apart. It is very important that no grinding action be secured as the wheat passes between the cracking rolls. These rolls merely act lightly on the wheat, for the most part merely producing cleavage cracks in the wheat berries without causing a separation to any appreciable extent between the particles of the berries and while retaining the individual berries in unitary form. The said light cracking does not break or cleave the germ sacs to any appreciable extent, largely because of the elasticity of the germ and because of the light action of the cracking rolls.

While I prefer to employ the cracking step inasmuch as this simplifies my processes, I have found that this cracking step is not absolutely essential.

Proceeding further with my processes and considering that the wheat has been cracked, the cracked wheat chiefly in its unitary berry form passes to an impactor such as shown diagrammatically in Fig. 1 and shown in detail in Figs. 2, 3, 4 and 5. If the cracking step is not used the cleaned and conditioned wheat is carried directly to the impactor at the head end of the mill. In the impactor the berries are violently thrown at high speed against an impactor wall or ring or otherwise caused to be brought violently into contact with a fixed or moving surface, thereby causing the friable endosperm to be shattered and broken apart from the germ while the more elastic germ is broken away in substantially whole form from the endosperm and bran without being broken up to any appreciable extent.

In practice it is found necessary to vary the violence of impactation depending on the type, moisture content, and quantity of grain being subjected to the impact treatment. It is, therefore, necessary in commercial installations to provide a variable speed drive or control for the impactor and to set the speed of operation of the impactor such as to secure the best results with each batch of grain being impacted. The setting should be such as to break out the germ in whole

form from the endosperm with a minimum reduction of the endosperm to flour.

The impactor discharges into a sifter designated the No. 1 sifter in Fig. 1 of the drawings and this sifter will be preferably provided with one or more upper screens of approximately 18 mesh, one or more screens of approximately 24 mesh, one or more screens of approximately 32 mesh, and below these three sets of screens it may be provided with suitable Grits Gauze and bolting cloth such as the 60 mesh Grits Gauze and 11 XX bolting cloth designated. The No. 18 mesh screens will allow all the wheat germ that has been broken out by the impacting action and all particles of endosperm and bran of approximately the same size or smaller size to go through the meshes thereof while some larger particles which have not been shattered by the impacting action and, of course, include a small portion of the germ will tail over the 18 mesh screens and they are then carried to conventional corrugated first break rolls having a standard differential speed as of $2\frac{1}{4}$ to 1 as shown in Fig. 1. The throughs of the 18 mesh screens pass onto the 24 mesh screens and some of the finer germ particles together with what little flour is made during the impacting step and the finer endosperm particles and the finer bran particles also pass with the smaller germ particles onto the 32 mesh screens. Practically none of the germ particles produced by the impacting action are small enough to pass through the 32 mesh screens but the finer particles of endosperm and bran will pass on down through the first sifter below the 32 mesh screens substantially free from germ and these fine particles will thereafter be treated in accordance with conventional milling practice. The overs of the 24 mesh screens contain most of the larger germ together with larger particles of endosperm and larger bran particles and the overs of the 32 mesh screens carry small germ and smaller particles of endosperm and bran. The overs of the 24 mesh screens are carried to a No. 1 purifier as indicated while the overs of the 32 mesh screens are preferably carried to a No. 2 purifier as indicated. These purifiers remove the fine bran particles and the throughs of each of the No. 1 and 2 purifiers go to what I term germ sizing rolls which are smooth faced rolls having a differential speed at about $1\frac{1}{2}$ to 1. Two sets of these germ sizing rolls are shown, the germ sizing rolls receiving from the No. 1 purifier being designated "Large germ sizings," while the germ sizing rolls receiving from the No. 2 purifier are designated "Small germ sizings." These germ sizing rolls crush the endosperm which is rather friable and breaks easily, while the germ being tougher and carrying oil is simply flattened out to enlarge the same without being broken up to any great extent. The products from the two germ sizing rolls are carried to the No. 4 and 5 sifters respectively having such screens, Grits Gauze and bolting cloth as those indicated namely, approximately 20 mesh screens more or less, 54 mesh Grits Gauze and 11 XX bolting cloths. The flattened germ is retained by the uppermost screens of the No. 4 and No. 5 sifters while the flour particles pass on through these uppermost screens and are treated in accordance with conventional milling practice thereafter. The germ scalped off the upper screens in the No. 4 and No. 5 sifters may still contain some endosperm and small bran particles and accordingly this germ as indicated in Fig. 1 is carried to a pair of germ flaking rolls desig-

