the complainant. It is true that the defendant uses a succession of devices, which, when the cap is held in a sloping position, appear to be, severally, of a diamond shape; but, when both caps are held upon a horizontal plane, the effect of the one is wholly different from that produced by the other. For the diamond upon the plaintiff's cap there is substituted a rhombus upon the defendant's, and the space between each of these respective figures is about twice as great in the defendant's design as in that of the complainant. To these differences in detail, separately considered, I would not attach importance; but because, as a whole, they result in producing quite distinct pictures, they are controlling. The respective rosettes are so absolutely unlike as to render any comparison of them unnecessary. The bill is dismissed, with costs.

DEERE & CO. v. ROCK ISLAND PLOW CO.

(Circuit Court of Appeals, Seventh Circuit. January 3, 1898.)

No. 356.

1. PATENTS—COMBINATIONS—NEW RESULTS.
   The new result which a combination is required to attain is a result which is new and distinguishable as compared with results produced by the elements in their separate state, or as assembled in a mere aggregation, without functional relations to each other. A combination is not unpatentable merely because its results may also have been produced by other combinations.
2. SAME—CORN PLANTERS.
   The Waterman patent, No. 480,304, for improvements in corn planters, does not cover, in its first claim, a mere aggregation, but a patentable combination, in which the force generated by the friction between the outer edges of the disks (which cover the corn, and at the same time support and carry the seed box) and the ground works the mechanism in the seed box to drop the corn in fixed quantities; the disks being at the same time, by reason of their variable angular adjustment to the line of travel of the machine, functional in determining the distance between the charges of grain as deposited in the furrow.

   Woods, Circuit Judge, dissenting.

Appeal from the Circuit Court of the United States for the Southern Division of the Northern District of Illinois.

This was a suit in equity by Deere & Co., a corporation, against the Rock Island Plow Company, for alleged infringement of a patent for improvements in corn planters. The circuit court dismissed the bill for want of novelty in the patent, and the complainant has appealed.

L. L. Bond, A. H. Adams, C. E. Pickard, and J. L. Jackson, for appellant.

John G. Manahan and Edward Rector, for appellee.

Before WOODS, JENKINS, and SHOWALTER, Circuit Judges.

SHOWALTER, Circuit Judge. Appellant, a corporation, exhibited its bill in the circuit court, alleging infringement by appellee, which is also a corporation, of the first claim of letters patent of the United States numbered 480,304. This patent was issued August 9, 1892. Complainant owns the same, as assignee of the inventor, Lewis E. Wa-

terman. The invention of this patent "relates to improvements in corn planters." Fifteen claims were conceded in the patent office. The first, being the one in controversy in this suit, reads:

"In a corn planter, the combination, substantially as hereinbefore described, of a seed box, mechanism for measuring and delivering seed from the box, co-operating disks on either side of the box, which disks carry or support the seed-box and the measuring and delivering mechanism, and which actuate the latter, and means for adjusting the disks so as to vary their covering capacity."

As applicable to this claim, the specification and diagrams of the patent show a horizontal frame, approximately round, with an extension or tongue from one side inclining slightly downward, and cut out vertically at its outward extremity into two arms, which arms pass on either side of, and are pivoted to, a central forward portion of the rigid frame whereby the subsoiler is held to a double-moldboard lister plow. This circular frame is, by means of the pivot whereby it is attached in the rear of the plow, movable vertically out of its horizontal position. Transversely across and underneath the broadest portion of this frame, and at right angles to the direction of the plow, extends an axle, on either end of which ground wheels, not spoked, but made in the form of disks, are fixed. On this frame, itself supported by the axle and ground wheels, is supported vertically a cylindrical seed box, containing in its bottom a seed measuring and delivering mechanism, and a spout leading from the bottom downward through said frame to a tube or conductor fixed vertically behind the subsoiler, and in the frame which carries the subsoiler. Through this spout and tube, as the plow parts its furrow, and the subsoiler the secondary furrow, the seeds are dropped into the latter furrow in fixed quantities or charges, and at fixed intervals. On the axle, which turns with the disks or ground wheels, and by the friction between the outward edges of the latter and the ground as the structure is drawn in the wake of the subsoiler, is a vertical, beveled cog wheel, which engages with cogs on the underside of a horizontal annular plate in the bottom of the seed box, and thereby actuates the seed measuring and delivering mechanism. This vertical, beveled wheel is between the center of the axle and the disk fixed on the end thereof. So far as now described, the structure contains all the factors of the claim quoted, except the last, namely, "means for adjusting the disks so as to vary their covering capacity." These factors, not being in combination with the last, would themselves combine to the one result of dropping the grain in fixed quantities, and at fixed intervals, into the secondary furrow behind the advancing subsoiler. In such hypothetical combination, however, the disks would have merely the function of wheels. As disks, they would be functionless. But the patentee, by the operation of his device in dropping the corn, undertakes also to cover the same as and when dropped into the furrow. For this purpose the axle between the disks is made in halves. These are joined together under the central portion of the seed box by a coupling operative as a universal joint. By this means each ground wheel or disk may be set so that its plane of revolution, being a vertical plane, is at a greater or less angle with that vertical plane which would pass through the central longitudinal line of the furrow, or direction of the

