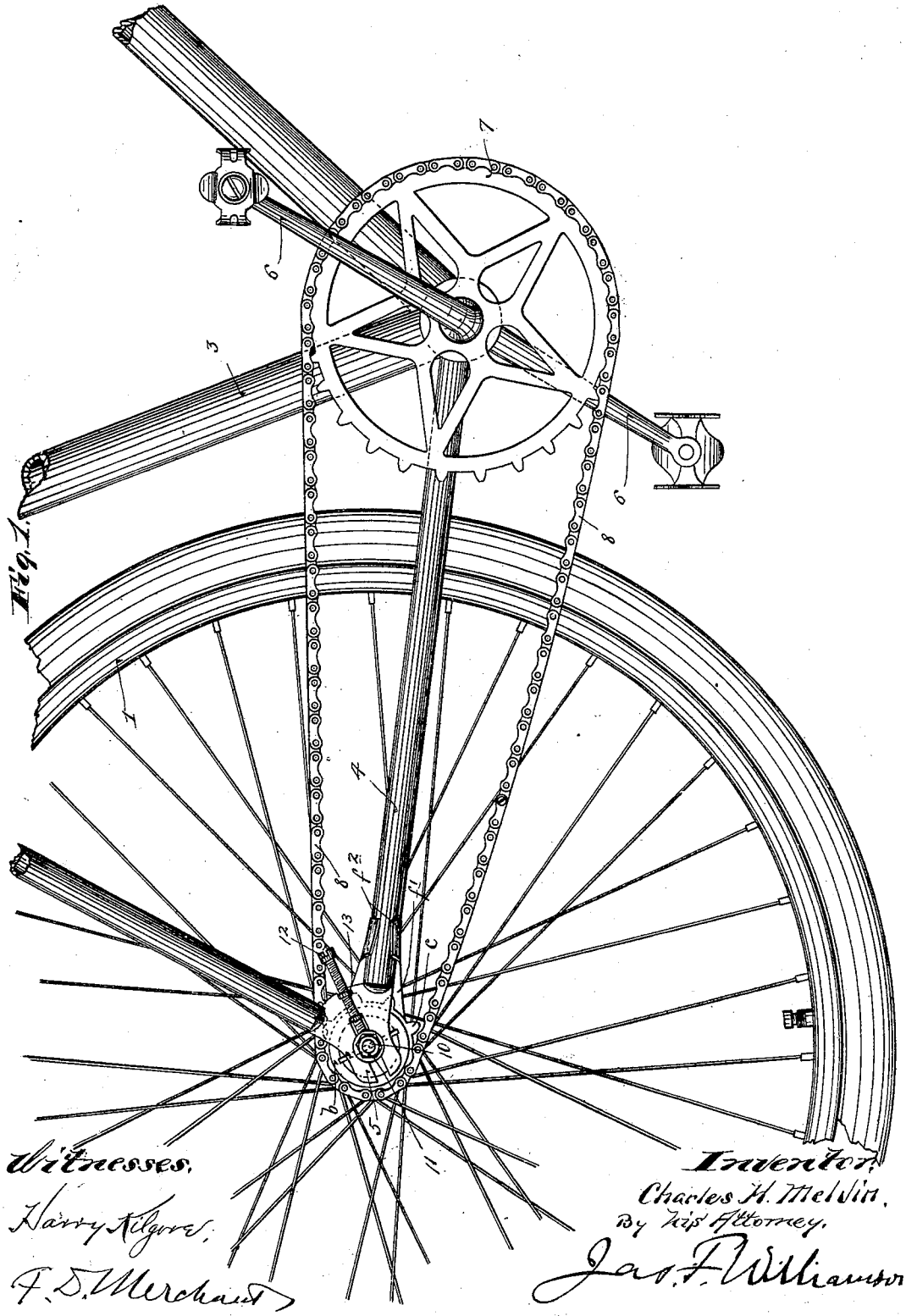
No. 648,971. Patented May 8, 1900.