nated "Germ flaking rolls" which flake out the germ to even a greater extent than previously by the germ sizing rolls earlier referred to. The germ flaking rolls are smooth faced rolls running at a differential speed. From the germ flaking rolls, the flaked germ together with whatever bran and endosperm is released therefrom by the action of the flaking rolls, are carried to a No. 6 sifter carrying upper screens of approximately 20 mesh whereon the highly flattened germ is retained and the germ scalps off from these screens in practically pure form. The matter passing through the upper screens of the No. 6 sifter is treated for further reduction in the conventional manner.

As has been stated there is a small quantity of germ with larger particles of the wheat berry which are scalped off the upper 18 mesh screens of the first sifter. The scalplings from the 18 mesh screens of the first sifter are carried to conventional first break rolls which are corrugated and are operated at a differential speed and from the first break rolls the material is carried into a No. 2 sifter as is indicated. What little germ is present is for the most part carried through the upper 18 mesh screens of the second sifter and the larger particles of this germ together with larger particles of endosperm and bran are caught by the second 24 mesh screens of the second sifter while the finer particles of the germ together with some of the smaller particles of endosperm and bran are caught by the 32 mesh screens of the second sifter. The scalplings from the 24 mesh screens of the second sifter are carried to the No. 1 purifier as indicated while the scalplings from the 32 mesh screens of the second sifter are carried to the No. 2 purifier and are thereafter treated as has been heretofore described. The material passing through the 32 mesh screens of the second sifter contains very little germ and is treated according to conventional milling practice. The material scalping off the upper most 18 mesh screens of the second sifter is handled in accordance with conventional milling methods and carried over to the second break rolls etc.

In Fig. 1 of the drawings the various streams carrying the germ are indicated in heavy lines with heavy arrows while other streams not carrying appreciable quantity of the germ are shown by lighter lines and lighter arrows. Very little flour is made by the cracking step or by the impacting step and most of the germ is carried directly to the first two purifiers before it has been ground and thus most of the germ is eliminated before germ particles or germ oil is given an opportunity to work into flour streams to any appreciable extent. While there is a small amount of germ that will be ground by the first break rolls the amount of germ present which works between the first break rolls is very small compared to the amount working through the first break rolls and ground thereby in the conventional milling process. Such germ as does carry over to the first break rolls is quickly separated from the flour streams and the germ does not carry over to an appreciable extent into the streams at the tail end of the mill. This permits much easier separation of the tail streams because these streams will not be as sticky as in the conventional milling process because of the lack of the germ oil and germ in these streams and accordingly proper separation can be made with fewer sifting steps, fewer breaks, and with fewer reductions.

The presence of wheat germ or germ oil in flour is desirable in some respects and undesirable in other respects. The germ itself is high in fat, proteins and various vitamins, all of which are of high nutritive value and from this standpoint it is desirable to have the germ in the flour. The germ, however, contains oil and other substances particularly enzymes that act adversely on yeast during the baking of bread and if the flour contains wheat germ the baking quality of the flour is greatly reduced inasmuch as it is impossible to secure a loaf of bread of good volume if much germ is found in the flour from which the bread is baked. Furthermore, the germ has a tendency toward rancidity and this is another reason why it is desirable to remove the germ and germ oil without permitting the same to become mixed with the flour. As, in accordance with my process the germ is substantially removed from the flour streams at the head end of the mill and is taken off in practically pure form, this germ can be treated as desired to remove part or all of the germ oil from the same and if desired it may be fed back into certain streams of the flour to produce a flour containing germ without germ oil to an exact regulated amount. Actually with my improved process, in excess of 90% of the germ is removed from the flour streams after the centrifugally flinging type of impaction against the hard surfaces and the subsequent first general sifting step or operation. In referring to the first sifting operation, I mean of course, the use of the first sifting apparatus whether one screen or a large number of screens of different mesh are used therein for separation from the flour stream of a substantial proportion of the germ, often exceeding 92%. In some instances it may be desirable to feed back the germ without first removing the oil and of course the germ can be ground to the desired degree of fineness and introduced in regulated amount into any of the mill streams. Uniformity in the quantity of germ in flour and in the amount of germ oil in flour produced can thus be secured if desired.