plow. The planes of revolution in the disks, if extended, meet in a vertical line through the center of the furrow in the rear of the advancing seed box, as attached to the plow in operation. In order to move the loosened soil more effectively, the disks or ground wheels are "preferably" made concavo-convex, with sharpened peripheries, and placed on the axle with the concaved surfaces towards each other. Each half of the divided axle is journaled in a bracket which is attached by bolts to the horizontal frame which carries the seed box. The openings in the frame for these bolts are slots concentric with the annular plate in the bottom of the seed box which moves the seed measuring and delivering mechanism. By loosening the nuts on these bolts, a different angular adjustment of the axle and disks may be made. The nuts are then tightened so that the new position of the disks is maintained. By varying the angular adjustment, the disks move more or less earth,—in other words, increase or decrease the depth at which the corn is covered.

The patent No. 418,526, issued December 31, 1889, to T. P. Lynch, shows, in a lister plow or corn planter, the combination "of a seed box, mechanism for measuring and delivering seed from the box, co-operating" wheels "on either side of the box, which" wheels "carry or support the seed box and the measuring and delivering mechanism, and which actuate the latter." In the device of the Lynch patent, the ground wheels, which are not disks, but spoked wheels, are fixed vertically on the ends, respectively, of the axle, so that their planes of revolution are parallel to each other, and to a vertical plane through the longitudinal central line of the furrow. In this patent the axle is not divided, or in halves; the means for covering the grain being two curved shovels adjusted to follow in the rear of the advancing seed box. In the patent in suit the divided axle, the central coupling forming a universal joint, the angular adjustment of the disks, and the frame whereby the axle and disks are held in position, and attached to and made to follow the plow, constitute the mechanism described in the specification, whereby earth is thrown over the corn to cover it. The central coupling between the two meeting ends of the divided axle forming the universal joint, the tube or bearing in which each half of the axle is journaled, the brackets on the tube, with the bolts and slots through the frame, whereby the axle is held to the frame which supports the seed box, constitute the last element specified in the claim, namely, the "means for adjusting the disks so as to vary their covering capacity," as described in the specification. The construction of the Lynch device, above referred to, has the one distinct result, namely, it drops the grain in fixed quantities, and at fixed intervals, in the furrow. If we suppose the divided axle of the patent in suit to be set and secured so that the two halves are in a straight line, the disks will then have only the function of the wheels in the Lynch device. On this hypothesis, if the words, "means for adjusting the disks so as to vary their covering capacity," be omitted from the claim in suit, the remaining elements, as expressed in the claim, would attain the result of the Lynch combination. But disks, as disks, would not be a factor towards such result. Again, disks attached to a lister plow, following the subsoiler, set, as in the patent in suit, angularly to the direc-

tion of the plow, by an angular adjustment, which may be changed, and which cover the grain dropped behind the subsoiler from a seed box in fixed quantities, and at fixed intervals, are found in the patent to Loughry, dated March 4, 1890, and numbered 422,603. But in the Loughry patent each disk is upon a spindle projecting from the lower end of an adjustable upright rod. There is no axle connecting these disks. They are not functional in carrying the seed box, in actuating the seed distributing and delivering mechanism, or in fixing the intervals or distances between the charges of corn as dropped into the furrow behind the subsoiler. In the patent in suit, and in the claim in question, the "co-operating disks" are on "either side of the box." These disks are distant from each other about 10 or 12 inches. The box is between them, and not on one side, in order that the corn may be dropped into the furrow straddled by the disks. Again, the box is between the disks, and not on one side or above them, in order that, in the work required of them, they may retain the upright position, and not topple over.