# C. H. MELVIN.

## BACK PEDALING BRAKE.

(Application filed June 19, 1899.)

(No Model.) 2 Sheets—Sheet 1.




Witnesses,
Harry Kilgore.
F. D. Merchant.

Inventor,
Charles H. Melvin.
By his Attorney,
Jas. F. Williamson

No. 648,971. Patented May 8, 1900.

# C. H. MELVIN.

## BACK PEDALING BRAKE.

(Application filed June 19, 1899.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 6.

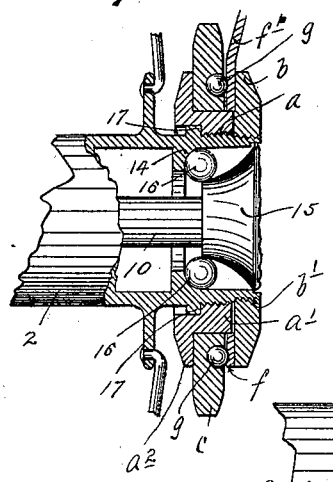


Fig. 2.

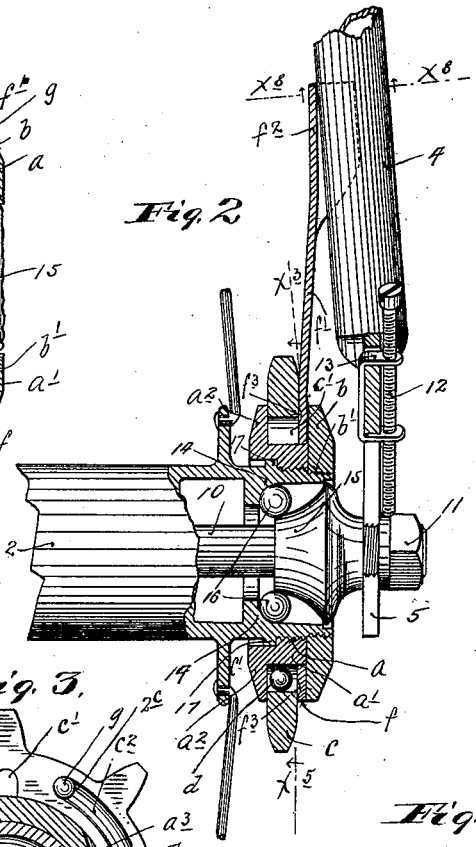


Fig. 9.

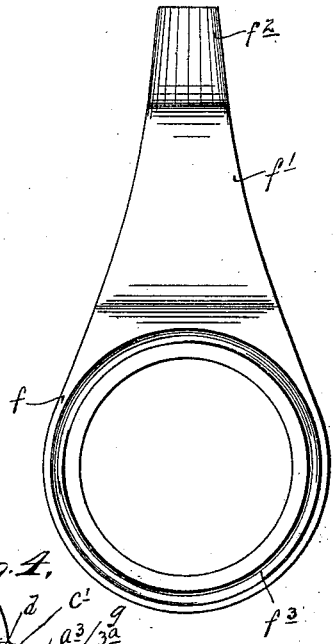


Fig. 3.

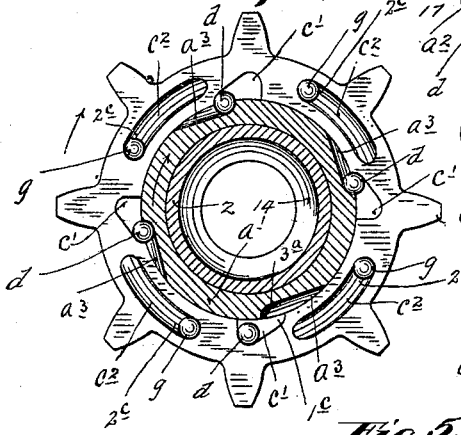


Fig. 4.