Referring now to Figs. 2, 3, 4 and 5 there is illustrated an impactor of a type that I prefer to use to secure my impacting action although it will be understood, of course, that other types of impactors can be employed. The impactor shown in said views of the drawings includes a suitable stand 7, carrying bearings 8 within which a horizontal shaft 9 is journaled, this shaft being driven in any suitable manner as by means of a belt (not shown) working over a variable speed pulley 10 or by any other type of variable speed drive. Secured to the left side of the stand 7 is a hollow casing 11, the two spaced side walls of which have upper parts of somewhat greater than semi-circular shape, the lower edges of which converge to form a discharge mouth 12. The shaft 9 runs into the central part of the casing 11 and carries at its end within said casing a flange collar 13 to which a circular disc 14 is secured as by the bolt 15. Spaced from the disc 14 is an annular disc 16, the external diameter of which is the same as the disc 14, and the annular disc 16 has a conical flaring mouth 16a. Between the two discs 14 and 16 are disposed a series of circumferentially spaced arms or vanes 17 and these vanes extend from the outer peripheries of the two discs inwardly toward the shaft 9 to points contiguous to the flaring mouth 16a. The two discs 14 and 16 are secured together and the vanes or arms 17 are as-

sembled to the two discs as by means of nutted bolts 18 which run through the two discs and extend through suitable grooved brackets 18a attached to the arms 17.

An impactor ring 19 having an internal diameter somewhat greater than the external diameter of the discs 14 and 16 is provided and this impactor ring is secured in concentric relation in respect to the two discs as by means of heavy nutted bolts 20 which extend through spacing sleeves 21 and through eyes formed at circumferentially spaced points on the periphery of the impactor ring 19. The ring 19 is made of heavy metal and is of a width somewhat wider than the spacing between the two discs 14 and 16. It is provided with a series of transverse corrugations at its inner periphery forming a multiplicity of teeth 19a.

Secured to the left side of the casing 11 is a feed chute 22 having an angularly bent lower part extending into the flaring mouth 16a of the annular disc 16.

The two discs 14 and 16 and the arms or vanes 17 form an impeller which is driven at high speed by the shaft 9. The grain is admitted to the central part of this impeller through the chute 22 in a constantly flowing stream. The grain entering the central part of the impeller carries into the several segment shaped passages of the impeller between adjacent arms or vanes 17 and the two discs 14 and 16. The high speed of rotation of the impeller causes the grain to be carried outwardly from the longitudinal axis of the shaft 9 by centrifugal force at very high velocity and the vanes 17 through the grain at high velocity in a direction substantially tangential to the ends of the vanes against the teeth 19a of the impactor ring. If the impeller is rotating in the direction indicated by the arrow shown in Fig. 2, the grain strikes those portions of the corrugations 19a set substantially normal to the line of movement of the grain running from the outer ends of the vanes and as the grain strikes such corrugations with great force the grain berries are shattered so that the endosperm of the grain is broken up into many particles while the germ, being more resilient and able to withstand the shock of the impact is broken out whole from the grain berry. While some bran is loosened by the impaction, much of it clings to the endosperm particles. It will be noted that the casing 11 is made considerably wider than either the impeller or impact ring and accordingly after the grain has been thrown out against the impact ring it drops by gravity through the discharge mouth 12. Of course, the impeller sets up a fan action and considerable air is moved within the casing 11 back into the entrance mouth 16a of the impeller between the edge of the entrance mouth and the chute 22 and this air acts to distribute the grain entering the impeller through the chute 22 quite evenly to the several channels of the impeller.

With the construction of the impactor shown the grain continuously flows to the impactor, is impacted and flows from the impactor. The grain berries are impacted but once and thus but little flour is made during the impaction action, which is desirable.

While my milling processes have been described chiefly in connection with the milling of wheat, these processes are adapted to the milling of certain other grains particularly rye.

It will be seen that novel and improved milling

processes have been provided having many advantages over the processes now in use.