Counsel for appellee has put in evidence a very large number of prior patents. To about 12 of these he makes reference in his argument. The patent 305,430, to E. A. Daniel, in 1884, is seemingly dwelt on with most confidence. Counsel says:

"The patent to Daniel, of 1884, shows each of the parts named in said first claim. In the Daniel structure there are three disks on each side of the center of the machine; constituting two groups, which throw in towards each other, as in the patent in suit. Every function set out in the claim sued on is performed in the Daniel structure by the same agency respectively named in said claim. Inasmuch as a change of location of an element in a combination, without change of function, does not affect the identity of the combination (Dane v. Manufacturing Co., 3 Biss. 374, Fed. Cas. No. 3,558), the Daniel structure, if subsequent, would be an infringement on the claim sued on, were the latter valid; but 'what would infringe a patent, if later, will defeat a patent, if earlier.' (Knapp v. Morss, 150 U. S. 229, 14 Sup. Ct. 81.)"

The device of this Daniel patent belongs to the harrow or broadcast-seeder family. The three disks constituting the gang on one side of this device are on a single axle. The two axles are set, by means of a frame above the disks, at an angle to each other, so that by the mutual opposition of the two gangs of disks the machine may be drawn over the prepared field in a direct line of travel. There is over each gang a separate seed box, set at a considerable elevation above the disks. If one of the gangs with its seed box should be detached from the other, and fastened to the rear of a plow, or should itself, as a single implement, be drawn over ground already prepared, its course would be zigzag, or at least uncertain. Its disks would not co-operate to keep it in the line of travel. If, on the other hand, the disks be set so that their planes of revolution are in the line of travel, then they would have no covering capacity. Moreover, if the distance between the exterior disks should be fixed at 10 or 12 inches, the machine would topple over. In this Daniel machine the adjacent disks—one on the inner end of one axle, and the other on the inner end of the other—are in the same position, relatively to each other and to the line of travel, as the disks of the patent in suit. Moreover, their angular adjustment may be varied. Still further, in front of

these two disks are firmly secured to the tongue of the machine two other disks, with the opposite angularity, intended to open, in a prepared soil, shallow, parallel, and closely-adjacent furrows. By a spout extending from the left-hand seed box obliquely towards the right-hand inner-end disk, a stream of seed is thrown, apparently, against said last-named disk, to be thereby scattered in the wake of the two forward disks attached to the tongue. The seed so scattered is thereupon covered, but whether by the action of one or both of the inner-end disks of the gangs, does not clearly appear. At all events, the right-hand inner-end disk has no connection with the box from which the seed flows as last mentioned. The two inner-end disks do not co-operate upon any mechanism in said seed-box. They are not "co-operating disks on either side of the box." In the machine of the patent in suit, assuming the plane of revolution in the disks to be in line with the direction of the plow, one full turn of the disks will measure a uniform interval or distance in the furrow. By the revolution of the plate in the bottom of the seed box, the charges of seed are carried successively to the opening of the spout, through which they fall into the furrow at distances apart corresponding to that portion of the circumference of the disks which rolls over the ground while the seed plate, after one charge drops, brings another to the spout. Further, though this may be a feature of no special importance apart from accuracy of description, these predetermined intervals between the charges of grain as dropped into the furrow are made in a degree greater or less by change in the angular adjustment of the disks. In other words, the disks, with their variable angular adjustment, are functional, in the machine of the patent, in fixing the intervals at which the charges of seed are dropped into the furrow; and the disks themselves, apart from the matter of angular adjustment (their friction with the ground being aided by the weight of the seed box and its contents), are functional in operating mechanism whereby one charge is separated from the mass of grain, and separately carried to the upper opening of the spout, and there dropped into the furrow. Disks having functions as disclosed in the claim in suit are not found in the device of Daniel, or in any of the numerous machines shown in the record, of that class to which the machine of Daniel belongs. In many of these machines a stirring implement of some sort, actuated through connecting appliances by the revolution of the disks, operates on the mass of seed in the box, and continuous streams from the mass of seed find outlets by gravity through holes in the bottom of the box, sometimes connected with downward spouts or conductors.