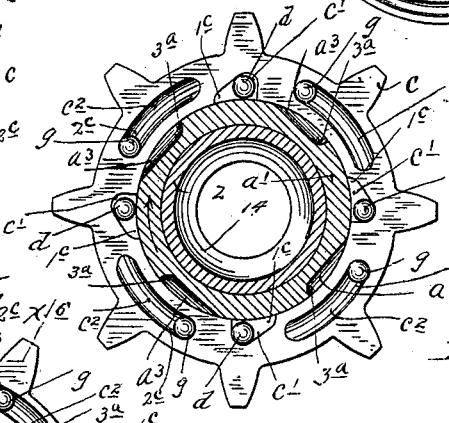


Fig. 5.

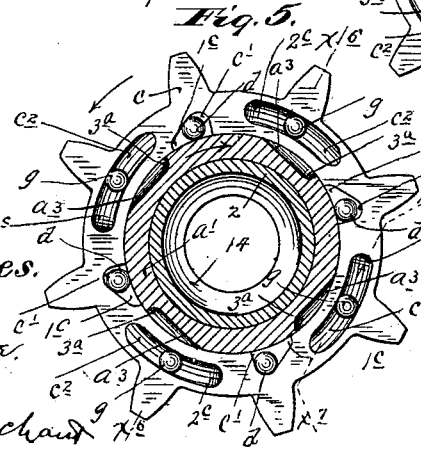


Fig. 8.

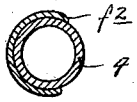
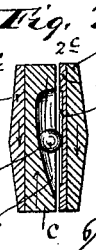


Fig. 7.



Witnesses.

Harry Tyler.

F. D. Merchant

Inventor.

Charles H. Melvin.

By his Attorney.

Jas. F. Williamson

# UNITED STATES PATENT OFFICE.

CHARLES H. MELVIN, OF ST. PAUL, MINNESOTA, ASSIGNOR TO FRANK M. SMITH, OF SAME PLACE.

## BACK-PEDALING BRAKE.

SPECIFICATION forming part of Letters Patent No. 648,971, dated May 8, 1900.

Application filed June 19, 1899. Serial No. 721,014. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES H. MELVIN, a citizen of the United States, residing at St. Paul, in the county of Ramsey and State of Minnesota, have invented certain new and useful Improvements in Bicycle-Brakes; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to what are known to the bicycle trade as "combined brakes and coasters," which devices are found incorporated as a part of the sprocket-and-chain driving mechanism of some lately-improved bicycles. These so-called "combined brakes and coasters" have already been so constructed and applied to the driving-gear that the rider may coast by holding the pedals against rotation, may set the brake by a back-pedaling movement, and may drive the machine by the ordinary forward-pedaling movement. These prior devices are subject to objections, certain of which are obvious and certain others of which will appear later on in the following detail description.

My invention has for its object to remove certain objections hitherto found to prior devices of this general character and to provide a device having greater efficiency and durability and to accomplish these results by a simple device which may be readily applied to bicycles now in general use as well as to bicycles in the process of manufacture or before leaving the works. These objects I accomplish by my invention, which is illustrated in its preferred form in the accompanying drawings, wherein like characters indicate like parts throughout the several views.

Figure 1 is a right side elevation of a portion of a safety-bicycle equipped with my invention, some parts of the same being broken away. Fig. 2 is a detail partly in plan and partly in horizontal section, showing the right-hand portion of the hub of the rear or traction wheel and immediately-connected parts. Figs. 3, 4, and 5 are transverse vertical sections taken on the line $x^3$ $x^5$ of Fig. 2, but illustrating different positions of the parts. Fig. 6 is a transverse section taken on the line $x^6$ $x^6$ of Fig. 5. Fig. 7 is a transverse section taken on the line $x^7$ $x^7$ of Fig. 5. Fig. 8 is a transverse vertical section taken on the line $x^8$ $x^8$ of Fig. 2, and Fig. 9 is a plan view showing the inner face of the so-called "brake-plate."