It will, of course, be understood that various changes may be made in my processes and the steps thereof without departing from the scope of the present invention which generally stated consists in the matter shown and described and set forth in the appended claims.

What is claimed is:

1. The process of milling such a grain as wheat or rye which consists in first moisture-conditioning the grain, subjecting the grain berries to an impacting action at the head end of the mill to break away the germ from the more friable endosperm prior to substantial grinding or breaking up of the berries, thereafter removing the fines and the largest particles from the impacted grain, thereafter crushing the remainder of the impacted grain to flatten the germ while breaking up the endosperm to a greater extent and sifting the flattened germ from the crushed portions of the berries.

2. The process of milling such a grain as wheat or rye which consists in first moisture-conditioning the grain, lightly cracking the grain at the head end of the mill before grinding, thereafter centrifugally flinging the cracked grain at high velocity against an impacting surface at the head end of the mill to break away the relatively non-friable germ from the relatively more friable endosperm before the germ is substantially ground, thereafter removing the fines and the largest particles from the impacted grain, thereafter crushing the remainder of the impacted grain to flatten the germ while breaking up the endosperm to a greater extent and sifting the flattened germ from that part of the grain subjected to the crushing action.

3. The process described in claim 2, and grinding the largest particles taken from the impacted grain and separating the germ from such ground particles.

4. The process of milling such a grain as wheat or rye which consists in first moisture-conditioning the grain, subjecting the grain berries to an impacting action at the head end of the mill to break away the germ in substantially whole form from the more friable endosperm prior to substantial grinding or breaking up of the berries, thereafter removing the fines and the largest particles from the impacted grain, thereafter purifying the remainder of the impacted grain, thereafter crushing the purified grain to flatten the germ while breaking up the endosperm to a greater extent and sifting the flattened germ from the purified crushed portions of the berries.

5. The process of milling such a grain as wheat or rye which consists in first moisture-conditioning the grain, subjecting the grain berries to an impacting action at the head end of the mill to break away the germ from the more friable en-

dosperm prior to substantial grinding or breaking up of the berries, thereafter removing the fines and the largest particles from the impacted grain, thereafter purifying the remainder of the impacted grain, thereafter crushing the purified grain to flatten the germ while breaking up the endosperm to a greater extent, sifting the flattened germ from the crushed portions of the berries, flaking the sifted flattened germ and sifting the flaked germ from the material loosened by the flaking operation.

6. The process of milling such a grain as wheat or rye which consists in first moisture-conditioning the grain, lightly cracking the grain at the head end of the mill before grinding, thereafter subjecting the cracked grain to an impacting action at the head end of the mill to break away the relatively non-friable germ from the relatively more friable endosperm before the germ is substantially ground, thereafter removing the fines and the largest particles from the impacted grain, thereafter purifying the remainder of the impacted grain, thereafter crushing the purified grain to flatten the germ while breaking up the endosperm to a greater extent and sifting the flattened germ from the purified crushed portions of the berries.

7. The process of milling such a grain as wheat or rye which consists in first moisture-conditioning the grain, lightly cracking the grain at the head end of the mill before grinding, thereafter subjecting the cracked grain to an impacting action at the head end of the mill to break away the relatively non-friable germ from the relatively more friable endosperm before the germ is substantially ground, thereafter removing the fines and the largest particles from the impacted grain, thereafter purifying the remainder of the impacted grain, thereafter crushing the purified grain to flatten the germ while breaking up the endosperm to a greater extent, sifting the flattened germ from the purified crushed portions of the berries, flaking the sifted flattened germ and sifting the flaked germ from the material loosened by the flaking operation.

8. In the process of milling such a grain as wheat or rye, moisture conditioning the grain, lightly cracking the grain at the head of the mill without producing drawing or shearing action on the berries, thereafter subjecting the grain so cracked to impact action against surfaces disposed substantially perpendicularly to the movement of travel of said cracked berry with that degree of force to break away the germ in substantially whole form from the more friable endosperm prior to substantial grinding or breaking up of the berries, thereafter crushing the grain containing said germ to flatten the germ while breaking up the endosperm and sifting the flattened germ from the crushed portions of the berries.

ROBERT J. S. CARTER.