The argument most persistently urged by the learned counsel for appellee goes to the proposition that the elements assembled in the claim in controversy are really a mere aggregation, and not a patentable combination. The seed box of the patent, for instance, considered as a hollow receptacle for holding seed, is identical with itself in other situations. But here the seed box, besides holding the mass of corn in appropriate relation to the seed measuring and delivering mechanism, is functional as an instrumentality whereby said seed measuring and delivering mechanism is held in position to receive, as its means of operation in dropping corn, a force generated by the im-

pact or friction between the rims of the disks and the ground, which disks, with their angular adjustment, are at the same time functional in determining the intervals of distance between the charges of corn, and in covering the same as dropped. Counsel for appellee says that the elements of the claim in controversy "were not original with the complainant's assignor, and produce no new result in their present situation, wherefore a patentable combination does not obtain." The new result of a patentable combination is a result which is new and distinguishable as compared with results produced by the elements in their separated state, or as assembled in a mere aggregation, without functional relations to each other. A combination is not unpatentable merely because its results may also have been produced by other combinations. A footnote to section 156, Rob. Pat., reads:

"It is frequently stated in the decisions of the courts that no new combination can be produced unless its result or effect be also new. This is to be understood as referring to the effect of the combination as compared with the effect of its elements in their separate or aggregated state, not as compared with the effect of other combinations of the same or different elements. It is true that no combination can have been invented unless it is capable of producing effects beyond those resulting from the use of any or all the elements in their separated state. But it is not true that the same elements cannot be grouped into different combinations, governed by different co-operative laws, although their practical effect as arts or instruments may be the same. The decisions are to be read with this distinction in mind."

In Reckendorfer v. Faber, 92 U. S. 357, as showing the distinction between a mere aggregation and a patentable combination, it is said:

"Another illustration may be found in the frame in a sawmill which advances the log regularly to meet the saw, and the saw which saws the log; the two co-operate and are simultaneous in their joint action of sawing through the whole log,—or in the sewing-machine, where one part advances the cloth, and another part forms the stitches; the action being simultaneous in carrying on a continuous sewing. A stem-winding watch key is another instance. The office of the stem is to hold the watch, or hang the chain to the watch. The office of the key is to wind it. When the stem is made the key, the joint duty of holding the chain and winding the watch is performed by the same instrument. A double effect is produced, or a double duty performed, by the combined result. In these and numerous like cases the parts co-operate in producing the final effect,—sometimes simultaneously, sometimes successively. The result comes from the combined effect of the several parts, not simply from the separate action of each, and is therefore patentable."

As before pointed out in this opinion, if the disks be made functionless otherwise than as wheels,—in other words, if disks be taken out and wheels put in,—then all the elements of the claim, barring the last, may combine to the one result of dropping corn in fixed charges, and at fixed intervals. But such a supposed combination is not itself a factor in this claim. The last element, namely, "means for adjusting the disks so as to vary their covering capacity," by which we must necessarily understand, as described in the specification, disks which have the angular adjustment, as well as disks whose angular adjustment may be changed, might, when separated from the seed box and contained mechanism, or when these latter parts are functionless by the absence of seed from the box, cover charges of corn previously dropped by some other machine, or by hand. But in the combination of the claim the force generated by the friction or impact between the

outer edges of the disks and the ground as the machine follows the plow works the mechanism in the seed box to drop in fixed quantities the corn covered by the disks themselves while generating said force; the disks being at the same time functional in determining the intervals of distance between charges of grain as deposited in the furrow. The claim in controversy is not the aggregation of two distinct combinations. The last element may perhaps be called, in itself, a "subcombination," but the remainder of the claim, as set down, does not constitute another subcombination. This is not a case where two subcombinations are assembled. The criterion here is not whether the result of the union is anything more than the aggregate of two results, one attributable to one subcombination, and the other to the other. This is not a case of two machines brought together with no effect beyond adding the result of one to that of the other. A combination consisting of all the elements specified in this claim, except the last, is not itself a factor in this claim. The elements of the claim, barring the last, are not here combined otherwise than in an organism which includes the last. The claim is not accurately thought of as containing but two elements; the result of one being the dropping corn in fixed quantities, and at fixed intervals of distance, and of the other the covering the corn so dropped. Corn planting results from the co-operation of all the elements as adjusted for the time being to meet the conditions of the soil in which the work is carried on. This court does not concur with the learned counsel for appellee in his proposition that the claim in controversy is a mere aggregation, nor in his further proposition that "there was no invention in simply transferring to the Lynch and other organizations the well-known driving and covering functions of the disks of former organizations." As already pointed out in this opinion, the disks of the claim in suit have functions not found "in the disks of former organizations"; nor were these functions simply transferred to the Lynch, or to any other, organization.