Of the ordinary parts of the bicycle the numeral 1 indicates the rear or traction wheel, provided with an ordinary barrel-hub 2. The numerals 3, 4, and 5 indicate the machine-frame. The numeral 6 indicates the pedal-crank, provided with a large sprocket 7, and the numeral 8 indicates a sprocket-chain which runs over the sprocket-wheel 7 and over a sprocket-wheel to be hereinafter noted and which it may be here stated is loosely mounted on the hub 2 of the said traction-wheel 1. As is also ordinary the rear or traction wheel is mounted on a spindle or axle 10, which is screw-threaded at its ends and securely held where set in the slots of the rear pronged forks 5 of the frame by means of nuts 11. In the illustration given set-screws 12, which work through brackets 13 on the machine-frame, give a graduated adjustment of the spindle or axle 10 to take up the slack of the chain. In its ends the hub 2 is provided with internal annular ball seats or runways 14, with which cone-bearings 15 on the screw-threaded ends of said spindle 10 coöperate to confine the bearing-balls 16 in working position in the ordinary manner. One end—as shown, the right-hand end—of the hub 2 is reduced to form a shoulder 17. (Best shown in Figs. 2 and 6.)

We are now to consider my features of improvement which go to make up my present invention, herein illustrated in its preferred form.

Tightly screwed, preferably by right-hand threads $a$, onto the reduced right-hand end of the hub 2 and against the shoulder 17 is a ring or collar $a'$, provided at its inner extremity with a peripheral clamping-flange $a^2$. A clamping-flange in the form of an annular nut or ring $b$ is secured by left-hand threads $b'$ on the still-further-reduced right-hand end of the hub 2 and is tightly screwed against the adjacent edge or side of the collar or ring $a'$. The purpose of using left-hand threads to secure this clamping nut or collar $b$ onto the hub is, as will hereinafter appear, to

cause the same to tighten and not to loosen under the braking action. An annular seat or channel having parallel sides is thus formed between the periphery of the collar $a'$ and the opposing faces of the coöperating clamping flanges or parts $a^2$ $b$. In this annular channel or seat an annular sprocket-wheel $c$ is loosely mounted.

In its periphery the collar $a'$ is provided with pockets or recesses $a^3$, and for coöperation with said pockets the sprocket-wheel $c$ is provided in its adjacent bearing-surface with pockets $c'$, constructed as presently more specifically described. Metallic driving-balls $d$ are placed in the pockets $c'$.

At one extremity each pocket $c'$ is cut deep enough to permit the coöperating ball $d$ to be loosely contained therein at times when the uncut peripheral portion of the collar $a'$ is turned into line with said pocket $c'$, as shown in Fig. 4, for example. The other extremities of said pockets $c'$ (indicated in the drawings at $1^c$) and the opposing opposite extremities of the pockets $a^3$, formed in the periphery of the collar $a'$ and marked $3^a$, are cut on a curve equal to the radius of the bearing-balls $d$. In virtue of this construction it follows that when the balls $d$ are thrown into operative driving positions, as indicated in Fig. 3, they will be engaged and clamped between the opposing and correspondingly-formed extremities $1^c$ and $3^a$ of the coöperating-pockets $c'$ and $a^3$, with the result that when said sprocket is driven in a direction to propel the wheel, and as indicated by the arrow marked on Fig. 3, the wheel-hub, and hence, of course, the wheel, will be positively driven in the same direction. Under such a driving action there will be practically no radial strains put upon either the sprocket $c$ or the collar $a'$, inasmuch as the said driving-balls are then so engaged that they do not produce a wedging or camming action between the surfaces which engage them. A very different action from this is attained in the previous devices, wherein a friction-clutch is provided by wedging or causing the balls to engage with a wedging action between diverging surfaces. With this wedging action, such as found in the said previous constructions, intense strains are put upon the exterior member of the clutch, and these exterior members are thus soon stretched out of shape and rendered defective and in many cases broken.

In my improved construction the inclined surfaces of the pockets $c'$ simply act to insure the proper delivery of the driving-balls $d$ to the pockets $a^3$ under the driving movement of the sprocket; but as soon as they have delivered the said balls to said pockets $a^3$ they have no further engagement with or action upon the said balls. On the other hand, the bottoms of the pockets $a^3$ are inclined or run gradually to the periphery of the collar $a'$ simply to insure the proper return of the driving-balls into the pockets $c'$, either under the coasting action, the back-pedaling or brake-pedaling action, or whenever the sprocket $c$ is run at a speed less than that at which the traction-wheel is rotated. In practice I have found that it is better to make the pockets $a^3$ concave in cross-section, and I have also found it of the greatest importance that the pockets $c'$, particularly the inclined portions thereof, be straight at cross-section. If the bottoms of the pockets $c'$ are channeled out to fit or approximately fit the curve of the driving-balls, I have found that oil on becoming thick or sticky will hold the balls in said pockets and prevent the same from properly operating.

From what has been said in the earlier part of this description it will of course be understood that the sprocket-chain 8 runs over the sprocket-wheel $c$. Working between the outer face of the sprocket $c$ and the inner face of the clamping nut or flange $b$ is an annular section $f$, which on account of the function which it performs I refer to as the "brake-plate." This brake-plate $f$ has a stem portion $f'$, which terminates in jaws or flanges $f^2$, that are adapted to embrace and slide endwise from the adjacent rear bottom stay or tubular section 4 of the machine-frame. These prongs or jaws $f^2$ flare in the direction of the stem $f'$, so that they engage the tubular frame-section 4 only at their outer ends, and thus leave them free to adjust themselves to said frame 2 as they are slid endwise thereon by the adjustment of the rear wheel to take up the slack of the chain. In the construction illustrated the prongs $f^2$ are adapted to be sprung over the frame-tube 4. As is obvious, with this device the adjustment of the rear wheel may be made in the ordinary manner and the operator need pay no attention to the adjustment of the brake-plate or other parts of my improved mechanism, as these adjustments automatically take care of themselves.

In the inner face of the annular section $b$ of the so-called "brake-plate," extending concentric to the axis of the spindle 10, is a shallow annular groove or channel $f^3$, and in line with this channel $f^3$ the adjacent face of the sprocket $c$ is provided with a series of cam grooves or pockets $c^2$. The cam grooves or pockets $c^2$ are deep enough at one of their extremities (marked "$2^c$") to entirely contain the brake-balls $g$, which are seated therein, or at least to allow them to recede out of engagement with the cam-channel $f^3$ of the brake-plate $f$ at times when they are not called into action to perform their assigned functions of applying or setting the brake. At their other extremities the cam grooves or pockets $c^2$ are very shallow or entirely run out at the face of the sprocket.

It will of course be understood that if desired the prongs $f^2$ may be lined with leather or felt to prevent marring of the frame-tube 4. It will be further understood that my in-

vention is capable of many modifications in its details of construction within the scope of the invention.

Operation: The operation of the device above specifically described will be substantially as follows: Under the ordinary pedaling motion, such as is given to the cranks in driving the machine ahead, the sprocket-wheel *c* will be driven, as indicated by arrows marked on Fig. 3, and the driving-balls *d* will be dropped into operative positions, (shown in Fig. 3,) and the action will be to positively connect the collar *a'* on the hub of the traction-wheel with the said sprocket-wheel and positively propel the said traction-wheel, as previously stated. Under this action or movement of the sprocket-wheel the brake-balls *g* will be kept worked back into the deep extremities $2^e$ of the cam-grooves or pockets $c^2$, and hence, of course, there will be no tendency to set the brake. In coasting the operator holds his feet and the pedals against rotation, and hence the sprocket *c* will be held against rotation, while the traction-wheel, its hub, and the collar *a'* will continue to rotate in the direction indicated by the arrow marked thereon in Fig. 4. Under this movement of the flange *a'* the driving-balls *d* will be caused to recede into the deep extremities of the pocket *c'* by the inclined bottoms of the pockets $a^3$, so that no appreciable resistance is offered to the rotation of the said collar *a'*. Furthermore, at this time, as there is no movement of the sprocket with respect to the brake-plate *f*, the brake-balls *g* will remain in the deep extremities $2^e$ of the cam-pockets $c^2$, as also shown in Fig. 4, and hence the brake will not be applied in coasting or as long as the sprocket *c* is held stationary or against backward rotation. In fact, in coasting the pedals may be rotated in the direction to drive the wheel, but at a lower rate of speed than that at which the traction-wheel is rotated, and the actions of the driving clutch device and of the brake-setting device will be substantially the same as if the pedals were held stationary or against rotation.