Assuming the validity of the claim, we do not understand the infringement to be contested. Mr. Waterman, the inventor, was formerly an employé of the appellant corporation. In 1894 he entered the service of appellee, and has since remained in that service. While employed by appellee, and on May 21, 1895, there was issued to said Waterman, "assignor to the Rock Island Plow Company," appellee, letters patent No. 539,495. Appellant makes plows under the Waterman patent of 1892, being that in suit; appellee, under the Waterman patent of 1895. Plows made by appellee pursuant to the specification of the last-named patent contain, unmistakably, the combination of the claim in suit. Appellant's expert so testified. No witness has expressed any opinion to the contrary; nor, as said above, does the learned counsel even contend that the infringement is not clear if the claim be valid. There is no question here as to the utility of a machine made within the terms of the claim in comparison with the machines of Lynch or Loughry. Utility to the patentable degree is not disputed. The decree is reversed, and the cause remanded, with the direction to the circuit court to enter a decree for an injunction and an accounting.

WOODS, Circuit Judge (dissenting). I am unable to see that the Waterman combination embodies a new conception. Its exact counterpart, it is true, has not been found in the prior art; but the elements are all old in fact, as well as in theory, and, in plows, cultivators, harrows, and seed drills, have all been in familiar use, in the same relations to each other, and performing the same functions in the manner shown in the patent in suit. It is pointed out, and emphasized by repetition, that the disks of this patent have functions which do not all belong to the disks alone, or wheels alone, of any prior device; and in this fact, as I understand the opinion, is recognized the novelty which made the combination patentable. "These predetermined intervals between the charges of grain as dropped into the furrow," it is said, "are made in a degree greater or less by change in the angular adjustment of the disks. In other words, the disks, with their variable angular adjustment, are functional in the machine of the patent, in fixing the intervals at which the charges of seed are dropped into the furrow; and the disks themselves, apart from the matter of angular adjustment, their friction with the ground being aided by the weight of the seed box and its contents, are functional in operating mechanism whereby one charge is separated from the mass of grain, and separately carried to the upper opening of the spouts, and there dropped into the furrow." The first of these functions, the varying of the predetermined intervals between the charges of the grain dropped by changing the adjustment of the disks, I do not find to have been pointed out in the specification, or suggested either by experts or by counsel for the appellant. The discovery, therefore, would seem to be original with the court. But that it is genuine must be conceded, since it is manifestly true, theoretically, that a revolving disk will advance further by a single revolution on a line coincident with its own plane than if drawn forward on a line at an angle with its plane, and the greater the angle the shorter will be the forward movement, the total variation possible being the difference between the circumference of the disk and its diameter. Practically, the variation, I think, will be very much less, and probably without appreciable effect; but, whether great or small, I do not perceive that it can be a beneficial feature of the device. The contrary seems probable. The question, however, is an immaterial one. That part of the prior art which is disclosed in the opinion alone would compel me to a different conclusion on the question of patentability from that declared by the court. It is shown in the opinion that, without the means for adjusting the disks, the elements or factors of the claim in suit "would themselves combine to the one result of dropping the corn in fixed quantities and at fixed intervals," but that "the disks would have merely the function of wheels"; and on this hypothesis it is conceded that the Lynch patent, which shows, in a lister plow, the combination "of a seed box, mechanism for measuring and delivering seed from the box, [wheels instead of] disks on either side of the box which carry or support the seed box and the measuring and delivering mechanism, and which actuate the latter," is not different in combination or result. It is also conceded that in the Loughry patent are "disks attached to a lister plow, following the subsoiler,