The brake is very readily set by back-pedaling, so as to move the sprocket *c* in the direction indicated by the outside arrow, (marked on Fig. 5,) which movement causes the brake-balls *g* to crowd against and into the channel $f^3$ of the brake-plate *f* and crowd their way toward the shallow extremities of the cam pockets or grooves $c^2$, as shown in Figs. 5 and 7. The harder the cranks are back-pedaled the harder the brake will be set. In this brake-setting action the brake-balls in crowding with a wedge action between the channel or groove $f^3$ and the inclined bottoms of the cam pockets or grooves $c^2$ force the innermost side of the sprocket tightly into frictional engagement with the clamping-flange $a^2$ of the collar *a'* and force the flat outer surface of the brake-plate *f* into frictional engagement with the inner surface of the clamping ring or flange *b*. In this manner the surface, which is frictionally engaged to set the brake or in the brake-setting action, is distributed over considerable area, so that no great amount of wear will come at any particular point. The efficiency of the brake is also thus greatly increased.

The efficiency of the device above described is thought to be obvious. The simplicity of the device is also an obvious feature.

My improved brake and coaster adds but very slightly to the ordinary cost of a bicycle and occupies but very little room, and, furthermore, it may be applied to almost any form of cycle-wheel hub and in no case requires any objectionable construction as incident to its application to a bicycle.

It will be further understood that my improved coaster and brake is not limited to use in connection with sprocket-chain-driven bicycles.

What I claim, and desire to secure by Letters Patent of the United States, is as follows:

1. In a cycle, the combination with a pair of laterally-spaced friction-flanges on the hub of the traction-wheel, of a driving member loosely mounted on the said hub between said friction-flanges, an anchored brake-plate working between said driving member and one of the said friction-flanges, a one-way driving-clutch connecting said driving member and said wheel-hub, and a reversely-acting friction brake device comprising profile cam-grooves in the face of the driving member adjacent to said brake-plate, and balls working in said profile cam-grooves and adapted by backward rotation of the said driver to be clamped between the same and said brake-plate, substantially as described.

2. In a cycle, the combination with the hub 2 provided with the laterally-spaced friction-flanges *b* and $a^2$, of the sprocket *c* loosely mounted on said hub between said flanges, said sprocket having the internal seats or notches *c'* and the profile cam-grooves $c^2$, the plurality of driving-balls *d* working in said seat *c'* and coöperating recesses $a^3$ in the said hub, the brake-plate *f'* working on said hub between the outer face of said sprocket *c* and the said friction-flange *b*, and the brake-setting balls *g* within the profile cam-grooves $c^2$ of said sprocket, which balls $g^2$ are pressed against said brake-plate under backward rotations of the said sprocket, substantially as described.

3. In a cycle, the combination with a rotary driver and a rotary driven member, said driver being in the form of a ring mounted on said driven member and provided with a series of internal ball-seats and provided also with a series of profile or side cam-grooves on one face thereof, friction-flanges on said driven member embracing said driver, an anchored or relatively-fixed brake plate or member positioned between one of said friction-flanges and

the profile cam-grooves of said driver, a series of driving-balls in the internal ball-seats of said driver operative on said driven member under driving movements of said driver, and a series of driving-balls in the profile cam-grooves of said driver operative on said brake plate or member under backward rotations of said driver, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES H. MELVIN.

Witnesses:
M. M. McGRORY,
F. D. MERCHANT.