set, as in the patent in suit, angularly to the direction of the plow, by an angular adjustment, which may be changed, and which cover the grain dropped behind the subsoiler from a seed box in fixed quantities, and at fixed intervals"; but those disks, it is explained, "are not functional in carrying the seed box, in actuating the seed distributing and delivering mechanism, or in fixing the intervals or distances between the charges of corn as dropped into the furrow." It is further conceded that in the Daniel machine, which is a broadcast seeder with three disks on an axle on either side of the center, "the two axles are set, by means of a frame above the disks, at an angle to each other, so that by the mutual opposition of the two gangs of disks the machine may be drawn over the prepared field in a direct line of travel"; that there "is over each gang a separate seed box"; that "the adjacent disks (one on the inner end of one axle, and the other on the inner end of the other) are in the same position, relatively to each other and to the line of travel, as the disks of the patent in suit"; that "their angular adjustment may be varied"; that "in front of these two inner-end disks are firmly secured to the tongue of the machine two other disks, with the opposite angularity, intended to open, in a prepared soil, shallow, parallel and closely-adjacent furrows"; that, "by a spout extending from the left-hand seed box obliquely towards the right-hand inner-end disk a stream of seed is thrown, apparently, against said last-named disk, to be thereby scattered in the wake of the two forward disks attached to the tongue," and there "covered, but whether by the action of one or both the inner-end disks of the gangs does not clearly appear"; that, "at all events, the right-hand inner-end disk has no connection with the box from which the seed flows as last mentioned"; that "the two inner-end disks do not co-operate upon any mechanism in said seed box"; that "they are not 'co-operating disks on either side of the box.'" My view may be as well explained by starting at this point. It is conceded that the Daniel machine embodies a lister plow, the wheels on the tongue cutting the furrow, and the inner-end wheels being in a position to cover the corn as dropped or poured into the furrow. It needed no invention to cut away the other two disks of each gang, and instead of two seed boxes, one over each gang, to substitute one box located above and between the wheels, changing the feeding mechanism only to the extent necessary to fit it into the new box, and operating it as before by connections with one or both disks. If with both, then they would be "co-operating disks on either side of the box." Thus changed, the machine, it is true, would not have dropped the seed at regular intervals; but, again, it required no invention to produce that result. It was only necessary to take the seed box and dropping mechanism already in use in the Lynch device, and place it above and between, and connect it with, the inner-end disks of Daniel, instead of the wheels of Lynch, and, the disks being already adjustable, the result would have been an anticipation of the Waterman combination. To put it in another way, equally simple and void of possible invention: It was only necessary to take the two inner and adjustable disks of Daniel or Loughry, and put them in the place of the wheels of the Lynch plow, and, whether the covering plates of

that plow remained or were removed, the result would have been the combination in question; and, though it be conceded that in the combination so made the disk would be required to perform the function of a wheel, and also the function of turning the soil, and incidentally of varying the distance between the charges dropped, that is not important, because the fact that a disk is a wheel is obvious, and to make it serve the uses of a wheel in addition to any other known function cannot be invention. The Loughry patent is not less significant. If its disks do not carry the seed box, and are not functional otherwise like those of the patent in suit, it needed only to transfer to it the seed box of Lynch, with its mechanism for measuring and dropping the grain, and to connect the mechanism with the disks, instead of the spoked wheels.

DETROIT MOTOR CO. v. JENNEY ELECTRIC MOTOR CO.

(Circuit Court, D. Indiana. December 17, 1897.)

No. 9,176.

PATENTS—INVENTION—ELECTRIC SWITCHES.

The Blades patent, No. 418,678, for an improvement in electric switches to be used with shunt-wound electric motors, is void, for want of patentable invention, as to claims 1 and 4, since the only new element not found in the prior art is a spring attached to the switch for returning it to its initial position when the magnet is de-energized; and there is no invention, in view of the prior art, in the use of a spring for this purpose.

This was a suit in equity by the Detroit Motor Company against the Jenney Electric Motor Company for alleged infringement of a patent relating to electric switches.

George H. Lothrop, for complainant.
Chester Bradford, for defendant.

BAKER, District Judge. This is a suit for infringement of patent No. 418,678, granted to the complainant, as assignee of Harry H. Blades, dated January 7, 1890, for an improvement in electric switches to be used with shunt-wound electric motors. The answer denies patentable novelty in the alleged invention, in view of the prior state of the art, and also denies infringement. The specification states that:

"It is the object of the invention to provide a switch for electric motors on constant potential circuits, such that, when there is a cessation of the current, it will automatically break the armature circuit, and assume its initial position, ready at will to gradually turn the current on the armature in starting. In starting shunt motors on constant potential circuits, the field circuit is first made, and then the current is thrown gradually on the armature. This leaves the switch lever for starting the armature in its final position. In stopping, the operator first breaks the main circuit, including the field circuit, and then, after the motor stops, turns the switch lever for starting the armature from its final position back to its initial. Very often, however, the operator forgets to turn this armature lever back, and, when the time comes to start, the motor turns on the main switch, and then throws the full current into the armature before it has time to generate its counter electro-motive force, and thus reduce the current flowing through it. The result of this is that either the armature is burned out or the fusible plugs put in for its protection are blown; also, the